Market-based instruments and other socio-economic incentives enhancing food waste prevention and reduction

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Reducing food waste through social innovation

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Colophon

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Executive summary

The objective of this report (*FUSIONS T3.2.1 Market-based instruments (MBIs) and other socio-economic incentives enhancing food waste prevention and reduction*) was to explore the potential of market-based instruments and other socio-economic incentives as specific policy measures for stimulating food supply-chain operators and households to prevent and reduce food waste. Market-based instruments (MBIs) are policy tools that encourage behavioural change through market signals by providing economic incentives rather than through traditional regulations.
The analyses have been carried out using a four step approach that included: 1) an inventory of available information on food waste drivers, 2) a literature review, 3) expert interviews and 4) qualitative impact assessment analysis of the select market-based instruments.

The analyses have identified a number of market-based instruments and incentives that could potentially be applied to the design of food waste reduction and prevention policies. However, the effective implementation of the potential instruments and incentives requires accurate advance planning and a thorough analysis of the possible impacts and barriers. The results have indicated that the role of the government is indispensable in introduction and implementation of market-based instruments and incentives for food waste reduction and prevention. Moreover, a good mix of different regulatory and voluntary instruments increases the possibility of successful implementation of food waste prevention and reduction policy.

The identified instruments are **mostly price-based instruments (PBIs)** based on positive and negative incentives. Positive incentives seek to motivate actors to certain actions by promising a reward, whereas negative incentives aim to motivate actions by threatening a punishment. The examples of positive incentives are subsidies for food waste reduction technologies, fiscal incentives for food waste donation. The examples of negative incentives are posing different taxes on wasted food.
Positive price-based instruments are assumed to have a voluntary character, entailing close collaboration between governmental and private initiatives. At large these tools usually imply costs for governments and occasionally also for the chain operators. Yet, benefits from waste reduction are considered to offset the costs, since implementation of such tools are considered to be practically easy with low risk involvement, with economic and social benefits due to waste reduction and job creation.

Box 0.1 Most promising PBIs addressing food waste reduction and prevention

SUBSIDIES AND GRANTS FOR:

- Gleaning
- Stimulating knowledge exchange & co-operation between chain operators
- Stimulating food waste prevention & reduction projects
- Developing new technologies
- Enabling environment for social innovation projects

TAX CREDITS:

- To stimulate voluntary agreements & social innovation initiatives
- To exempt VAT on donated food

Instruments that offer *negative incentives* are mainly represented by **"pay-as-you-throw" (PAYT)** schemes and various taxes. The PAYT principle was identified as one of the most promising tools and it is anticipated to have a major positive impact on food waste prevention and reduction. This is due to assumption that in order to pay less, consumers and supply chain actors will reduce food waste. At the same time this tool may stimulate the implementation of food waste

prevention measures as well as possibilities to use food otherwise wasted in alternative ways (e.g. donation or as ingredient in cooking recipes). Different types of PAYT are possible to implement (e.g. pay-by-volume or pay-by-weight). Depending on the type of PAYT introduced it may involve partly high investment costs. However it is expected that these costs would be compensated by higher revenue.

Beside price-based instruments, several **informational policy** *tools* have been identified as having potential to reduce and prevent food waste. These tools refer to requirements for the public disclosure of certain information by industry to consumers and can include labelling programmes, rating and certification systems. Voluntary certification systems and agreements provide another example of information-based instruments. Hereby there is an interaction of actions between public governmental policies and voluntary improvements, where private incentives can be designed in combination with complementary policy initiatives. These tools are often initiated by private organizations and supported by government and often imply a voluntary character. In some cases these tools may also be mandatory (e.g. obligatory disclosure of food waste data).

Box 0.2 Most promising informational tools addressing food waste reduction and prevention

PROVISION OF INFORMATION AND CAMPAIGNS

- Awareness: campaigns: ugly fruits, best before
- Guidance methodology & obligatory disclosure of companies' food waste data

VOLUNTARY AGREEMENTS & MARKETING STANDARDS

- Use of Social Fuel Stamp standard
- Use of Ecolabel on food waste reduction

Overall the implementation process of the various market-based policy options should include the following actions:

1. **To provide subsidies for communication campaigns to increase awareness during the initial phase of the process;**
2. **To implement tax schemes, subsidies and quality assurance and certification systems/schemes in the later stages.**

In order to implement market-based instruments related to food waste successfully, food waste targets need to be set using a comprehensive assessment of all the costs and benefits implied by the targets. The targets should be implemented with full consideration of the economic and social trade-offs involved. Furthermore, the motivation for food chain actors to implement food waste prevention and reduction policies reflects the prior expectations of decision makers regarding the potential benefits and costs associated with the adoption of a specific policy and related better practices. When the costs of implementation relative to the expected benefits are high, and where the hurdles associated with adoption are not easily overcome, there may be less motivation to implement certain policies. Hereby, governmental regulations play a leading role.
Overall, there is a need for a quantitative economic analysis of the entire set of incentives for food chain actors to implement enhanced food waste prevention and reduction policies and how these vary across chain actors and markets. Additionally, the legal basis of the market-based instruments must be thoroughly specified. Therefore, it is important for governments to work together with private businesses and other chain actors to develop market-based instruments that are transparent in their operation. In food waste applications, there is a strong need for good quality science to support any potential market-based instruments.

1 Introduction

Food waste is gathering increasing global interest and is engaging governments, research institutions, producers, distributors, retailers and consumers in its definition and in the identification of appropriate policy interventions for its prevention and reduction.

FUSIONS (Food Use for Social Innovation by Optimising Waste Prevention Strategies) is a project aiming at contributing to a more resource efficient Europe by significantly reducing food waste through a range of activities including the harmonisation of food waste monitoring, the enhancement of an improved understanding of the extent to which social innovation can reduce food waste, and the development of a set of guidelines for a Common Food Waste policy for EU-28. Within this framework the project is specifically looking at social innovation and at policies stimulating social innovation initiatives addressing food waste.

This report (FUSIONS T3.2.1 Market-based instruments (MBIs) and other socio-economic incentives enhancing food waste prevention and reduction) focuses on a variety of market-based instruments and economic incentives as alternatives or supplements to conventional regulations that potentially stimulate food waste reduction and prevention by correcting the market through cost (or other) signals.

Experiences with use of such instruments is quite limited since food waste has been included in governmental agendas largely only in the last 5 years (from 2010 and onward). There are however broad experiences concerning the use of market-based instruments implemented to address waste management in general. Food waste, as a fraction within general waste (municipal or organic), is indirectly affected by measures containing provisions such as landfill taxes and levies aiming at the reduction of the waste amounts going to landfill. Food waste is indirectly affected also by fiscal benefits. An example is given by the Hungarian fiscal system where 20% of the value of donated products (including food) can be deducted from the corporate tax base. Some examples of instruments directly addressing food waste are the VAT exemption for donated food and subsidy schemes such as those implemented by the Government of the Netherlands. The Dutch Ministry of Economic Affairs and National Service for Entrepreneurs support “Small Business Innovation Research specific to reduce food waste”. However such examples are quite few. Therefore, a literature review on market-based instruments and incentives applied to other areas is presented to identify promising tools from other areas applicable to the food waste issue. Based on the results from the literature review and a number of experts’ interviews, the work qualitatively assesses the impacts of these instruments and identifies the most promising market-based instruments, emphasizing their challenges and opportunities.

The report is organised as follows. Section 3 describes the objective of this report followed by an explanation of the methodology (section 4). Section 5 is devoted to background information and definitions used in this study as well as in WP3. The analysis of market based instruments and incentives applicable to reduce food waste is carried out in Section 6. Section 7 finalises the report with conclusions from the study.

2 Objective

According to the FUSIONS Document of Work, the sub-task 3.2.1 explores the potential of market-based instruments and other socio-economic incentives as specific policy measures for stimulating food supply-chain operators and households to prevent and reduce food waste. This activity contributes to the achievement of the general objective of task 2 in WP3, namely, identifying sound measures and best practices for an improved legislation to reduce food waste through social innovation.

More specifically, this report of subtask 2.3.1:

- performs an inventory of the market-based instruments used in other sectors such as solid waste management, environmental pollution, nutritional health and obesity, product quality, sustainability and biofuels, food safety;
- identifies the most promising market-based instruments in terms of food waste prevention and reduction;
- illustrates qualitatively their possible environmental, economic, and social impacts.

This report will also provide a base of information for the development of the other tasks within FUSIONS' WP3. It will contribute to the development of FUSIONS' T3.1.2 "Scenario analysis of current trends of food waste generation" and T3.4 "Guidelines for a European Common Policy encouraging food waste prevention and reduction through social innovation".

3 Methodology

In order to analyse market-based instruments and incentives addressing food waste reduction and prevention four main steps were undertaken: inventory of available information on food waste drivers, literature review on market-based instruments and incentives, experts' interviews, and qualitative impacts assessment. These steps are summarized in Figure 3.1.

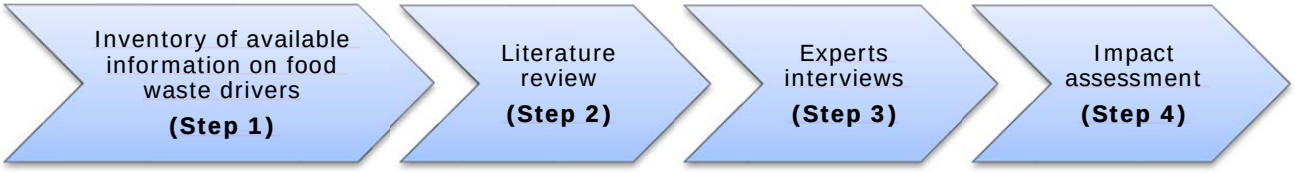

Figure 3.1 Methodological steps of the study

Step 1. Inventory of available information on food waste drivers

The study started with the inventory of the food waste drivers developed in D1.5 (Canali et al., 2014, "Drivers of current food waste generation, threats of future increase and opportunities for reduction") of the FUSIONS project, in order to identify:

1. Barriers/drivers (both legislative and business-related) affecting decision-making behaviour with respect to food waste prevention and reduction among the food supply chain operators and households.
2. Actions and recommendations with potential to enhance market-based instruments and incentives.

D1.5 of FUSIONS project (WP1) identified more than 200 food waste drivers (see D1.5). Considering the vast amount of inputs and in order to detect information relevant to market-based instruments and incentives, a data analysis was carried out. As a guiding tool for the data analysis a matrix was developed that included information concerning barriers and drivers summarised in 12 categories and information related to actions and recommendations able to tackle these barriers.

The matrix was distributed among FUSIONS T3.2.1 (WP3) contributing partners. Contributing partners had to fill in the matrix by ticking + or – in the boxes for the following questions:

- Which actions and recommendations related to the barriers to tackle food waste generation can be used as market-based instruments and incentives?
- By whom the actions and recommendations should be undertaken - government, private actors and/ or interactions between them?
- Which actions and recommendations can be considered as being a social innovation?
- Which 10 actions/recommendations from the elaborated list are considered as being the most promising market-based instruments and economic incentives?

Next to the inventory of the information from D.1.5, a consultation session was organised with experts, during the European Platform Meeting (EPM) which took place on October 31, 2014 in Brussels in the framework of the FUSIONS. The objective of this consultation session was to collect more practical information on actions and recommendations beyond the literature review and internal FUSIONS project and to integrate it with the inventory information from D1.5. The experts consulted were the representatives of governmental bodies, research institutes and private companies, all engaged in food waste reduction.

Box 3.1 Guiding questions of the consultation session at FUSIONS European Platform Meeting 2014

- Should governments establish specific taxes or fees by charging for food waste produced at the different levels through a system of compulsory protocols, targets and standards?
- How could fiscal benefits contribute to private investments specifically addressing food waste reduction/prevention?
- What are the most promising market-based instruments and other socio-economic incentives as specific policy measures for stimulating food waste prevention and reduction?

Step 2. Literature review

The literature review on market-based instruments and economic incentives for stimulating food waste prevention and reduction was not a systemic scan, but rather a narrative and selective activity that collated relevant studies and drew conclusions from them. Since the topic of food waste is rather new, the literature review was carried out on market-based instruments and incentives applied to food waste as well as to other areas. This was done in order to identify tools from other areas that could be applicable to the food waste issue. The identified areas other than food were: household solid waste management; environmental pollution; sustainability including biofuels; product quality including nutritional health and obesity; and food safety.

The selection of these areas was influenced by the fact that the above-mentioned issues have been on the agenda of governmental and business policies much longer, compared to the food waste issue. Thus, they may offer potentially applicable tools for food waste reduction and prevention.

The selection of the identified market-based instruments and incentives from the literature was carried out according to the following criteria:

- General principle of action (e.g. taxation, subsidy, certification schemes).
- Tool/incentive is advised and/or applied by.
- Government - EU, national governments/countries, local governments.
- Supply chain operators (producers, retailers, food services, etc.).
- Tool/incentive is advised, but not implemented yet or implemented.
- Efficiency/positive impact.
- Potential applicability to food waste.

Step 3. Experts' interviews

Personal semi-structured interviews have been conducted face-to-face or by phone with the representatives of different stakeholder groups.

The experts' interviews were similar to the exercise carried out at the consultation session during the EPM meeting in Brussels, in October 2014. In both cases, the main objective was to collect interesting practical ideas on possible market-based instruments applicable to food waste prevention and reduction. The main difference was that the consultation session involved different stakeholders that brainstormed together around the set of questions and have provided broad ideas, while face-to-face interviews provided an opportunity to gather more detailed information on specific market-based tools. Besides, experts' interviews were used to select the most promising tools and incentives applicable to food waste issues, including those identified from the literature that are applied in areas other than food waste.

Experts were asked to assess the potential impact of implementation of selected tools and incentives. The methodological details of this impact assessment are described in the next section.

The experts had relevant background on food waste: they were food supply chain stakeholders, representatives of governmental bodies and institutions and researchers interested or working on this topic (see more information regarding the experts in Annex 2).

Interviews were structured around the following main question: "What are the most promising market-based instruments and other socio-economic incentives as specific policy measures for stimulating food waste prevention and reduction?"

Box 3.2 Guiding questions of the interviews with experts

- What are the potential incentives in the supply chain and on the consumption side?
- What are the most important levels for specific policy measures: EU, national government, local governments, businesses?
- What type of fiscal benefits should be granted to private investments specifically addressing food waste reduction/prevention?
- Should governments establish specific taxes or fee charging for food waste produced at the different levels of the food chain through a system of compulsory protocols, targets and standards?
- Should governments support the implementation of voluntary agreements among food chain operators who commit themselves to specific targets of food waste reduction/prevention and in what way?
- What kind of agreements would be workable?
- Should governments give any preference to companies which assure the most food waste reduction/prevention in public procurement?
- How should market-based instruments and other socio-economic incentives contribute to socially innovative solutions to reduce food waste?

Step 4. Qualitative impact assessment

Based on the literature review, FUSIONS partners own expertise and experts' interviews performed in step 3, an evaluation of the selected market-based instruments and incentives was carried out by means of a Qualitative Impact Assessment Matrix, adapted from BIOIS (2010). The matrix takes into account the perceptions of experts regarding the impact of selected market-based instruments on different aspects and uses scoring system to obtain these perceptions.

This assessment aimed to evaluate the possible impact that implantation of selected market-based instruments may have on food waste prevention and reduction as well as on socio-economics and environment. Note that the ultimate objective of this assessment was to illustrate qualitatively the possible impacts that the selected instruments might have on environment and socio-economics as well as on possibilities of food waste reduction and prevention. It is based on experts' perception and does not involve any data estimation on actual impact. The scoring system for the impact assessment of market-based instruments is presented in Table 3.1.

The Qualitative Impact Assessment Matrix helped to structure the evidence on potential market-based instruments and incentives from a variety of sources (literature, expertise of the FUSIONS project team, experts' interviews) derived from a variety of methodologies used.

FUSIONS partners were asked together with experts to identify the 3 top market-based instruments and incentives having the most potential for reducing and preventing food waste. Next, for each of 3 selected tools a qualitative impact assessment was carried out using the matrix and the scoring system presented below:

Table 3.1 Scoring system for the impact assessment of market-based instruments

+3	Major positive change
+2	Significant positive change
+1	Positive change
0	No change
-1	Negative change
-2	Significant negative change
-3	Major negative change
NA/NR	Not Available-the interviewed person did not fill out the score Not Relevant-the interviewed person found the specific item to be not relevant

The assessment criteria covered the following aspects:

AC1. General issues

- Targeted supply chain operators, retailers, food services, and households
- Legislative change
- Mandatory / voluntary form

AC2. Food Waste Impact

- Food waste reduction
- Food waste prevention
- Food waste management
- Food use optimization
- Other

AC3. Environmental Impact

- GHG reduction (magnitude)
- Creating of carbon sinks (magnitude)
- Increased provision of ecosystem services via ecosystem conservation (magnitude)
- Improved soil quality (magnitude)
- Reduced erosion (magnitude)
- Increased ecosystem resilience (magnitude)
- Other

AC4. Economic impact

- Implementation costs for EU institutions (governmental bodies)
- Implementation costs for MS (governmental bodies)
- Implementation costs for businesses/chain operators
- Benefits to consumers/households (due to reduction of their own waste)
- Benefits to businesses/chain operators (due to reduction of their own waste)
- Impact on economic growth, change in GDP (due to an overall food waste reduction)
- Other

AC5. Social impact

- Job creation in public authorities
- Job creation in private sector
- Other

AC6. Practicability

- Is this practical to implement (Yes/No)
- Consistency with other regulations (Yes/No)
- Degree of risk / uncertainty (in terms of results achievable)

4 Background and definitions

FUSIONS' definition of food waste

FUSIONS (D1.1 FUSIONS Definitional Framework for Food Waste Executive Summary) defines food waste as: "any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed (including composted, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)".

FUSIONS' definition of policy

FUSIONS adopted a working definition of policy identifying policy as "actions undertaken by governments and public authorities and organisations such as regulations/legislations, governmental subsidies and support actions, private initiatives".

Policy instruments were characterized according their approaches (Gupta, et al., 2013), as summarized in Figure 4.1 (The more detailed information regarding this figure and the framework behind can be found in Easteal, 2014).

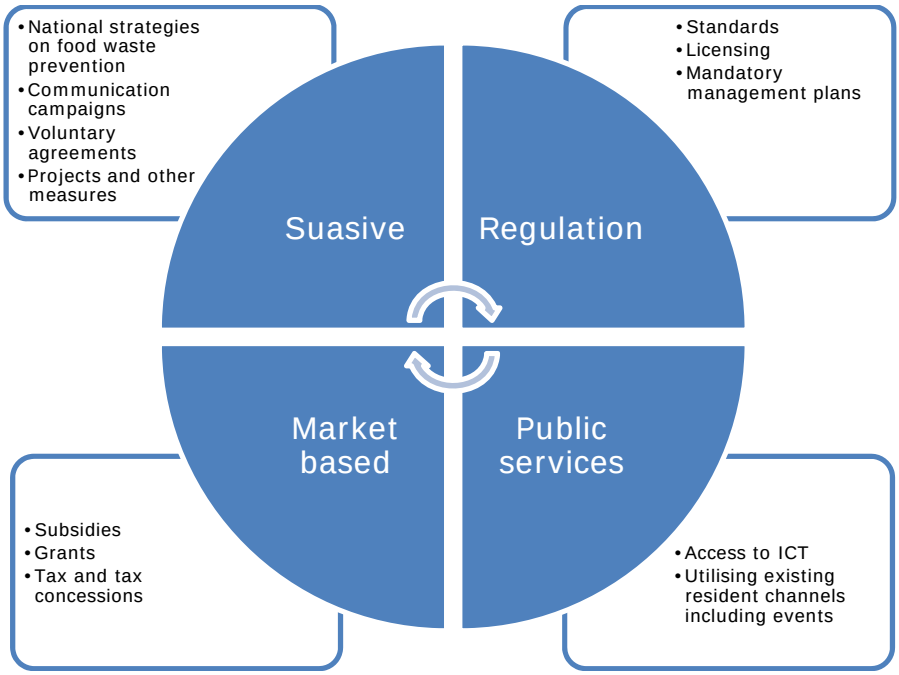

Figure 4.1 Policy instruments according to different approaches

- **Suasive approaches**: policy tools that encourage changes in behaviour through the provision of information, such as via general education programs, guidelines and codes of practice, training programs, extension services and research and development. The suasive policy measures include:
  - **National strategies on food waste prevention**: methods, strategies or plans specifically addressing food waste prevention. Key sectors addressed in the plan should include local authorities, households, the hospitality industry, the retail supply chain, businesses and institutions (such as schools and hospitals).

- **Communication and campaigns**: national “umbrella” campaigns; local campaigns; short campaigns and festivals; education and training activities; contests and competitions; exhibitions, whose aim is to raise awareness on food waste.
- **Voluntary agreements**: alternative courses of actions such as self-regulations developed by the industry generally aimed to deliver the policy objectives faster and/or in a more cost-effective manner compared to mandatory requirements.
- **Projects and other measures**: initiatives like neighbourhood projects, food sharing platforms, platform/networks, labelling, applications, etc. that contribute and/or are connected to food waste reduction.

- **Regulatory approaches**: require changes in behaviour by introducing penalties for parties who do not comply with regulatory provisions. Regulations and regulatory instruments are governmental or ministerial orders backed by the force of law. Regulatory instruments are sometimes called "command-and-control"; public authorities mandate the performance to be achieved or the technologies to be used. Types of regulatory instruments include standards (including planning instruments), licensing, mandatory management plans and covenants.
- **Market-based instruments**: policy tools that encourage behavioural change through market signals rather than through explicit directives. There are a range of types of market-based instruments including trading schemes, offset schemes, subsidies and grants, accreditation systems, stewardship payments, taxes and tax concessions.
- **Public provision of services**: often used when the management solution has the characteristics of a ‘public good’ which makes it difficult for the private sector to provide the service, e.g. national parks.

A FOCUS ON MARKET-BASED INSTRUMENTS

‘Market-based instruments’ usually refer to a wide variety of alternatives to traditional regulations (Driesen, 2006). In a business dictionary incentive is defined as “an inducement or supplemental reward that serves as a motivational device for a desired action or behaviour”[1]. Thus, *market-based instruments can be defined as policy tools that encourage behavioural change through market signals by providing economic incentives rather than through traditional regulations* (Driesen, 2006; Gupta et al., 2013).

Authors distinguish between price-based or financial instruments, quantity-based instruments and informational-based instruments (Richards, 2003; OECD, 1993; 1998).

Price-based instruments can be divided into three basic categories, those offering negative, positive or mixed incentives (OECD, 1993; 1998).

Positive incentives seek to motivate actors to certain actions by promising a reward, whereas negative incentives aim to motivate actions by threatening a punishment.

An example of *negative incentives* is taxing environmental burdens, thereby encouraging better environmental practice as a means of reducing the tax. An example of positive incentives is enabling those improving their environmental practices to earn money by doing so.

Subsidies provide the most obvious example of a positive price incentive. Subsidies are financial means granted by government to reduce the private costs of specified goods, services or behaviour (Driesen, 2006). They take many forms including grants, favourable loan terms, tax concessions and assumption of liability. Market prices usually do not integrate all costs and benefits. As a result, too much or too little is consumed or produced. Therefore, governments introduce subsidies, charges and taxes to improve the functioning of markets (Koesveld, 2007).

Mixed incentives combine negative and positive incentives. An example of such mixed incentives is a deposit-refund system. A government can obligate retailers of beverages to collect a deposit

[1] Business Dictionary: www.businessdictionary.com/definition/incentive.html [Accessed online, October 19th, 2015].

from consumers associated with the cost of collecting bottles. This deposit funds a refund paid to a person when the empty bottle is returned for reuse or recycling.

Quantity-based measures are enacted by government and set requirements for behaviour (such as limitation on allowable emissions or environmental benefit trading programmes) and then impose penalties for failure to comply with those requirements (Casey et al., 1999).

In this case the government determines the required quantities to be met (for instance emission reductions). The private sector retains some control over the price through its ability to choose techniques to meet the quantitative limit. Trading programs (e.g. governments allow polluters to purchase credits beyond their own limit, from better performing polluters that made 'extra' reductions) and transferable quotas (e.g. fishermen are allowed to catch more than their individual quota by purchasing quota from other fishermen) are also examples of quantity-based measures.

Informational policy instruments refer to requirements for the public disclosure of certain information (e.g. related to environmental pollution), generally by industry to consumers. These include labelling programmes, rating and certification systems (Metz et al., 2007).

Voluntary certification systems and agreements provide another example of information-based instruments.

Voluntary and negotiated **agreements** aim to encourage single firms, groups of companies or industrial sectors to improve their resource efficiency and environmental performance beyond existing legislation and regulations (GTZ, 2006). Voluntary agreements imply 2 essentials: 1) business and/or industry participate voluntarily and/or 2) there is an interaction between public authorities and business/industry through negotiations about targets and measures to be taken.

According to GTZ publication (2006) voluntary agreements range from initiatives where participating parties set their own targets and conduct their own monitoring and reporting, to initiatives where a contract is made between a private party and a public body or stakeholder groups such as local communities and/or non-governmental or environmental groups. Voluntary agreements facilitate the formulation of policies that address different aspects beyond the compliance of law and can stimulate the dialogue aiming to achieve sustainable consumption and production.

When selecting policy instruments, it is important to consider the likely costs for the society and benefits the policy is intended to achieve as well as the efficiency of each instrument in achieving intended actions. However, it is not always possible to identify and calculate them. When it comes to financial measures such as costs for subsidies they can be easily estimated, while costs arising within firms and public administrations subject to different policy instruments are difficult to be accurately quantified. The benefits of policies are often even more difficult to quantify. This is due to the fact that in many cases benefits relate to society and welfare as a whole while costs are often born by the state or by private companies (GTZ, 2006).

In this study we distinguish three types of actions that can be undertaken by different stakeholders to set up market-based instruments and incentives for food waste prevention and reduction:

1. **Actions undertaken by governments, public authorities and organizations**. Governments can use a full range of market-based instruments to provide incentives to stimulate prevention and reduction of food waste. Here we refer mainly to price and quantity–based incentives and public payment schemes (e.g. tax measures, depreciation of investments in special "less food waste" technologies, subsidies)
2. **Actions undertaken by private actors**. Here we think mainly about measures like standards, purchasing requirements and information based incentives. Market forces (along the chain) on their own can promote voluntary improvements to prevent and reduce food waste (self-organized private market instruments and incentives, marketing labels and certification schemes, long-term supplier contracts, preferred supplier agreements, application automatically and dynamically offers discounted price and other purchasing incentives for perishables approaching their expiration dates, etc.). They are called voluntary because they are not on a compulsory base and tend to improve the corporate

reputation, the brand impact, the strong corporate governance, the competitive advantage, etc.

3. **Interactions of actions between public governmental policies and voluntary improvements**: private incentives are designed in combination with complimentary policy initiatives.

5 Inventory of potential market-based instruments and economic incentives based on food waste drivers

Based on the gathered information from FUSIONS D1.5 "Drivers of current food waste generation, threats of future increase and opportunities for reduction" of FUSIONS project, an inventory of food waste drivers has been carried out. The objective of this inventory was to identify barriers (both legislative and to business) affecting decision-making behaviour with respect to food waste prevention and reduction and to analyse actions and recommendations with potential to enhance market-based instruments and incentives. The later ones provide a base for formulating propositions for market-based instruments and incentives.
Note that not all actions and recommendations are applicable to be used as market based instruments and incentives, because of their nature (i.e. they are not able to encourage behavioural change through market signals rather than through traditional regulations).
According to D1.5, drivers were grouped in 4 categories:

A. Technological
B. Institutional (business and management)
C. Institutional (legislation and policy)
D. Social (consumers' behaviours and lifestyles)

Each category includes three more detailed sub-categories and some specific drivers.
Figures 5.1–5.4 summarize drivers (category and subcategories), actions and recommendations, and applications of market-based instruments and incentives.

A. Technological drivers

A1. Drivers related to characteristics of food and/or its production and consumption, where technologies have become limiting:

a. *Advanced packaging (proper conservation and transport techniques)*
b. *Selective fishing gear (developing, using and enforcing more selective fishing gear to reduce by-catch)*
c. *Advances in plant and animal breeding*
d. *Electronic ordering systems and automatic storage management systems*
e. *New technology (refrigeration)*

A2. Drivers related to collateral effects of modern technologies:

a. *Increased mechanisation of harvesting and processing of foodstuffs, which may augment losses for damaged products and for products with non-standard shapes that cannot be processed by machinery*

A3. Drivers related to suboptimal use of, and mistakes in the use of, food processing technology and chain management:

a. *Access to modern equipment and techniques (various items: to reduce mechanical damage during harvest, reduced storage losses, improved processing yields)*
b. *Improved redistribution logistics*

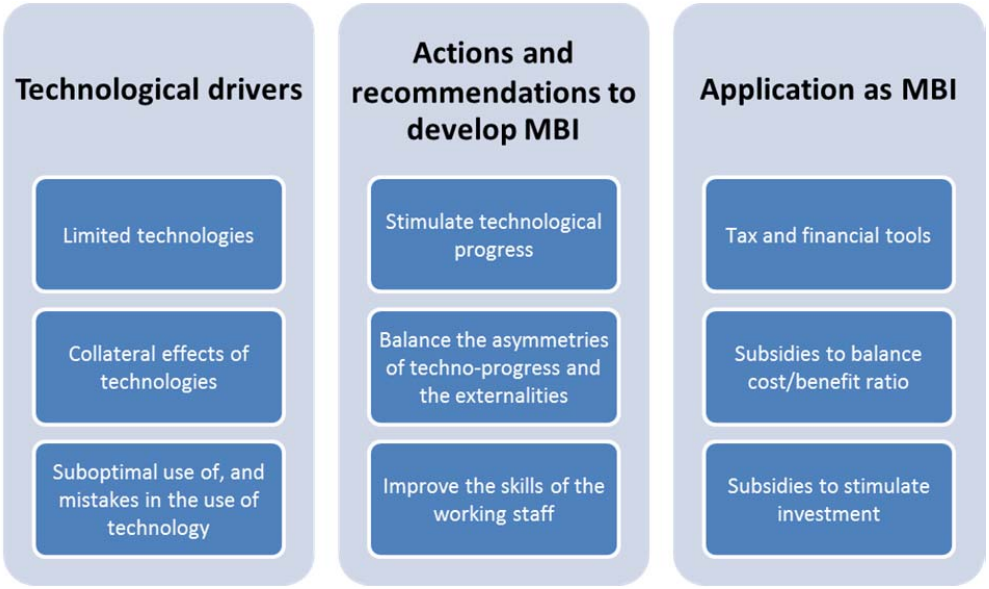

Figure 5.1 Actions, recommendations and application of market-based instruments to address food waste technological drivers

B. Institutional (business management) drivers

B1. Drivers related to macroeconomic trends at business level

a. *Globalization (waste from increase of traded food staples)*
b. *Costs and benefits (food waste generated by savings of other more costly factors of production)*
c. *Product price doesn't cover the cost of harvest and transport to markets*
d. *A product's price may not warrant the labour and transport costs required to bring the crop to market*
e. *Due to market demands on certain sizes etc, farmers choose to plough the entire production (if the majority of the production is imperfect), because it is too expensive to harvest the crop*
f. *Raising offer of short shelf life products*
g. *Trend to excessive portioning of many packaged products*

B2. **Drivers related to macroeconomic trends at consumer level**

a. *Consumer demand and expectations*
b. *Variety in choices offered*
c. *Health strategy (trends towards a wellness-driven lifestyle). Rising demand for "healthier" food, which tends to reduce content of preservatives and may reduce food shelf life*
d. *Increasing consumption of fresh products*
e. *Customers order decoupling point*[2]

[2] In value chain management the 'customer order decoupling point' is defined as the point of the value chain in which a product is linked to a specific customer order. To anticipate the decoupling point in the catering industry means, for example, that a meal will be prepared only after a specific customer order: this may contribute to reduce food waste (D1.5).

B3. Drivers related to changes by trends in the choices of firms

a. *Market power (power of retail over producers)*
b. *Contracts between customers and suppliers. Take back clause-related to losses and other contractual commitments*
c. *Precautionary measures with respect to public health risks/food safety/quality and the brand image (brand image protection)*

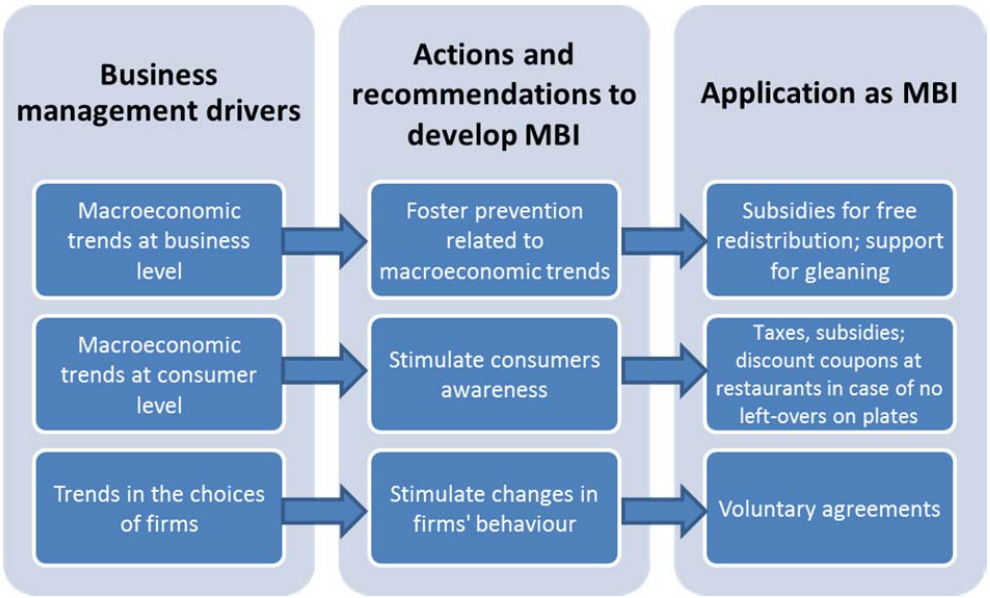

Figure 5.2. Actions, recommendations and application of market-based instruments to address food waste institutional (business management) drivers

C. Institutional (legislation and policy) drivers

C1. Legislation derived from: agricultural policy and quality standards

a. *Fisheries policy (fish discard)*
b. *Marketing/quality standards*

C2. Legislation derived from: food waste, consumer health and animal welfare

a. *Food safety standards*
b. *Labelling*
c. *Animal by products*

C3. Legislation derived from waste and tax policies and by other policies

a. *Separate waste collection*
b. *Waste policy (low cost of disposal/inadequate taxation)*
c. *Redistribution (hindrances to redistribution related to healthy risks and fiscal policies)*
d. *Public procurement laws (The law makes it difficult to buy local and ecological food. Instead the most economically advantageous food with less quality is chosen. The food tastes worse than if the raw material was of higher quality. The result is more food waste*
e. *Bio-fuel policy (incentives for bio-fuel production from food waste, using waste for energy production, may increase its value and therefore the desire to reduce waste can decrease)*

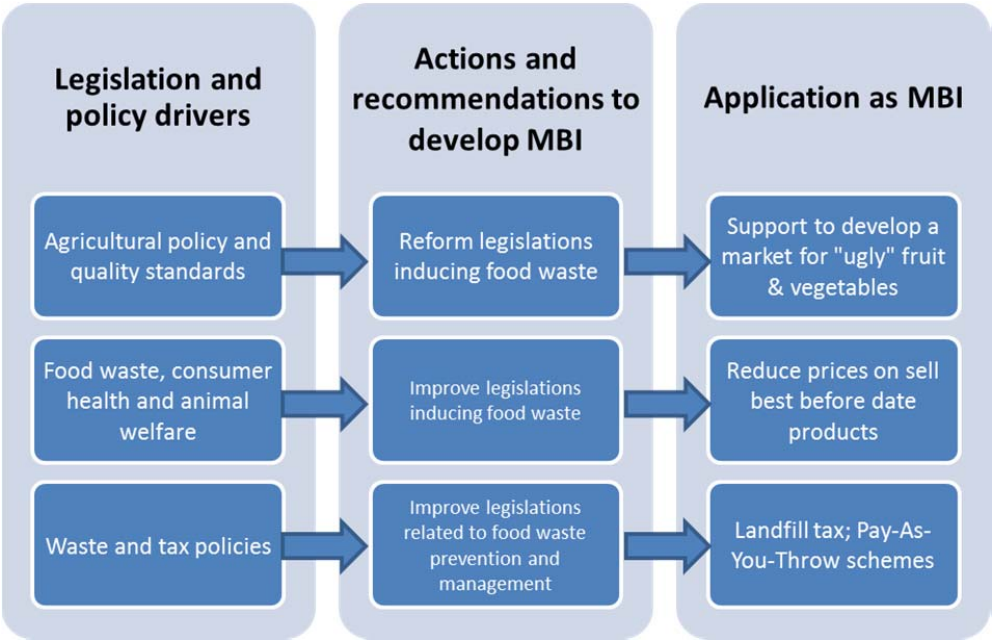

Figure 5.3 Actions, recommendations and application of market-based instruments to address food waste institutional (legislation and policy) drivers

D. Social (Consumers' behaviours and lifestyles) drivers

D1. Social trends and dynamics (point out the long term effects of global social dynamics)

a. *Social trends and dynamics*
b. *Demographic trends*
c. *Population age*
d. *Household structure*
e. *Income*
f. *Education*

D2. Individual behaviours / general expectation of consumers towards food (increasing demand for more food variety)

a. *Preference for good food aspect of food products ('perfect condition')*
b. *Possibility of acceding to broad quantities and varieties independently on place and time, all year around*

D3. Individual behaviours modifiable through information and strengthened awareness

a. *Consumer attitude towards food shopping (retailers):*
b. *Not feeling guilty about food wastage,*
c. *Reduced incentive to avoid food wastage due to new affluence,*
d. *Negative influence on consumer behaviours from promotional sales of food and from the practice of selling packaged food in large portions*
e. *Diet guidance (lack of food knowledge in educational curricula)*
f. *The way food is served in restaurants (caterers)*
g. *The level of general information and awareness about food*

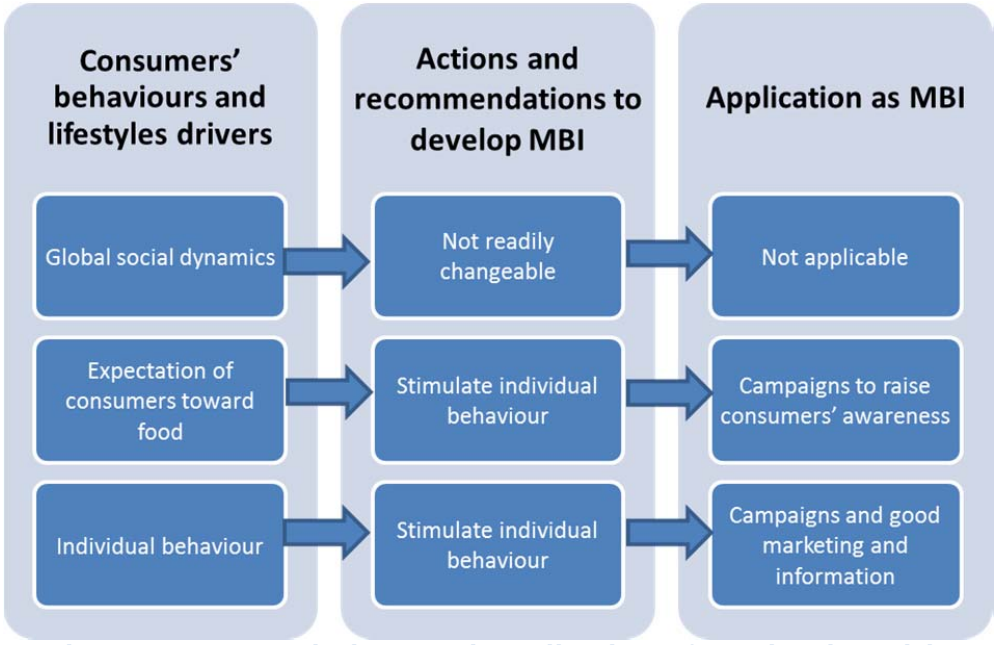

Figure 5.4 Actions, recommendations and application of market-based instruments to address food waste social (consumers' behaviour and lifestyles) drivers

In general, Figures 5.1 – 5.4 indicate the essential role of government in the introduction and implementation of market-based instruments and incentives for food waste reduction and prevention. The suggested instruments are mostly price-based instruments based on positive incentives (e.g. subsidies on food waste reduction technologies, fiscal incentives for food waste donation) and negative incentives (e.g. landfill tax, tax on wasted food).
Some examples of informational policy tools have been proposed such as voluntary agreements similar to a new voluntary code of practice introduced into the UK, or improved consumers' awareness towards food waste, by increasing food waste campaigns and information. Hereby there is an interaction of actions between public governmental policies and voluntary improvements, where private incentives can be designed in combination with complementary policy initiatives.

INSIGHTS FROM THE CONSULTATION SESSIONS

During the second FUSIONS European Platform Meeting in Brussels, held on 31st of October 2014, a consultation session entitled "Market-based instruments and other socio-economic incentives" was organised with the aim to collect more practical information on potential market-based tools and incentives beyond the literature review and internal FUSIONS project inputs.
The consultation session was organised around three main questions:

- **Question 1**. Should governments establish specific taxes or fees by charging for food waste produced at the different levels through a system of compulsory protocols, targets and standards?
- **Question 2**. How could fiscal benefits contribute to private investments specifically addressing food waste reduction/prevention?
- **Question 3**. What are the most promising market-based instruments and other socio-economic incentives as specific policy measures for stimulating food waste prevention and reduction?

The results are summarised in Table 5.1 below, where the tools and incentives selected by experts as the most promising ones are shaded in dark green.
By summarising the results from the consultation session it can be noticed that, similarly to the results from the inventory analysis, the role of the government is seen as key to development and

implementation of market-based instruments. At the consultation session it was concluded that introducing taxes and charges is probably not always the best option to contrast the food waste problem. Positive incentives such as stimulation via subsidies and searching interactions between private and public initiatives may lead to a higher food waste reduction. Thus subsidies to balance cost/benefit ratio could also be implemented.
Note that some of the tools presented below are initiatives rather than market-based instruments and/or economic incentives (e.g. awareness campaigns), but there could be economic incentives that encourage organisations to support certain actions/initiatives (e.g. subsidies to support awareness campaigns).

Table 5.1 Potential Market based tools and incentives: summary of consultation session with experts

Question 1. Taxes and charges	Question 2. Fiscal benefits	Question 3 Promising MBIs
a. Tax benefits from donating edible food	***a. VAT reduction on redistribution / donation / charity***	***a. Shelf life versus price: instrument regulating the price of perishable products approaching expire date***
b. Tax credit for taxpayers to engage in food waste reduction	***b. Subsidies to farmers to stimulate food waste reduction by X %***	***b. To reward and support initiatives from the private actors***
c. Taxes and charges for wasted food	***c. Reducing tax / (VAT) on technology aiming at food waste reduction – to reduce VAT from 25 %***	***c. Charges for throwing away (PAYT) and to use resources via tax-collected money for different initiatives***
d. Fees/taxes may have negative impact on social innovation (e.g. donation) and are not always considered as a good example to reduce food waste	***d. To introduce matching funds-private public partnership***	***d.*** Low interest rates (by banks) for ideas for innovative food waste solutions
	e. Venture capital funds to develop new business models or invest in novel technology	e. Social inclusion via subsidies
	f. Create/stimulate flexibility for business and innovation by reducing lengthy bureaucracy related to requests for subsidies	f. Adjusting (analysing upfront) conflict between governmental regulations regarding incentives
	g. The use of example on incentives for investment on solar energy-governmental subsidies on solar systems	
	h. Low-interest financing on business stimulating food waste reduction	
	i. Guarantee lower risk (insurance-wise) for starters/entrepreneurs	

Please note: dark green shaded information in italic refers to market based instruments and incentives selected by experts as the most promising ones.

The results from Fig 5.1-5.4 and Table 5.1 are combined and briefly summarised in the table below (Table 5.2). Table 5.2 presents a summary of selected tools and incentives identified by FUSIONS partners (based on food waste drivers inventory) and experts (from consultation session) as having the most potential in reduction and prevention of food waste.

Table 5.2 Summary of results from inventory and consultation session based on FUSIONS partners' and experts' selection

Price and quantity based instruments		Informational instruments
Taxes, fees and charges	***Subsidies, grants, tax benefits***	***Voluntary actions and agreements, standards, provision of information***
Unit pricing policies by charging on the basis of the volume or weight of trash discarded (e.g. "PAYT themes) instead of a flat tax or monthly fee	Subsidies/regulations to stimulate private companies to invest in food waste reduction technologies	Consumer stimulations applying marketing strategies (e.g. discount coupons at self-service restaurants in case of no left-overs on plates)
	Subsidies for free redistribution and new processes	Stimulation of Groceries Code Adjudicator Bill[3] introduced in the UK in December 2012
	Subsidies to farmers to stimulate food waste reduction by X%	Voluntary agreements such as a new voluntary code of practice[4] introduced into the UK supermarket sector in a bid to ensure the fair treatment of suppliers and address issues hindering competition in the market
	VAT exemptions on food donations, fiscal incentives for food donation such as tax breaks (e.g. France)	Government can stimulate the use of imperfect fruits and vegetables, development of a new market for fruit & veg waste. Examples of Fruta Feia (ugly fruit)[5] initiatives in Portugal
	Matching funds-private public partnership	Improved consumers' awareness towards food waste induced by increasing food waste campaigns and information
	Venture capital funds to develop new business models or invest in novel technology	"Shelf life versus price" instruments regulating the price of perishable products approaching expire date
	Local community and authorities can stimulating gleaning for products with imperfect sizes by supporting entrepreneurs (e.g. involving local communities and providing financial and non-financial support	
	Food service establishments can receive tax benefits from donating wholesome, edible food to food banks or food rescue organizations.	
	Provide tax credit as an incentive for taxpayers to engage in food waste reduction	

[3] Groceries Code Adjudicator Bill: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/226119/GCA_Supporting_facts_and_QA_July_2013.pdf [Accessed online, October 19th, 2015].
[4] Voluntary Code of Practice: http://www.opsi.gov.uk/si/si2003/draft/5b.pdf [Accessed online, October 19th, 2015].
[5] Fruta Feia: http://ppl.com.pt/en/prj/fruta-feia [Accessed online, October 19th, 2015].

6 Review of MBIs and economic incentives in selected areas of application

Food waste has only recently become one of the hottest global issues. The emergence of food waste has brought about new challenges for the design of policies addressed to prevent and reduce it. So far, the number of market-based instruments and economic incentives adopted specifically for food waste prevention and reduction is rather limited, with the only exception of food waste awareness campaigns.

Therefore, the market-based instruments and economic incentives adopted to solve other issues that have been on the agenda of governmental and business policies for a much longer period, compared to the food waste issue, might provide useful experiences to design such instruments for stimulating food waste prevention and reduction.

Furthermore, it should be noted that in general market-based instruments and economic incentives are relatively new mechanisms in international policy context although they are increasingly being considered for the management of natural resources and environmental pollution. The main reason for this is the theoretical potential of market-based instruments and incentives to deliver the same outcome as command-and-control instruments but generally at lower cost to industry and society.

This section of the report presents results of a rapid literature review on market-based instruments and economic incentives, as applied to solid waste management; environmental pollution; product quality, sustainability and biofuels; nutritional health and obesity; and food safety.

The basic question is whether such instruments and incentives might be applicable to food waste and be effective in preventing and reducing it.

Table 11.1 (Annex) presents an overview of different market-based instruments and economic incentives proposed or adopted in the areas described above by governments or other relevant organizations and private businesses (supply chain operators, retailers, food services).

Table 1.1 (Annex) does not aim to list all available instruments and incentives but it rather shows the most representative examples and synthesizes them into approaches so to identify the most suitable ones for food waste prevention and reduction. Specifically, the table provides some insights into effectiveness of the identified instruments and incentives and discusses their potential applicability to food waste prevention and reduction (this is described in the right-most column of Table 11.1, Annex). It needs, however, to be kept in mind that only the theoretical influence on food waste reduction and prevention is mentioned without looking at possible negative consequences (e.g. shift of waste to undesired or illegal pathways). Potential negative effects of specific instruments and incentives are discussed below.

To better demonstrate the identified generalities, the identified instruments and incentives were grouped according to the categories described in the “Background” section (price-based, quantity-based and informational policy instruments) and the categories used in environmental policies. Generally, the polluter pays principle underpins environmental market-based policies, especially price-based ones. This principle is enacted to make the party responsible for producing pollution also responsible for paying in proportion to the damage done to the natural environment. It is applied to stimulate environmentally positive behaviour or “green” investments.

6.1 Solid waste management

Table 11.1 (Annex) shows a range of market-based instruments that have been designed and adopted for solid waste management. Most of them are **price-based instruments**, offering three basic categories of incentives: negative, positive and mixed incentives (Jones et al., 2010).

Instruments that offer **negative incentives** and cause direct alteration effect are mainly represented by "**pay-as-you-throw**" (PAYT) themes and various taxes **(Figure 6.1, A.1)**. Similar to the polluter pays principle in environmental policies, the pay-as-you-throw principle is a basic principle in solid/household waste policies. This principle implies that charges are only made to cover the personally generated waste amounts. That is, any waste reduction efforts undertaken by the citizens are rewarded. Seventeen Member States employ PAYT systems for municipal waste, but they can vary even between municipalities of the same country (Watkins et al., 2012). Pay-by-volume themes are the common PAYT themes, which involve a graduated fee charge for each waste pick-up, relative to the container size (e.g., using user or bin identification and electronic measuring, container tag fee system) (Bilitewski, 2008). Pay-by-weight theme involves a variable waste charge. This theme is technically very demanding, since it requires collection vehicles that are equipped to weigh the waste bins at each property (AEA Technology, 2006; Gellynck et al., 2011; Dresner and Ekins, 2010; Puig-Ventosa, 2008).

Weight and frequency-based schemes (Figure 6.1, A.1) are the most effective, with volume-based initiatives bringing up the rear. The effects (increase in recycling rates and overall waste prevention) of pay-as-you-throw systems are well documented (Holmes et al., 2014; Dahlen and Lagerkvist, 2010; Dunne et al., 2008). These themes also have benefits in environmental terms (increase in recycling and reduction of waste to landfill), in economic terms (collection and treatment costs are adjusted to the weight treated) and fairness as people are billed according to the waste they produce. In theory such themes could lead to an increase of waste separation, of home composting, of second-hand sales and most important a prevention of waste. At the same time, critics argue that waste may end up intensively in illegal pathways such as burning of waste or illegal dumping or even see a shift of waste, e.g. disposing waste at working places or at other municipalities with no such a fee system. Outcomes of some studies (see Dahlen and Lagerkvist, 2010; Dunne et al., 2008) show that no correlation could be found between increased sorting for recycling and decreased amounts of residual waste in pay-by-weight or pay-by-volume schemes. This can be explained by the fact that residents might have adapted to producing less waste, or they may have disposed of waste outside the ordinary waste collection system.

As for taxes applied to solid waste management, most of them encourage recycling rather than prevention of waste, mainly via various forms of incineration tax and landfill tax, but also via other forms such as declaration payments made by waste generators or levy garbage fees (Sasao 2014). These taxes imply a levy charged by a public authority for waste disposal (Table 11.1, Annex). **Incineration taxes** and **lanfill taxes** are main tax instruments **(Figure 6.1, A.2)**. These instruments are rather efficient and also have a potential to be applied for food by-products and food waste (Hodges et al. 2011; Sasao, 2014). In general, in solid waste management, higher incineration charges are associated with higher percentages of municipal waste being recycled and composted.

For example, a Swedish study indicates that the incineration tax will have the largest effect on biological treatment of kitchen and garden waste, which may increase by 9% (Finnveden et al., 2007; Sahlin et al., 2007). Six Member States were found to have incineration taxes in place for the disposal of municipal waste. All MSs that have incineration taxes also have landfill taxes, and in every case the landfill tax is higher than the incineration tax (Morris and Read, 2001, Watkins et al., 2012, Cole et al., 2014). However, similar to PAYT themes the incineration and landfill taxes may provide perverse incentives for illegal dumping (Finnveden et al., 2007; Sahlin et al., 2007; Watkins et al., 2012). Furthermore, these instruments may encourage recycling over prevention. However, for countries where landfilling is still the most used option to dispose of food waste, the landfill tax is an efficent tool for food waste reduction in the residual stream (Morris and Read, 2001; Watkins et al., 2012; Cole et al., 2014).

Instruments that offer **positive incentives** and cause indirect alteration involve **funding opportunities or tax reduction (Figure 6.1, B.1)** for those who proceed to waste minimization or participate in recycling projects (Jones et al., 2010). EU and national governments offer **subsidies** in the form of **technological and financial support (Figure 6.1, B.2)** to communities that recycle and reuse solid wastes through an environmental agreement (Huang et al. 2014). A subsidy on recycled materials to support smart product and packaging design is an example of such an instrument. A subsidy based on secondary material recovered will result in a higher recycling rate and will improve recovery technology more than a subsidy for recyclable wastes collected and sorted (Chen, 2005).

Some of these incentives solely support separate collection and recycling of waste but not really reduction. Examples include the setting of recycling rates, or subsidising the use of biogas use, and some other measures which ensure that the waste is going to an adequate disposal pathway, such as provision of bins and bags to households by municipalities (Bernad-Beltran et al., 2014).

The third category includes mixed incentives instruments, which have long been established in the field of solid waste management. The deposit–refund systems (DRSs) is the most well-known example (Jones et al., 2010), where, e.g. for beverage containers (bottles or cans), first, a tax is placed on the purchase of the container; second, a subsidy is provided to whomever returns the container so as to dispose of it in the environmentally preferred way (reuse or recycling) (Lavee, 2010). Data show a clear correlation between the implementation of DRSs and increased rates of recycling (correlation coefficient higher than 80); however DRSs do not seem to be applicable for the reduction of food waste.

Other non-monetary measures for stimulating prevention and waste reduction were also detected. Identified non-monetary incentives (e.g. participation in food waste prevention campaigns and correlated prize awards) aim at stimulating people's participation or in increasing the quantities of recycled products. Other incentives (e.g. shop vouchers, community rewards, charitable donations, school rewards) (Harder and Woodard, 2007) might be adapted to food waste prevention and reduction, alongside the participation to pilot actions which may result in a learning-by-doing effect.

Many non-monetary incentives can result in a positive attitude of households towards food waste prevention and reduction. This is underlined by the finding of studies evaluating the households characteristics recycling schemes. They stated that households are better encouraged to recycle when they have a strong moral commitment and a positive attitude towards environmental policies (Halvorsen, 2012). Those attitudes may be achieved through the participation in food waste reduction and prevention campaigns supporting the effect of such initiatives.

The implementation of reporting tools for companies was found in the literature as an incentive for waste avoidance and may therefore be also interesting for the prevention of food waste. Such tools may be developed and introduced by national authorities that want to support the evaluation of baseline data according to the EU-Regulation for Guidelines on Waste Prevention Programmes. This support can either be in the form of financial resources for the implementation of such tools or in the establishment of special framework conditions. An implementation of a reporting tool using an example of Zero Waste Index (not existing so far), (Zaman and Lehmann, 2013) may also increase awareness of food waste avoidance within a community and enhance the reduction of food waste. This index can be used to forecast the amount of virgin materials, energy, water and greenhouse gas emissions substituted by the resources that are recovered from waste streams (Zaman and Lehmann, 2013). Such support programmes are not further discussed in this report, as they are linked to EU-policies which may have an effect on food waste reduction and not on marked-based instruments or socio-economic incentives in a narrow sense.

Figure 6.1 summarises the findings of this review. In the area of household waste recycling, smart product design and packaging design were mentioned by several authors. As an out-of-box idea packaging material can be derived from food by-products in a valorisation step thus reducing the

amount of food by-products which would be disposed of as food waste. Another out-of-box idea found in literature is a pay-per-can scheme[6], in the area of large commercial producers of degradable waste which may lead to food waste reduction.

Overall, pay-by-volume and pay-by-weight schemes can be applied in a broader sense to reduce food waste, at both household and industrial level. Economic incentives should probably be particularly regarded as tools, which can be used to impact those people who cannot otherwise be motivated to prevent or reduce waste. Huang et al. (2014) emphasizes that: 'Even though financial investment is important and significant for the household waste sorting and reduction, it cannot produce results on its own. It should be targeted to appropriate stakeholders in the context of wider considerations to produce an overall environment for food waste recycling to become mainstream'. Other non-monetary incentives can be implemented in a selective way, such as **shop and leisure vouchers, or also prize draws (Figure 6.1, C.1)**, in order to prevent food waste. Furthermore, it needs to be considered that not only monetary incentives affect waste reduction, but also the provided service level (e.g. collection frequency or kerbside recycling (Lakhan, 2004)) and other stimulating prevention and waste reduction measures (e.g. promotion activities, awareness raising campaigns), which are not the specific focus of this literature research.

Social influence is discussed as another kind of extrinsic incentive: 'non-economic external' incentives – specifically, actual and perceived social influence – strongly stimulate recycling' (Hornik et al., 1995). This indicates the important role of **social networks (Figure 6.1, C.2)**, also as applied to the food waste issues. There are numerous examples in the literature showing the importance of social networks, but the review of this literature is out of scope of this study.

If early recycling efforts and early food waste mitigation efforts are comparable, economic incentives should probably be regarded as one of several tools in the full toolbox, which can be used to impact those people who cannot otherwise be motivated to prevent or minimise waste.

[6] Pay-per-can scheme refers to scheme where households and commercial activities have their own bin or container for the delivery of waste, which is collected at their doorstep: http://www.med-zerowaste.eu/deliverables/DST_Final/index.files/Page2018.htm [Accessed online, October 19th, 2015].

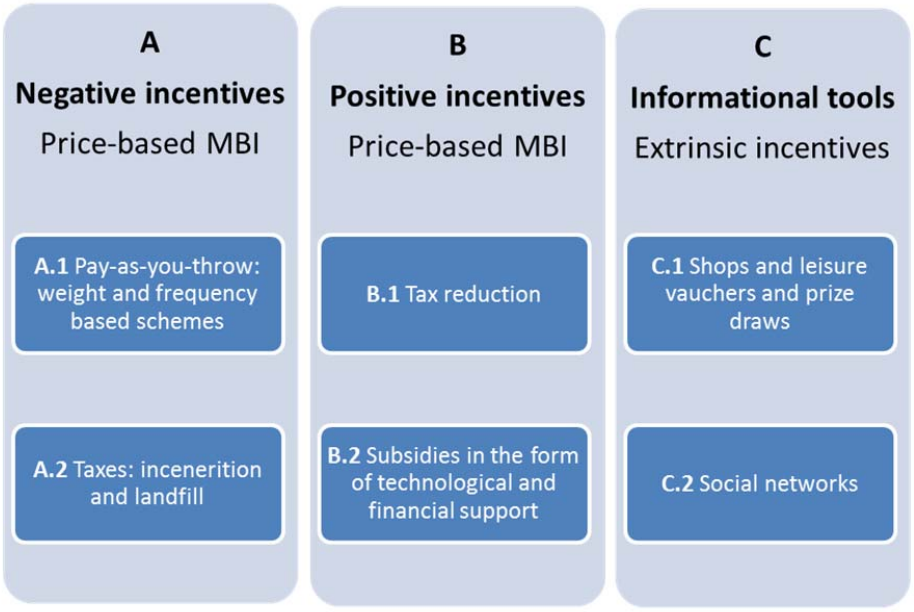

Figure 6.1 Market-based instruments and economic incentives toolbox to prevent and reduce food waste: experience from solid waste management.

6.2 Environmental pollution

A range of market-based instruments identified in literature for environmental pollution mainly focus on the "polluter pays principle" as an economic principle for environmental policy. The basic tenet of this principle is that the price of a good or service should fully reflect its total cost of production, including the cost of all resources used. Thus, the use of water, air or land for the emission, discharge or storage of wastes is as much a use of resources as labour and material inputs. Market-based systems of incentives and disincentives are instruments adopted to put the polluter pays principle in practice and to increase the efficiency of existing command-and-control mechanisms. According to the literature, under competitive conditions market based instruments usually perform better than command-and-control (Requate, 2005). However, the success of these instruments depends on regulations, macro-policies and institutional conditions of the country where they are implemented (De Motta et al, 1999). Moreover, the effectiveness of each measure depends on the type of instrument adopted and the specific objectives pursued by the environmental policy as well as market conditions (Jung et al., 1996; Montero, 2002).
Generally, with the implementation of a market-based instrument a government aims to modify the economic behaviour of producers and/or consumers by promoting the internalization of environmental costs of their activities. In some cases, public administrations or governments decide to mitigate the effect of these instruments (often taxes) using rebates or refund (Johnson, 2007). The success of this type of decision depends on the manner by which the refund is distributed (Johnson, 2006).
The most common market-based instruments that involve direct alteration of price are:

- **Emission charges.** They are charges (e.g. taxes or tariffs) on the discharge of pollutants into air, water and soil and related to the quantity and the quality of the pollutant and the damage costs inflicted to the environment.
- **User charges.** They are related to treatment cost, collection and disposal cost, recovery of administrative costs depending on the context of application. However, they are not directly related to environmental damage cost.

- **Product charges.** They are levied on products harmful to the environment and related to the environmental damage costs that they cause**.**
- **Deposit-refund systems.** They involve a deposit paid on potentially polluting products. If products are returned to some authorized collectors a refund is paid.

Indirect alteration or positive price based incentives are often used to stimulate the reduction of environmental pollution. It takes place when incentives are provided to induce environmentally clean technologies (Turner et al., 1994). These are **direct subsidies**, **soft loans, fiscal incentives, enforcement incentives, such as non-compliance fees and performance bonds**.

Market creation and market support are often used tools to tackle environmental pollution. Market creation is often done on the basis of changed legislation or regulation e.g. emissions trading, quota auctioning as a consequence of limiting emissions or catches in a certain area, insurance schemes in response to changed liability legislation etc. Market support occurs when public or semi-public agencies take responsibility for stabilizing prices or certain markets (e.g. secondary materials such as recycled paper or steel) (Turner et al., 1994). Among them, marketable permits are very common. They are environmental quotas or ceilings on pollution levels. They can be traded according to the rules.

Some connections with food waste issue are evident. First, some of the market-based incentives and disincentives are addressed to waste that result from production and consumption activities. Food waste is a type of waste and it also impacts on the environment. If the environmental cost of food waste was estimated, a tax at the socially optimal level could be levied in order to transfer this cost to the responsible subject.

By contrast, a firm that reduces or prevents food waste generation would, in fact, be creating a positive externality, and in such cases **subsidies** (e.g. fiscal incentives) could be provided to the firm in direct proportion to the value of this external benefit. For example, **incentives for retailers who decide to donate unsold - but safe – products**, in a way that higher incentives go to those who donate to food for human consumption, less incentive to those donating for animal consumption[7]. This kind of instruments could also stimulate social innovation, in terms of networking, bottom-up initiatives or inclusive strategies to solve a social problem like food waste.

[7] According to the food waste pyramid http://www.feeding5k.org/businesses+casestudies.php [Accessed online, October 19th, 2015].

6.3 Nutritional health and obesity

For nutritional health and obesity, the market-based instruments underpinned are mainly voluntary agreements, rather than regulations. Some of the reviewed instruments (e.g. awareness campaigns) are not always directly classified as market-based instruments or economic incentives, but are included in brief in this analysis as they are essential components of the overall policy directions on nutritional health and obesity. The policy measures that have been identified for nutritional health and obesity are fairly standard, and confirm some policy approaches that could potentially be used for stimulating food waste prevention and reduction, as summarized in Figure 6.2.

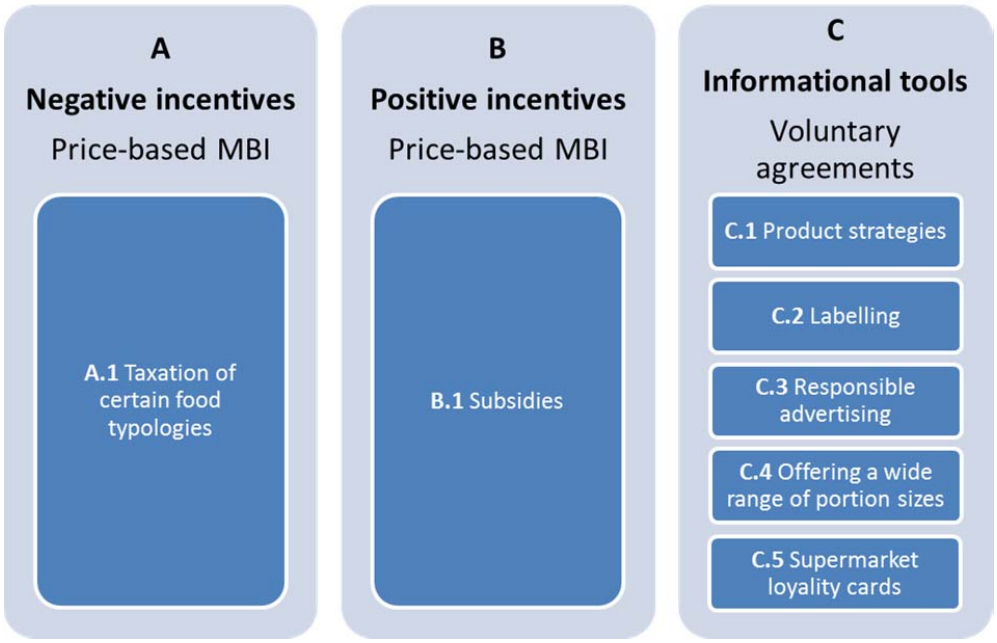

Figure 6.2 Market-based instruments and economic incentives toolbox to prevent and reduce food waste: experience from nutritional health and obesity management.

Putting taxes on certain types of foods (Figure 6.2, A.1) and **subsidies (Figure 6.2, B.1)** may contribute to improving nutritional health. A study by Powell et al. (2013) provided an over-arching review of research in the USA on food pricing and subsidies in order to collate existing knowledge for informing policy. The study concluded that taxes and subsidies are increasingly being considered as policy instruments to provide incentives for consumers to improve their food and drink consumption patterns. The practice of putting taxes on certain types of foods is established in some countries (e.g. Denmark and Hungary), and often it is applied to the types of food and drink that are considered to be particularly unhealthy (e.g. soft drinks, sweets, snack foods). However, this practice has not been widely implemented, it is rather in experimental phase and longer term impacts are not known yet. Further work is needed to assess practical aspects of its wider implementation and. Such taxes would potentially be applicable to food waste prevention (in that higher food prices would encourage less food waste). However, this policy could have negative social implications, therefore, it is not very practical.

A number of instruments could also be implemented to influence purchasing and potentially improve nutritional health. Some retailers in the UK have been introducing a voluntary policy to remove confectionery from displays at the point of purchase (i.e. near the check-out counters in stores). This has been proposed by the Scottish Government in a draft policy framework, with a focus on voluntary participation by retailers[8]. Limited information is available on the effects of such policy, but some documents indicate a positive impact is likely (Hawkes et al., 2015). However, the concept of selecting the types of product displayed at point of purchase would have limited applicability to the prevention of food waste.

There is limited research and data available on the effects of food portion and pack sizes, but there has been a trend in increased portion sizes, which is likely to be contributing to the increased levels in obesity (Steenhuis et al., 2009). In terms of market-based instruments and incentives related to portion and pack sizes in restaurants and retailers, the focus tends to be on voluntary measures, linked to **product strategies (Figure 6.2, C.1), labelling (Figure 6.2, C.2), responsible advertising (Figure 6.2, C.3), offering a wider range of portion sizes (Figure 6.2, C.4)**, etc. (EIRIS, 2006; Steenhuis and Vermeer, 2009). A recent study by Dobbs et al. (2014) identified portion control as the most effective measure to tackle obesity. Measures to decrease portion and pack sizes have high applicability to the prevention of food waste (Quested and Murphy, 2014; Quested and Luzecka, 2014), particularly for those people living alone.

Supermarket loyalty cards (Figure 6.2, C.5) providing detailed information on consumer behaviour could potentially be used to target education to shoppers that buy more unhealthy products. However, there is concern about data protection issues. Web searches on relevant new items indicate that there has been only limited discussion on the potential use of loyalty award schemes to provide incentives to shoppers that make healthier purchases. There is a patent application in the USA related to such a component of loyalty card schemes (Doak, 2013). Loyalty card schemes could be applicable for prevention of food waste, for example by encouraging people to purchase tools to help manage their food better, by providing information and advice based on actual purchases and by helping to mitigate against price barriers (for example smaller packs may be relatively more expensive than larger ones), although the cards would not provide data on food waste generation.

Labelling (Figure 6.2, C.2) is another potential instrument. The EU Regulation 1169/2011 on the provision of food information to consumers (FIC) includes mandatory nutrition information on processed foods. The obligation to provide nutrition information will apply from December 2016. As an example, the EU FIC[9] is being implemented in the UK through the UK Food Information Regulations (FIR)[10] (SI No.1855) (2014), which include requirements on nutrition and ingredient information. Traffic light labels on food sector products are used in some European countries on a voluntary basis, particularly in the UK. The labelling scheme shows how much fat, saturated fats, sugar and salt are in the product by using the traffic light signals for high (red), medium (amber) and low (green) percentages for each of these ingredients. The concept is that the traffic light

[8] Alcohol (Minimum Pricing) (Scotland) Act 2012 (asp 4). An Act of the Scottish Parliament to make provision about the price at which alcohol may be sold from licensed premises; and for connected purposes. Available online: http://www.legislation.gov.uk/asp/2012/4/pdfs/asp_20120004_en.pdf

[9] The EU Regulation 1169/2011 on the provision of food information to consumers (FIC).Available online: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R1169&from=EN.

[10] The UK Food Information Regulations (FIR) (SI No.1855) (2014). Available online: http://www.legislation.gov.uk/uksi/2014/1855/pdfs/uksi_20141855_en.pdf; https://www.food.gov.uk/enforcement/regulation/fir; http://www.weightlossresources.co.uk/calories/nutrition/information-restaurant-menu.htm; https://www.food.gov.uk/scotland/scotnut/healthycatering/cateringbusiness/calorie.

label on the packaging is easier to be identified and interpreted than the Guideline Daily Amount (GDA) labelling. Several studies have researched the potential effects of the traffic-light nutrition labelling on foods, and most of the ones reviewed have concluded that the measure is likely to have significant impacts on nutritional health (Sacks et al., 2011; Lobstein and Davies, 2008; Sonnenberg et al. 2013). Information on packaging labels to encourage food waste prevention is highly applicable.

Furthermore, there have been numerous awareness campaigns about nutritional health and obesity[11]. Awareness campaigns to encourage food waste prevention are highly applicable, for example Love Food Hate Waste in the UK, which has proved to be very successful in raising awareness, enabling behaviour change and reducing food waste (Quested et al., 2013).

[11] Change 4 Life and Eatwell campaigns. Available online: http://www.nhs.uk/change4life/Pages/change-for-life.aspx; http://www.weightlossresources.co.uk/healthy_eating/healthy-lifestyle/change-for-life.htm.

UK "5 a day" campaign. Available online: http://www.nhs.uk/Change4Life/Pages/five-a-day.aspx; http://www.foodmanufacture.co.uk/Regulation/Labour-government-would-regulate-food-industry.

Public Health Responsibility Deal. Available online: https://responsibilitydeal.dh.gov.uk/.

6.4 Organic product and quality

Economic incentives are provided by governments to encourage the consumption of better quality products. For example, in OECD countries the economic incentives mainly include subsidies such as monetary grants, donations of goods and fiscal incentives in the form of tax reductions**(**OECD, 2008).[12] The logic is that by encouraging the consumption of such products, more suppliers and producers will ensure that these goods are being provided to the consumers. Generally, subsidies and tax incentives have only been efficient if they are able to close the gap so as to make the quality better and sustainable choice less expensive to consumers. Providing economic incentives to stimulate organic farming in the EU is one of the examples of how different regulatory and voluntary market-based instruments were developed. In 2007 the European Council of Agricultural Ministers agreed on a new Council Regulation (European Commission, 2007) [13] setting out the principles, aims and overarching rules of organic production (**performance** and **technological standards** as market-based instrument **(Figure 6.3, A.1)** and defining how organic products were to be labelled (**mandatory labelling program** as market-based instrument **(Figure 6.3, B.1)**. The legislation was renewed in 2014 and focuses on three main objectives: maintaining consumer confidence, maintaining producer confidence and making it easier for farmers to switch to organics. To help organic farmers, producers and retailers adjust to the proposed policy changes and meet future challenges, the Commission has also approved an Action Plan (European Commission, 2014) [14] on the future of Organic Production in Europe. The Plan aims to better inform farmers on rural development and EU farm policy initiatives encouraging organic farming, to strengthen links between EU research and innovation projects and organic production and to encourage the use of organic food, e.g. in schools. Different **subsidies for information and education schemes (Figure 6.3, C.2)** are to be applied to implement such a plan in practice. Furthermore, the Rural Development Policy [15] is a very important and relevant tool to support the sustainable development of rural areas and agriculture including organic farming, in the EU. The EC commissioned a study (European Commission, 2014) [16] which contributed to an overview of supporting measures addressing organic farming under the current rural development programmes. According to this study, four main Rural Development Policy measures were taken: (1) Setting up of young farmers: in the Czech Republic, in three Spanish and two Italian regions, young organic farmers receive higher payment rates than conventional young farmers; (2) Modernisation of agricultural holdings: in Flanders (Belgium), Madeira (Portugal) and North Rhine-Westphalia (Germany) higher grants are given to organic farmers investing in agricultural holdings to improve the overall performance of the farm. Organic livestock farmers but also other groups of farmers receive higher investment grants in Mecklenburg-Western Pomerania and Bavaria (Germany); (3) Participation of farmers in food quality schemes: Member States have adopted different approaches to refund certification and inspection costs of organic farmers. Flanders and Wallonia (Belgium) as well as Greece introduced the support scheme for organic farmers in 2011; (4) Setting up of producer groups: in Slovenia,

[12] OECD (2008) *Promoting Sustainable Consumption, Good Practices in OECD countries*, Paris: http://www.oecd.org/greengrowth/40317373.pdf [Accessed online, October 19th, 2015].
[13] Council Regulation (EC) No. 834/2007: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:189:0001:0023:EN:PDF [Accessed online, October 19th, 2015].
[14] EC, *Action Plan for the future of Organic Production in the European Union*, Brussels, 24.3.2014 COM(2014) 179 final: http://ec.europa.eu/agriculture/organic/eu-policy/european-action-plan/index_en.htm [Accessed online, October 19th, 2015].
[15] EC, Directorate-General for Agriculture and Rural Development: http://ec.europa.eu/agriculture/rurdev/index_en.htm [Accessed online, October 19th, 2015].
[16] Jürn Sanders Matthias Stolze Susanne Padel (2011), *Use and efficiency of public support measures addressing organic farming*, Institute of Farm Economics, Braunschweig: http://ec.europa.eu/agriculture/external-studies/2012/organic-farming-support/full_text_en.pdf [Accessed online, October 19th, 2015].

financial support is given to organic farmers who set up producer groups and therewith strengthen the institutional structure of the primary sector.

Furthermore, in general, the Common Agricultural Policy (CAP) has been actively involved in making agriculture greener, more efficient and fairer. One of the policies that it has recently endorsed consists of making all Member States use 30% of their direct payments to finance payments to farmers for sustainable agricultural practices. As far as the organic farming practices are concerned, the idea behind this new greening payment assumes that the methodologies adopted by an organic farmer automatically comply with the requirements of CAP(European Commission, 2014).[17]. The new Common Agricultural Policy (CAP)[18] (2014-2020) recognizes the role of organic farming in responding to consumer demand for more environmentally friendly farming practices: in the first pillar organic farms will benefit from the green direct payment without fulfilling any further obligations because of their overall significant contribution to environmental objectives.

At the same time, next to regulatory market-based instruments, the private sector introduced its own **voluntary instruments**. Examples are briefly presented below:

a. **Organic schemes and innovative technology**: Whole Foods Market has been especially singled out as an example producer and retailer using incentives and policies to supply good quality products and contribute towards food waste reduction **(Figure 6.3, A.3)**. Indeed, the Whole Foods Market, Inc., which owns and generates the chain of natural and organic foods supermarket in the US, Canada and the UK, engages in sustainable and organic products. Every Whole Foods Market store is equipped with stories about the food that they supply and the farmers, ranchers and fishermen who provide it. In fact, Whole Foods Market uses a two-pronged approach to consumer education and the involvement of public participation in creating a sustainable future. Each store is equipped with a TAKE ACTION CENTRE which strives to offer customers a range of information on local, regional, national and international issues of concern. Incidentally, customers are in a position to be informed about issues such as genetic engineering, the benefits of organic foods, pesticides, and sustainable agriculture. They are also updated on new legislation and ways in which they can actively take part influencing the aforementioned issues.

The stores engage in customer programs by providing full recycling facilities in their dining areas. Indeed, Whole Foods Market works very closely with two recycling plants- Gimme 5 and Cork ReHarvest (Whole Foods Market , 2012)[19].

b. **Funding and loans for local farmers (Figure 6.3, C.1)**: in January 2014, Whole Foods Market, shared its commitment to spend $25 million in funding for loans to local growers, producers and food artisans through its Local Producer Loan Program.[20] The institution's rationale is that by enabling producers and farmers to have easy access to loans, the program can support pioneering projects in areas such as biodynamic farming, non-GMO animal feed, pollinator health and sustainable packaging. Recently, WholeSoy received a loan of $400,000 which has enabled the company to maintain its production and supply of dairy-free yoghurt. To be eligible for a Whole foods Market loan, the potential recipient must meet the Whole Food Market's quality standards, use the funds for

[17] EC (2014), Organic Farming, A guide on support opportunities for organic producers in Europe, Brussels: http://ec.europa.eu/agriculture/organic/documents/eu-policy/european-action-plan/support-opportunities-guide_en.pdf [Accessed online, October 19th, 2015].

[18] EC (2013), Overview of CAP Reform 2014-2020, Brussels: http://ec.europa.eu/agriculture/cap-post-2013/index_en.htm [Accessed online, October 19th, 2015].

[19] Whole Foods Market's Green Mission Report, 2012: http://www.wholefoodsmarket.com/sites/default/files/media/Global/PDFs/2012GreenMissionReport.pdf [Accessed online, October 19th, 2015].

[20] Whole Foods Market Newsroom, Whole Foods Market commits $25 million in funding for loans to local growers, producers and food artisans - See more http://media.wholefoodsmarket.com/news/whole-foods-market-commits-25-million-in-funding-for-loans-to-local-growers [Accessed online, October 19th, 2015].

expansion and have a viable business plan. The loans typically range from $1,000 to $100,000 and command low fixed interest rates.

c. **Discounted prices for "ugly" fruits and vegetables (Figure 6.3, A.2)**: The French retailer Intermarché has put in place temporary stands of downgraded fruits and vegetables which do not fall under the marketing standards but are still edible. The so-called "ugly" fruits and vegetables were sold at discounted prices to customers in order to incentivise them to be bought. The campaign was very successful and it had a great impact on EU retailers which replicated the initiative. There are no studies yet proving its impact on food waste reduction and prevention but it has created awareness around food waste. Monoprix, another French retailer, has now a permanent stand of "ugly" fruits and vegetables.

This case of organic farming represents a good example where regulatory market-based instruments of the government (performance and technological standards, labelling program, subsidies for education and information campaigns for farmers and consumers) and voluntary instruments of the private sector (organic schemes, funding and loans for local farmers, discounted/reduced prices for "ugly" fruits and vegetables) complement each other in achieving the same goal, i.e. to promote production and consumption of organic food. Such a mix of regulatory and private market-based instruments would also be useful for food waste prevention and reduction (Figure 6.3).

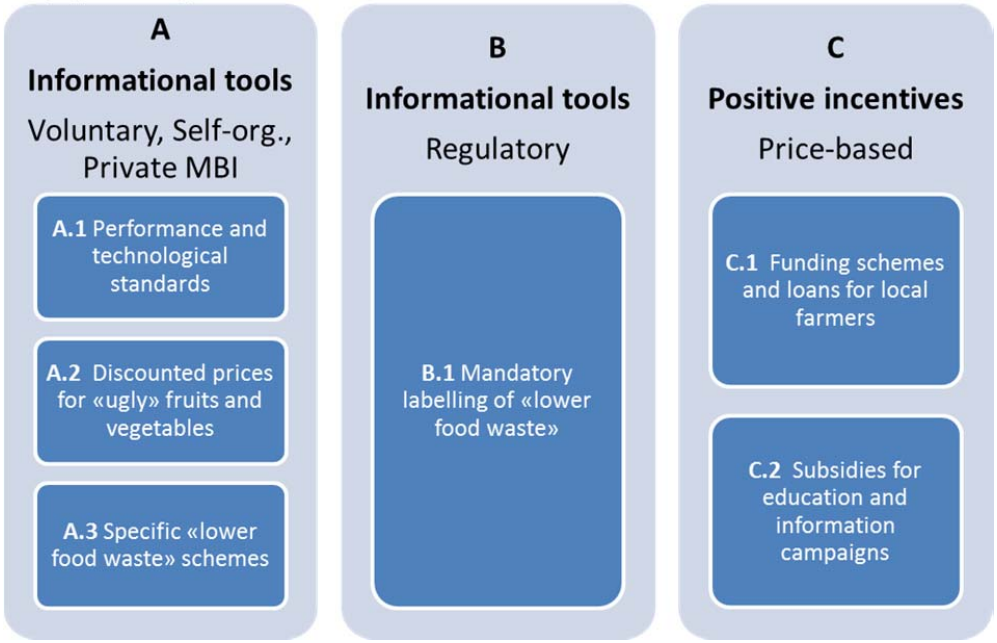

Figure 6.3 Market-based instruments and economic incentives toolbox to prevent and reduce food waste: experience from organic product quality management.

6.5 Sustainability

Since sustainability is a rather broad issue, the present analysis of existing market-based instruments has focused on certification schemes and Corporate Social Responsibility (business sustainability) schemes. From the numerous examples of existing instruments (Table 11.1, Annex), we summarised those that are different in their basic principle (as also distinguished in the previous sections) and examined how these could be relevant to food waste prevention and reduction.

In terms of their relevance to food waste, three groups of potential market-based instruments are resulting from this analysis. Here we only mention those instruments that we considered to be applicable in the short- or mid-term.

Firstly, examples similar to the voluntary 'Food Processing Sector Disclosures' document from the Global Reporting Initiative suggests the importance of corporate reporting tools for food waste issues. The Disclosures document contains a set of disclosures for use by all organizations in the food processing sector. They cover key aspects of sustainability performance that are meaningful and relevant to the food processing sector and which are not sufficiently covered in the G4 Guidelines. Such a reporting instrument might be suggested for food waste prevention issues, in particular, as guidance on how food waste should be measured and to identify what kind of processes and structures need to be used for reducing food waste. Without such guidance materials, companies' food waste data would not be comparable. So, an important market-based policy tool would be the **voluntary / mandatory reporting to disclose companies' food waste data (Figure 6.4, C.1)**. This would be beneficial for several reasons:

- Reporting requires measuring. Many companies do not follow the quantities of their food waste and once they start measuring, the numbers draw attention to prevention (e.g. better production planning).
- Disclosure (based on the same measurement methodology) allows comparisons, identification and sharing of best practices.
- (Mandatory) Disclosure may be the basis of a tax on waste.

This is an extremely under-published area (see other FUSIONS outputs), there are very few data available on food waste quantities. A voluntary/obligatory disclosure policy would be a great help in this matter.

The design of such a reporting tool raises some questions. Voluntary disclosure would only cover a fraction of companies, and this number would probably grow slowly. In case voluntary disclosure becomes mandatory (a good example is the new EU regulation under implementation, in this case information disclosure became compulsory for companies of certain types and size; as well as reach) how deep should be the reported information (what kind of data to report, should they report causes of food becoming waste etc.)? Disclosure of the information by companies regarding quantity of food waste (absolute and relative to other indicators) would be useful for policy design. Furthermore, disclosure of information on types/causes of food waste and internal policies on how to prevent and treat food waste could be another useful tool in preventing and reducing food waste. This can be followed by establishment of internal practices and processes in relation to food waste. A small step in this direction could be to ask for a specific indicator on food waste to be included in the Global Reporting Initiative food processing sector supplement, of which waste is unfortunately not a subject at the moment.

Secondly, **certification (mandatory or voluntary) schemes (Figure 6.4, C.2)** are another important policy making opportunity. Fair Trade and FSC are well known sustainability examples. Certification schemes are also popular instruments in the field of biofuels, e.g. 'White Certificates' in the transport sector (Farinellia et al, 2004). White Certificates are generated when the obligated parties themselves, or other actors, introduce energy saving measures. Such certificates can be exchanged and traded on the market. This measure is implemented by biofuel suppliers. On 10 June 2010, the EC announced its scheme for certifying sustainable biofuels, part of a set of

guidelines explaining how the Renewable Energy Directive, coming into effect in December 2010, should be implemented (www.biofuelstp.eu/sustainability). One of the points discussed was a communication from the Commission on voluntary schemes and default values in the EU biofuels and bioliquids sustainability scheme. The sustainability scheme contains two tools designed to reduce the administrative burden for economic operators: a) The option to use recognised 'voluntary schemes' or 'bilateral and multilateral agreements' to show compliance with some or all of the sustainability criteria; and b) The option to use 'default values' laid down in the Directive to show compliance with the sustainability criterion on greenhouse gas emissions savings. Economic operators must show MS that the sustainability criteria relating to greenhouse gas savings, land with high biodiversity value and land with high carbon stock have been met. They can do this in three ways: 1) by providing the relevant national authority with data, in compliance with requirements that the MS has laid down (a 'national system') , 2) by using a 'voluntary scheme' that the Commission has recognised for the purpose, 3) in accordance with the terms of a bilateral or multilateral agreement concluded by the Union with third countries and which the Commission has recognised for the purpose. (http://www.biofuelstp.eu/sustainability.html#verify)

A Certification Scheme for food waste could be a document verifying that a certain reduction of food waste has been achieved. For example, now that the French Law about supermarkets' donations has been introduced (May 2015, rejected August, 2015) revised and voted in the French National Assembly (December 9, 2015) http://www.assemblee-nationale.fr/14/ta/ta0632.asp, white certificates could be given to supermarkets whenever an amount of food waste is reduced through donations; furthermore the supermarket could use the certificate for its own target compliance or could sell it to (other) parties who cannot meet their targets. The ethics of such a measure is however questionable.

Companies might be certified according to their policies and/or practices on how they prevent/treat food waste and the amount of food waste they produce. Certification has to be based on a common guidance methodology for processes and measurement (see above). Here it is not the product, but the company (and its processes) that have to be certified. But the certification can also appear on products: certified companies can have something like a "less food waste" or "food waste minimiser" label on their products.

For certification processes of company B Corporations (a new type of company that uses the power of business to solve social and environmental problems), FSC, MSC and Fair Trade can be good inspirations. These could provide a model on how to certify food waste treatment across all food production processes.

Certification requires an independent certification agency, a robust methodology and a long time to be developed. Stakeholders involvement in the creation of such a scheme is essential. For this, the Global Reporting Initiative can provide a good example as it is based on intensive involvement of a wide range and number of stakeholders, especially companies. The advantages of food waste certification are as follows:

- Good and bad companies can be clearly distinguished.
- A label can be motivating for a company to start measuring and implementing policies/processes.
- Certification can be a basis for a good public procurement policy that supports food waste reduction. (see below)
- Thirdly, **tax schemes (Figure 6.4, A.1)** are a very important possibility coming from the review of sustainability-related market-based instruments. As briefly discussed in the previous section, tax schemes can be twofold:
- Tax refund/reduction might be provided to companies donating food. This is already happening in some countries, e.g. Hungary. This instrument diverts food surplus from bins to redistribution (even in the last minute, on the day of expiry).
- Or food waste produced might progressively be taxed following the food waste pyramid scheme (see Papargyropoulou et al., 2014 for more details on food waste pyramid), i.e. most tax on landfill/incineration. Implementation of such a tax would also imply getting

information about the amount of food waste. Or in another perspective, this policy could be based on a robust food waste measurement methodology in companies.

Combining the two tools (rewarding and taxing) (Figure 6.4, A.2) would create additional benefit for providing extra motivation to reduce food waste in companies. Inspiration and experiences can be drawn from taxes on unhealthy food (e.g. Hungary, Denmark, Finland), and possibly from other waste-related taxes.

Fourthly, public procurement (supply/access measures) is another potential top priority instrument for food waste prevention and reduction (Tsai and Chou, 2004). Public authorities are major consumers in Europe, spending approximately 2 trillion Euros annually, equivalent to approximately 19% of the EU's gross domestic product. By using their purchasing power to choose goods and services with lower impacts on the environment, they can make an important contribution to sustainable consumption and production. It does not only provide extra motivation for companies to start measuring food waste and implementing reduction practices, but also increases the awareness of this topic among important decision makers.

Green public procurement (GPP) **(Figure 6.4, C.3)**[21] is a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured. GPP is a voluntary instrument, which means that Member States and public authorities can determine the extent to which they are willing to implement it. This can be because of higher initial purchase costs that will only be offset by longer term benefits, because of lack of a critical mass of demand to make production viable, or simply due to lack of awareness of alternatives and their benefits. Green public procurement could provide a strong stimulus for eco-innovation, helping to make the EU a more resource-efficient economy and acting as a market driver for eco-industries.

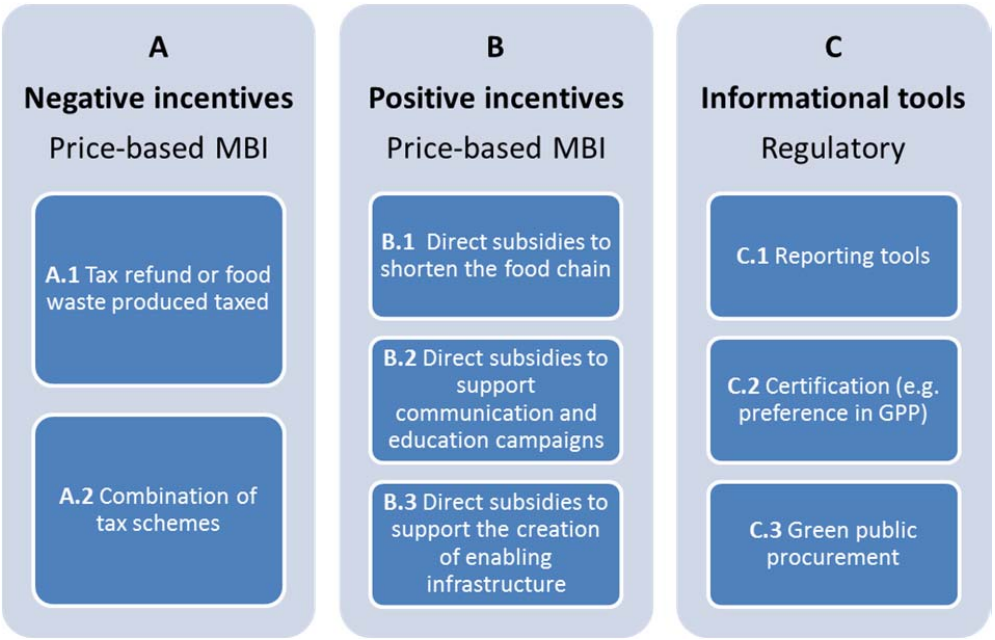

Figure 6.4 Market-based instruments and economic incentives toolbox to prevent and reduce food waste: experience from sustainability management.

[21] EC (2012), Green Public Procurement. A collection of good practices, Brussels http://ec.europa.eu/environment/gpp/pdf/GPP_Good_Practices_Brochure.pdf [Accessed online, October 19th, 2015].

Other identified potential market-based instruments with medium relevance and importance to food waste reduction is financial support via **subsidies** for:

a. **Innovation in shortening the food supply chain (Figure 6.4, B.1)**. Short food chains are also important for other issues / stakeholders, thus important alliances can be made in this field.
b. **Communication/education campaigns (Figure 6.4, B.2)**. Food waste should be a part of sustainability education topics. It can have a direct impact on households if practical tasks are given to children to be done at home or if it becomes standard practice in the schools (almost a common practice in recycling). Schools are places where a lot of food is wasted, and this is especially harmful as children grow up seeing this as normal. Therefore reduction of food waste in schools is an especially important issue (WRAP 2011; Falasconi, 2015).
c. **Creation of enabling infrastructure (Figure 6.4, B.3)**, e.g. financing infrastructure development for food surplus redistribution (for example refrigerator vans and fuel for charities redistributing food).

The wise combination of identified instruments would provide extra impacts due to synergies, as summarized in Figure 6.4.

6.6 Food safety

In general, the food economics literature identifies three broad groups of economic incentives for firms to adopt enhanced food safety controls (see, e.g., Buzby, Frenzen, and Rasco, 2001; Loader and Hobbs, 1999). These are: (a) *food safety laws and regulations*, public statutory and regulatory laws provide regulatory incentives to adopt food safety controls. Firms that are noncompliant can be subject to fines, product recalls, and plant closure or other penalties imposed by the courts and/or government agencies. Performance standards that establish limits on pathogens and mandatory processes that include cleaning and sanitation tasks for pathogen reduction are an example of such regulations; (b) *product liability laws*, product liability laws are characterized by criminal and/or civil sanctions with potential financial compensation for those affected and punitive damages for the responsible parties; (c) *market forces*, contractual relationships (agreements between customers and suppliers to pay a price premium, make minimum purchases, or offer other inducements to suppliers in exchange for greater attentiveness to food safety process control) and indirect consumer pressure (cease purchases if products fail to meet consumers' expectations for food safety) are examples of market forces. These forces stimulate implementation of extra management-determined actions that include investments in human and physical capital, food safety technologies, and organizational arrangements that enhance food safety process control.
In practice, the relative importance of food safety laws and regulations, product liability laws and market forces, as incentives differs both between countries and across different sectors and regions within a country; although statutory food safety standards are used most frequently as the principal approach (Antle, 1995). For example, for the meat processing sector, different studies suggest that market forces and (private) economic incentives have a greater impact on the food safety responsiveness of firms than governmental regulatory actions. In general, however, the associated economic cost of food-borne illness and food safety reputation are the major factors motivating the enhancement of regulatory oversight of the food supply chain, over and above market-based incentives to enhance food safety controls. This creates challenges for regulators in defining policy instruments that promote greater levels of food safety control in food processing sectors rather than constraining firms from taking initiatives that exceed regulatory requirements (Jayasinghe-Mudalige and Henson, 2006).

The further analysis discusses concrete examples of principal market-based approaches enhancing food safety. All of them aim to affect the above incentives of food businesses (Table 11.1, Annex), with somewhat more focus on market-based instruments based on private initiatives of chain actors, since they seem to be more effective for improving food safety. The analysis also reviews the relevance of these instruments to food waste prevention and reduction.
Voluntary and mandatory quality assurance and safety schemes/systems (Figure 6.5, B.2 + C.2):

- International standards, such as International Organisation for Standardisation (ISO) standards, are internationally accepted procedures and guides initiated in order to maintain consistent quality and safety (Holleran et al., 1999);
- National assurance systems assure consumers that the products of a nation's farm are produced in a prescribed manner. Often these systems prescribe production practices from the farm level to the retail level, including transportation and storage (e.g. The Farm Assured British Pigs in the UK, where the products with this assurance system carry the Little Red Tractor stamp. This ensures consumers that it has been produced to stringent standards that are independently inspected) (Holleran et al., 1999);
- Proprietary quality assurance systems, such as the national retailer quality assurance systems in the UK, specify retailers' unique safety and quality requirements. UK retailers work closely with their suppliers to monitor and ensure contract specification compliance. Retailers only purchase from a list of 'approved' suppliers that adhere to their specific quality assurance and safety systems (Holleran et al., 1999).

Voluntary and mandatory traceability systems (also, often as part of quality assurance systems) **(Figure 6.5, B.2 + C.2)**:

Traceability systems accumulate information about product attributes, including safety and origin, as the product moves through the supply chain and it is part of EU food law. Traceability systems are defined by the breadth, depth, and precision of the accumulated information. The breadth of the information refers to the variety of the product attributes that are monitored, the depth of the information refers to how far the accumulated information moves through the supply chain, and the precision of the information refers to its specificity and accuracy (Golan et al., 2004). Recently electronic traceability is becoming an industry requirement (http://www.barcoding.com), where companies who produce, manufacture, process, pack, transport, or hold a food to maintain full pedigree of product information and electronic traceability records, among others, expiry date, country of origin. Supporting the spread and use of such bar codes could make it a lot easier for retailers to track their close-to-expiry stocks and thus, to reduce food waste. Also, quality traceability systems help optimize the production process and in this way may prevent and reduce food waste along the chain.

As it was also identified in the previous sections, such themes/systems are implemented by operators along the whole chain; with subsequent self-regulation control, which includes internal control systems that assure product quality, where the chain actor sets, monitors, and self-certifies the control parameters. Often these themes/systems also require a third-party audit for certification and continued compliance with the system; usually imparting information to the final consumer in the form of a product label (Henson and Caswell, 1999). Such certification by other parties and labels may be voluntarily sought by the company or required by those with whom it does business. In this sense, both certification and labels can be seen as market-based instruments, as it was also identified in the previous sections.

Voluntary and mandatory forms of certification by other parties (Figure 6.5, B.3 + C.3):

Certification involves the setting of product quality standards and their monitoring and certification by parties outside the firm, for example customers, industry trade associations, or bodies such as the ISO (Henson and Caswell, 1999).

As it can be seen from the previous sections, these market-based instruments are also outcomes of the reviews of other areas of application. The previous sections have also discussed the potential applicability of these instruments to enhance food waste prevention and reduction.

However, in the food economics literature there is no single agreement about the effectiveness of these market-based instruments in improving food safety. For example, for the case of traceability systems, while Pouliot and Sumner (2008) show that traceability always increases food safety; Resende-Filho and Hurley, Moises et al. (2012) show that voluntary traceability and mandatory traceability do not necessarily improve food safety. Also, the findings of Starbird and Amanor-Boadu (2006) suggest that greater supplier liability and more accurate inspection do not unambiguously lead to more powerful incentives or to safer food. The relationship between inspection and traceability systems influences the supply of safe food, and so understanding the relationship is vitally important for buyers, regulators, and consumers.

In general, food chain actors' responses to the above market-based instruments in terms of compliance mainly depends on the expected economic benefits. For example, if the benefits of a certification for quality assurance and safety theme/system exceed the adoption and maintenance costs, then the standard is worthwhile. However, identifying and quantifying costs and benefits of a specific standard may present a challenge (Henson and Caswell, 1999).

The quality assurance schemes, traceability systems and certification process themselves might become a barrier to trade. For example, many of the farm-level quality assurance systems are designed and implemented by national producer organizations, and it is certainly to their advantage to use the system to positively differentiate national production from competing imports (Holleran et al., 1999).

The challenges identified for application of these market-based instruments for food safety improvement might also be relevant when applied to food waste prevention and reduction. A greater economic analysis is needed to better understand the effectiveness of these instruments for food waste prevention and reduction.

The food economics literature identified also other private market-based instruments potentially applicable for food waste.

Incentive-based contracts (Figure 6.5, C.4):

These are contingent payment contracts where the buyer offers heterogeneous suppliers a payment to costly implement additional practices to improve food safety. For example, a buyer rewards a supplier if traceability (or another control/quality test) shows that the supplier provided material free from defect; and a buyer penalizes a supplier if traceability (or another control/quality test) shows the supplier provided defective material. A third alternative payment is made in the event that traceability (or another control/quality test) fails such that the buyer cannot verify whether the supplier provided defective or defect free material (Resende-Filho and Hurley, 2012).

Standards and specifications of large food companies (buyers) (Figure 6.5, C.1):

Through contracts with these large buyers, suppliers (along the whole chain) are able to appropriate the benefits of their investments in food safety. For example, the dominant drivers of food safety innovation in the U.S.A. meat industry and farming are the stringent requirements on product safety and quality demanded by large fast food restaurants, such as Burger King, Jack in the Box, McDonald's, and Wendy's.

By demanding safer products from their suppliers, these restaurants have successfully created markets for food safety. The success of these markets rests on the ability of these large buyers to enforce standards through testing and process audits—and to reward suppliers (through price premiums or guaranteed sales) who meet safety standards and punish those who do not.[22]. Generally, for example, slaughter plants subject to buyer specifications invest in more food safety than those without specifications.

Basically, these two private market-based instruments can potentially be developed by food chain participants, also to stimulate food waste prevention and reduction. When having enough economic incentives (better efficiency, reputation, consumer willingness to pay), large food companies / buyers may also adopt their role of channel captains, stimulating and monitoring food waste prevention and reduction up and down the supply chain. In this way, large food companies / buyers may help create markets for approaches to prevent and reduce food waste and provide mechanisms for appropriating the benefits of food waste innovation.

As for market-based instruments initiated by government, the applications of these instruments in the food safety area are rather similar to instruments identified by other areas of application. Therefore, we only briefly summarize those to illustrate the identified similarities of the used instruments, which indicates the potential of these instruments to be applied for food waste prevention and reduction as well.

The main motivation behind government-lead market based instruments to improve food safety is that with better informed consumers it is more likely that unsafe firms will bear some of the costs of unsafe production, such as recall, liability, and bad publicity. Having more informed consumers therefore strengthens market incentives for firms to produce safe foods - and to invest in food safety innovation. There are three main approaches:[23]

[22] USDA (2015), Food Safety Innovation in the United States, Market Incentives for Food Safety Innovation: Lessons from the Meat Industry, Part III. Market and Regulatory Incentives for Food Safety http://www.ers.usda.gov/media/494222/aer831h.pdf [Accessed online, October 19th, 2015].

[23] USDA (2015), Food Safety Innovation in the United States, Market Incentives for Food Safety Innovation: Lessons from the Meat Industry, Part III. Market and Regulatory Incentives for Food Safety http://www.ers.usda.gov/media/494222/aer831h.pdf [Accessed online, October 19th, 2015].

Strengthen appropriability[24] through safety information (Figure 6.5, B.4):
Programs that provide consumers (both final consumers and input consumers) with food safety information, particularly information on safe and unsafe producers should help the market to operate more efficiently. With more safety information, consumers will be able to choose the level of food safety (and price) that best matches their preferences. For example, consumer demand was sensitive to hygiene quality grades required by Los Angeles County and posted in restaurant windows.

- *Labelling*: the government has a number of tools at its disposal to reduce asymmetric information and transform credence attributes, such as food safety. Labelling programs may provide general food safety information like the safe-handling labels on retail product packages. Government safety labelling programs could be mandatory, like nutrition labelling, or voluntary, like some allergen labelling;
- *Informative lists*: In the US, both The Food Safety Inspection Service and the Food and Drug Administration post a list of recalls for contaminated, adulterated, or misbranded products. In another program, FSIS requires that the results of the HACCP Salmonella testing program for meat and poultry be published annually and made available to the public (though, unfortunately, results are not reported for individual firms, as was originally proposed by FSIS);
- *Other examples of information*: Other programs include time/temperature indicators for each package of refrigerated food; harvest/lay/slaughter dates on each package of an animal protein product; pathogen performance information on each company and its products; and a government-certified label for low-risk foods, so companies can compete on providing safety from pathogens.

As a prerequisite to providing consumers with information on safe and unsafe producers, the government must generate data on safety records. In the United States, the Federal Government and other public health officials have taken strides in building the infrastructure for tracking the incidence and sources of foodborne illness.

Strengthen appropriability through increasing the costs of failure and the benefits of success (Figure 6.5, B.1):
Government policies targeted at strengthening the costs of food safety failures and the benefits of food safety compliance and investment may likewise stimulate innovation.

- Policies specifically targeted to rewarding producers of safe products include – government safety certification and preference in government procurement programs;
- Policies specifically targeted to increasing the cost of food failures include recalls, testing schedules linked to performance, and higher fines or longer plant closures in cases of noncompliance;
- Performance standards encourage innovation by giving firms the freedom to develop new approaches to achieve outcome targets.

Subsidies for research collaborations monitoring (Figure 6.5, A.1)
Investment in the scientific infrastructure and support research on safety testing is an example of this approach.
Figure 6.5 summarises a toolbox of identified governmental and voluntary market-based instruments would to be potentially useful for food waste prevention and reduction.

[24] The feature of inventive and innovative activity that most clearly sets it apart from other strategic investments made by firms is the problem of appropriability. The problem of appropriability refers to the idea that the innovator cannot obtain the full value of its innovation from potential users. Perhaps we should consider whether there is a spectrum of types of new knowledge and innovation, not all of which conform to the "pure public good" definition (Geroski, P. 1995).

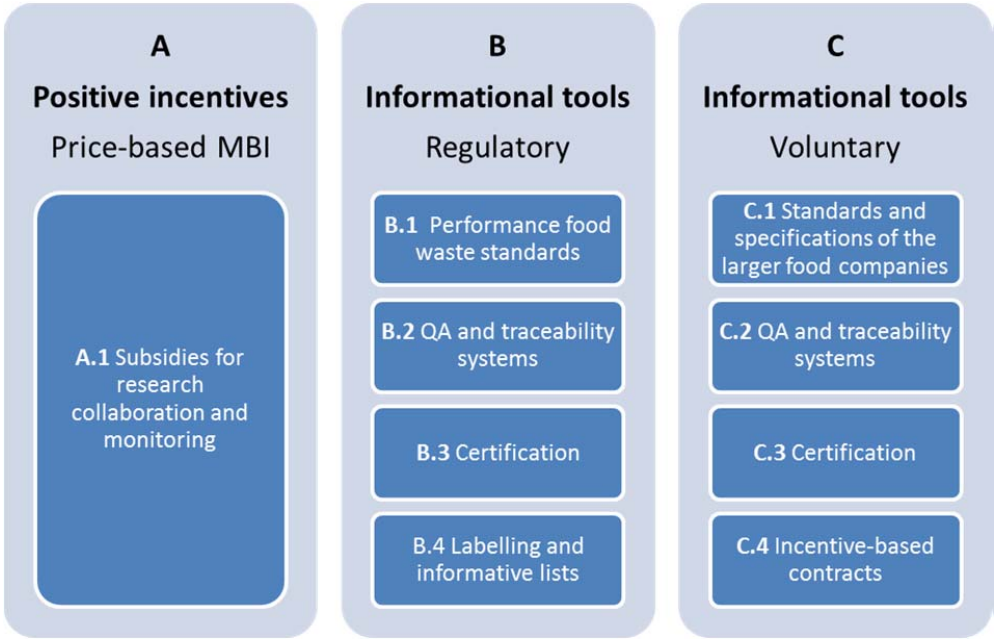

Figure 6.5 Market-based instruments and economic incentives toolbox to prevent and reduce food waste: experience from food safety management.

7 Experts' interviews

The experts interviewed have very diverse backgrounds varying between policy makers, food supply chain stakeholders and researchers but they all have solid background in food waste issues. The details of the interviewed experts are presented in section 11.2 of Annex. The results of the interviews are summarised below.

Food waste prevention policies and incentives

In practice, policy on food waste prevention would be a mix of: (i) top-down policy, involving over-arching legislation and/or stimulating voluntary agreements; and (ii) bottom-up policy to stimulate and facilitate specific projects and research, including social innovation.

Many market-based instruments and economic incentives would not be directly relevant to social innovation, although could be used to encourage social innovation and to develop an enabling environment for social innovation.

The measures can generally be split into three categories: (i) measures aimed at directly preventing generation of food waste, including encouraging redistribution; (ii) measures to strengthen the enabling environment for social innovation; and (iii) measures to divert food waste to animal feed.

Specific measures might be set up within a framework of higher-level government policies, which might include: implementing legislation, facilitating voluntary agreements, stimulating activity by civil society; as well as measurement and evaluation of policy implementation.

The more "standard" policy measures include:

- Taxes and pricing on food products
- Increasing landfill tax on food waste
- Economic incentives that encourage industry to make changes to some food products
- Grants and subsidies for food waste prevention / reduction projects, including competitions / awards schemes
- Policies to encourage volunteering / community work
- Policy measures on provision of public services for food waste prevention projects
- Policy measures to increase social innovation projects that divert food waste to animal feed
- Economic incentives related to the issue of sending food to redistribution projects for consumption
- Labelling
- Awareness campaigns
- Facilitating networking / information exchange
- Bureaucracy simplification
- Fiscal benefits
- Technical support
- Some less traditional measures include:
- Offering different portion sizes in restaurants and different portion/pack sizes at retailers (at prices that encourage the purchase of appropriate sizes of portions /packs).
- Adding a surcharge on a bill at a restaurant if food is left on the plate, or offering an 'empty plate' discount (this would need to be linked to the portion sizes on offer being optimised to avoid encouraging people to eat too much)
- Tax on food waste from restaurants

Economic incentives to encourage awareness campaigns

- Research into technology that leads to reduced food waste
- Subsidies for educational courses, provided by local people, at household or restaurants aimed at teaching how food (before being wasted) can be used
- Funding to create databases for distribution of edible food waste or inedible parts of food
- Web information that match people who demand and others who supply (e.g. someone who needs compost can easily find someone who "produces" compost).

Social innovation might be a good answer to many "social problems", such as food waste. However, it should not be considered as a substitute for activity by State and other authorities, but as a combination of initiatives complementary to governments' actions.

Measures to stimulate research and development (R&D) are important, but need to be implemented within a coherent overall R&D policy, covering behaviour change through to technical solutions, and ensuring mechanisms are in place to connect academic institutions with industry.

Campaigns to raise awareness and encourage behaviour change can be a highly effective approach to food waste prevention. As part of this, labelling is a particularly effective approach for stimulating food waste prevention and reduction, including labelling with guidance on storage, freezing and clarity on dates, in parallel with wider awareness campaigns. Awareness campaigns are not considered to be market-based tools or economic incentives, but there could be economic incentives that encourage organisations to support awareness campaigns.

Incentives within the framework of CAP

The newly implemented Common Agricultural Policy (CAP) of the European Union has the objective of supporting rural development by stimulating greener and more efficient agriculture. Six main policy measures incentivising farmers to reduce food losses were identified within the framework of CAP:

- Investment in physical assets

Farmers aiming to improve the economic and environmental performance of their agricultural holdings and rural enterprises and to improve the efficiency of the agricultural products marketing and processing sector are eligible for investment aids. These investments could provide farmers with infrastructure supporting them to reduce food losses.

- Knowledge transfer and information actions
- Support under this measure covers vocational training and skills acquisition actions, demonstration activities and information actions.
- Advisory services, farm management and farm relief services
- Financial support can be granted to help farmers benefit from the use of advisory services for the improvement of the economic and environmental performance as well as climate friendliness and resilience of their holding, enterprise and/or investments. For example, a consultancy firm could advise farmers on how to reduce and prevent food losses.
- Co-operation
- Support is granted to horizontal and vertical co-operation among actors in the supply chain, as well as for activities in a local context, catalysing the economically rational development of short supply chains, local markets and local food chains. Support can be provided in various forms such as clusters and networks for sharing expertise as well as the development of new and specialised services and products; pilot projects for testing the commercial applicability of technologies, techniques and practices in different contexts. Support for joint approaches to environmental projects and practices will also indirectly contribute to stimulating reduction of food losses at the farm level.
- Quality schemes for agricultural products, and food products.

Farmers are financially encouraged to participate in European and national voluntary quality schemes as they provide consumers with assurances on the quality and characteristics of the product and production process. They receive financial support for no more than five years. However, it is very difficult to establish a link between quality schemes and the reduction of food loss and waste. According to a study led by DG SANCO, food labelling scheme affiliation is the fifth most important factor after use by/best before date, price, brand, and country of origin. Further behavioural studies are necessary in order to assess whether consumers waste less qualitative products than "non-qualitative" products.

- Organic farming

Payments to farmers for the converting to, or maintaining, organic farming should encourage them to participate in such schemes thereby responding to the increasing demand of society for the use of environmentally friendly farm practices. Organic is not only a proof of quality, but also a proof of environmental friendliness. Thus, it can be assumed that consumers buying a product with an organic label are potentially more environmentally aware and waste less food. Howver this assumption needs to be tested via behavioural studies.

- Green Direct Payments

Within this new policy framework, farmers will be financially rewarded via green direct payments. Such payments account for 30% of the national direct payment envelope and reward farmers for sustainable agricultural practices such as maintaining permanent grassland, ecological focused area and crop diversification. Although not mentioned explicitly, the reduction of food losses at the farm level could be considered a sustainable practice and be rewarded as such. However it might be very challenging to assess the impact of the green payments on the reduction of the food loss volume exclusively.

The financial support granted by the CAP does not stimulate farmers to overproduce and thus waste food. According to Regulation (EU) No 1307/2013 the amount granted is decoupled from the quantity of food produced. Farmers receive grants based on other criteria than production.

Moreover, although not included as a measure in the CAP as it mainly refers to food processors, financial incentives for technological innovations improving product quality can also have an impact on food waste reduction. Several innovations increasing the product life throughout the food chain, while improving its nutritional quality were developed by researchers such as: high pressure pasteurisation, microwave techniques, aseptic filling, etc . Measures to stimulate research and development (R&D) programmes at the European and national level are thus crucial.

Thus surmising all measures discussed above the following standard policy measures can be suggested :

- Financial support for farmers to produce organic food
- Quality schemes
- Measures to stimulate investment in physical assets
- Knowledge-exchange and co-operation between farmers

Less traditional policy measures could be:

- Advisory services at the farm level
- Incentives for developing technology improving the product quality throughout the food chain (active packaging and high pressure pasteurisation)
- Introducing the reduction of food waste in the sustainability requirements of the CAP Green Direct Payments
- Put in place "ugly fruits" stands in all retail shops at discounted prices

Taxes, charges, tax benefits, subsidies

An appropriate incentive to stimulate food waste reduction in the food supply chain and at the consumption level could be the "pay-as-you-throw" (PAYT) system. Within this system governments should set standard criteria for PAYT schemes at municipal level.

Another effective incentive measure might be the exemption of VAT payment on donated food products. Such measure is already applied in several EU Countries, therefore the EU should harmonize the application of the EU VAT Directive (Council Directive 2006/112/EC) across the Member States especially addressing the grey area of the value of donated food close to its "best before/use by" date. A major problem is represented by the legal uncertainty on whether the food which is close to its "best before/use by" date has a countable - taxable value (therefore a VAT-able base) or a small or zero value (no VAT to be paid). In some Member States no VAT is paid when food is donated because the value of these products is considered as zero, while in other States a payment is foreseen.

Governments should also grant tax credits (or other fiscal benefits) for private investments specifically addressed to food waste reduction/ prevention, such as those in technology, process or product innovation. For example, fiscal incentives to stimulate the adoption of new technology able to: reduce food waste produced by obsolete tools and machines; improve storage conditions; extend shelf life of products thanks to better packaging solutions; decrease industrial process waste; valorize industrial by-product reintroducing them in the value chain (i.e. for feed) etc.

Moreover, governments should support the implementation of voluntary agreements among food chain operators in order to reduce/ prevent food waste. Operators that join voluntary agreements should be rewarded with tax credits or reduction of waste collection fee, if levied. For example, tax credits and other incentives should be provided to support social innovation initiatives and voluntary agreements among, for example:

- Farmers and retailers to promote the sale of fruit and vegetable not meeting marketing standards.
- Farmers and non-profit operators to promote gleaning practices.
- Retailers and non-profit operators to stimulate the donation of surplus/ excess.
- Food and feed industries to promote the valorisation of industrial by-products and former foodstuffs as animal feed.
- Operators at the same stage of the food supply chain, such as producers. For instance, brewers waste malt (or have some by-products) that could be used for animal feed. This could be a win-win solution, because brewer does not pay to dispose of malt (or by-products) and breeder does not pay for fodder.

In addition, the European Commission should review the Green Public Procurement (GPP) criteria to give preference to companies which assure food waste reduction and/ or prevention in public procurement. For example, a preference should be given in food services to those operators who demonstrate to implement specific measures for food waste prevention.

Experts with background mainly in the Italian context, did not agree with the possibility of introducing specific taxes or fees for each segment of the food supply chain, especially during an economic crisis such as the one Europe is facing. However, as far as food waste in municipal waste is concerned, the implementation of PAYT systems seems to be more advisable than establishing specific taxes or fees specific for each segment. On the other hand, food waste reduction in the “non-municipal” waste stream could be targeted by increasing fees and taxation for its disposal (landfill, incineration).

The linkage among market-based instruments and other socio-economic incentives and social innovation is a complex one also due to the nature of social innovation that might present different specific characteristics over time, places and sectors. All incentives that encourage the creation of bottom-up initiatives aimed at addressing food waste can potentially stimulate social innovation. Generally, incentives that reduce bureaucracy procedures and barriers, and encourage agreements and community engagement, may contribute to new models of food distribution and consumption.

Another promising tool is the adoption of the “Gleaning” procedure by farmers who intend to bridge the agricultural production - that would otherwise be left in the fields to rot - with those who suffer from food insecurity. Farmers that adopt this procedure could be recorded through an official governmental database, and government subsidize those farmers.

In the case of private companies or producers, food waste can be reduced by implementation of higher disposal costs of residual waste. In one expert's view only negative financial initiatives result in waste reduction, as companies always work with economic purposes. Fines could also be implemented if food waste is not collected separately. Yet, this requires a good evaluation of companies.

Informational tools

The experts stated two main issues which need to be addressed at household level: more information on the best before date and on proper storage. Information on the best before date needs to be spread through nationwide campaigns, radio and TV spots. Financial players need to be involved to engage big and strong campaigns in mass media. According to the experts it is always the same kind of people who are aware of food waste prevention campaigns or environmental education campaigns in general. Instruments and incentives need to be developed to reach other people. Such nationwide, strong media initiatives can contribute to it.

As a second target group are school children, who can be taught about the proper storage of food. As a consequence, children can then educate their parents. Such awareness raising campaigns should be initiated by a higher level e.g. ministries to guarantee an effect all over the country.

An implementation of an environmental logo or label for companies which reduce their food waste might prove to be successful. Yet, it requires also an evaluation process to measure the success of food waste reduction. Standards and criteria need to be fixed for the environmental label. The evaluation is often the main issue that hinders such initiatives. On the other hand it would be possible to combine existing waste prevention campaigns (e.g. green events in Austria, where packaging waste is reduced and waste from one-way dishes is prevented) with a special focus on food waste reduction. Such initiatives need to be implemented by ministry or local governments.

Another instrument to reduce food waste could be the waste management plan of the country. Reuse plays a major role in the new waste management plan in Austria. This can be implemented in other countries as well.

In general the greatest potential for food waste reduction lies in the experts' opinion at the household level.

According to several experts the major question on how to find reliable data on food waste remains. Without precise data it is not possible to know what are the most important intervention points and where to direct incentives. Without reliable data the different industry sectors are pointing fingers at each other.

To summarize, without detailed and reliable data on where and how much food waste is produced, it is impossible to know where the most effective intervention should take place. Some concluding remarks from the experts are:

- It is unclear whether voluntary or mandatory initiatives are better. There is no clear answer to that. Both have advantages and disadvantages.
- Companies need external help, expertise, counselling on how to spot, measure and reduce food waste. The general assumption is that "we are already doing all that we can", thus their practices and ways have to be challenged and tailored solutions be shown. Most companies will probably not make the effort on their own.
- Solutions for companies will most probably only be successful if they affect the business results. Pure CSR/PR related gains will not represent a strong motivation.

8 Impact Assessment

A number of potentially workable concepts/market-based instruments described in the previous sections were selected for a qualitative assessment. Experts were asked to select the 2-3 most promising market-based instruments and incentives and to assess their impacts not only in terms of food waste reduction, but also on economic, environment and social developments. It is important to note that the derived matrices are of a qualitative nature and present perceptions of experts and do not provide information or hard data on actual impacts. The assessment has been carried out using experts' perceptions expressed in the scale (+3 to -3) as explained in the methodology (See Section 4) where +3 refers to major positive change, +2 to significant positive change, +1 to positive change, 0 to no change, -1,-2,-3 to negative, significant negative and major negative change respectively. Next to the scores perceptions such as Not available/Not relevant are used for cases where respondents interviewed person did not fill out the score or found the specific item to be not relevant. In total 13 experts tool park in the assessment.
In the next sections three main assessment matrices are presented grouped by type of incentive used:

a. Positive price based incentives such as subsidies, grants and funds to stimulate food waste reduction initiated by government that can interact with initiatives by private organizations.
b. Negative price based incentives such as taxes, charges and fees posed by government to stimulate food waste reduction and quantity based incentives.
c. Informational incentives such as voluntary agreements, marketing standards and/ or information campaigns (e.g. awareness campaigns) often initiated by private organization and supported by government. There is a strong interaction between private and public initiatives.

8.1 Assessment of negative price-based and quantity-based incentives

Legal instruments that offer negative incentives and cause a direct alteration effects are mainly represented by "pay-as-you-throw" (PAYT) schemes and various taxes. The PAYT principle implies that charges are only made to cover the personally generated waste amounts. As previously discussed the downside of this principle could be that waste may end up in illegal pathways to avoid taxes and charges. Table.8.1 provides an overview of impact assessment of this measure on food waste reduction as well as its economic, social and environmental impacts. The detailed description of the assessment of this measure is provided below.

Taxes / charges on food waste – "pay-as-you-through" (PAYT) themes
A system of taxes/charges implemented through government regulation is likely to stimulate innovative solutions by organisations to reduce food waste, (e.g. actions to provide more choice of pack/portion sizes and reduced reducing prices for smaller portions; redistribution of food). There would be significant potential environmental and economic benefits. Several experts have suggested **pay-as-you-throw** (PAYT) schemes as a promising tool in the category taxes and charges.
Such schemes have been described in detail in literature review (See section 6.1). One of the experts has suggested a concrete example on how to apply taxes/charges on food waste from restaurants and food services, which eventually use the same PAYT principal. Therefore, the results from experts on similar PAYT have been combined under one heading PAYT in the Matrix above. PAYT schemes can be more easily targeted to food services and households. PAYT schemes are a cost signal that generally is an effective tool to modify the economic behaviour: they already

exist in some countries, but they should be implemented in all Member States on a mandatory base.
The impact on food waste reduction and prevention is expected from positive to major significant, since experts believe that in order to pay less, consumers and other actors in the supply chain will reduce food waste and implement food waste prevention measures (e.g. catering and food services). Experts believe that this measure will stimulate the use of food in alternative ways (e.g. donation or as ingredient in cooking recipes). For countries where municipal solid waste is still landfilled, food waste may be prevented from being landfilled thanks to this measure. A reduced amount of food waste (due to PAYT schemes) means ecosystem conservation that can be seen as a service. Depending on the type of PAYT introduced, the waste management company may have partly high investment costs (e.g. electronic devices for bin identification, weighting mechanism at collection vehicles). However, experts expect that any implementation cost would be compensated by higher revenues. Operators affected by PAYT suffer increased costs especially if they do not implement measures to reduce/prevent (food) waste.
For consumers, no evident economic benefit is expected. However this measure is a fair fee system, as households are only charged for their actual amount of waste produced. Though there is a high financial saving potential, if domestic food waste is reduced both in the sense of municipal solid waste and food waste. Of course, consumers who generate less food waste have a benefit in terms of a lower payment. Businesses/chain operators would be stimulated to make their activities and processes more efficient. PAYT may result in increased separate collection of other recyclables, which may lead to new jobs' creation. This measure has been implemented already in several countries in Europe.

This measure is consistent with EU Waste Framework Directive in order to reduce the amount of organic substances in the municipal solid waste. The actual aim to reduce food waste would need also other initiatives in combination with this measure. This kind of evaluation needs a deeper analysis. There would be several challenges to implement this measure such as difficulties to measure quantities and enforce the policy, and the tax would be highly unpopular with the sector.

Table 8.1 Price based instruments based on negative incentives such as taxes, charges and quantity-based measures

Assessment Criteria / Market-based instruments and incentives	"Pay-as-you-throw" (PAYT) themes
General issues	
- Targeted supply chain operators	Retailers, food services and households
- Legislative change	Yes
- Mandatory / voluntary	+2 to +3
Food Waste	
- Food waste reduction	+1 to +3
- Food waste prevention	+1 to +3
- Food waste management	0 to +2
- Food use optimization	0 to +3
Environmental	
- GHG reduction (magnitude)	+1 to +2
- Creating of carbon sinks (magnitude)	0
- Increased provision of ecosystem services via ecosystem conservation (magnitude)	NR
- Improved soil quality (magnitude)	NR
- Reduced erosion (magnitude)	NR
- Increased ecosystem resilience (magnitude)	NR
Economic	
- Implementation costs for EU institutions (governmental bodies)	-1 to 0
- Implementation costs for MS (governmental bodies)	-2 to 0
- Implementation costs for businesses/chain operators	-2 to 0
- Benefits to consumers/households (due to reduction of their own waste)	0 to +1
- Benefits to businesses/chain operators (due to reduction of their own waste)	+1 to +2
- Impact on economic growth, change in GDP (due to an overall food waste reduction)	-1 to 0
Social	
- Job creation in public authorities	0 to +1
- Job creation in private sector	0 to +1
- Job creation in civil society	0
Practicability	
- Is this practical to implement (Yes/No)	Yes
- Consistency with other regulations (Yes/No)	Yes
- Degree of risk / uncertainty (in terms of results achievable)	Low to High

8.2 Assessment of positive price based incentives

The assessment of positive price based incentives such as subsidies, grants and funds to stimulate food waste reduction initiated by government is presented in the Table below (Table 8.2). From Table 8.2.4 it can be seen that all suggested measures are assumed to have a voluntary character, which implies interaction between governmental and private initiatives. In general such tools typically imply costs for governments and in some cases also for the chain operators. At the same time the benefits from waste reduction are assessed to outweigh the costs, since implementation of such tools is evaluated to be practically easy with low risk involvement and economic and social benefits due to waste reduction and job creation.
Positive price based tools selected by experts are assessed in the Matrix provided below (Table 8.2) The detailed explanation of each tool is provided below in Table 8.2.

Grants for knowledge-exchange and co-operation between farmers
These incentives imply providing grants/ funds for organizing training courses and awareness raising events on the topic of food waste prevention and reduction at the farm level. These incentives are targeted to farmers and may have a significant positive impact on food waste reduction, depending on whether farmers exchange best practices about reduction of food loss and on the quality of the training courses. Reducing food waste at the farm level will reduce its impact on the ecosystem. Food waste puts pressure on soil and decreases its quality. The latter in its turn leads to further use of synthetic inputs that cause pollution and eventually, loss of arable land. Thus, such incentives may lead to a decrease in unnecessary pressure on soil and may improve its quality. With respect to the economic impact, these incentives will require investments from government, where the amount of the grant will depend on the costs of the training and exchange platforms put in place. Similarly, the actual positive impact will depend on the number of farmers that may reduce food waste: this requires extra man power and thus leads to the creation of more job opportunities. It is expected that such incentives are rather easy to be implemented and actual risks are very limited.

Incentives for developing technology improving the product quality throughout the food chain
Grants for technological innovation could reduce food waste at all levels of the food chain. For example, national governments and business can invest in the development of new innovative packaging and new conservation methods which increase the product conservation without hampering its quality. The impact on food waste reduction and/or prevention is expected to be positive although it will depend on the type of technology developed. The environmental impact is expected to be positive and the magnitude of the impact will depend on the types of technology developed. These incentives assume that consumers will have better quality products and less food waste. The actual benefits to business will depend on the types of technologies and the size of the investments. In addition new jobs in the private sector might be created, since new technology may require additional manpower. It is expected that such incentives are rather easy to be implemented and actual risks are limited.

Table 8.2 Positive price based incentives such as subsidies, grants and tax credits

Market-based tools and incentives / Assessment Criteria	Grants for knowledge-exchange	Incentives for developing technology	Grants and subsidies for food waste prevention / reduction projects and research	Local policy measures to facilitate social innovation in food waste prevention	Subsidies for Gleaning and social innovation initiatives	Tax credits to stimulate voluntary agreements and social innovation	VAT exemption on donated food
General Issues							
Targeted supply chain operators, retailers. Food services, and households	Farmers	All	all	Retail, food services	Farmers,	All	Producer, retail, food services
Legislative change	No	NR	No	No	Yes	Yes	Yes
Mandatory / voluntary	Voluntary	Voluntary	Voluntary	Voluntary	Voluntary	Voluntary	Voluntary
Food Waste							
Food waste reduction	+2	+2	+2	+2	+ 3	+2 to 3	+3
Food waste prevention	+2	+2	+2 to +3	+2	+ 3	+2 to 3	+1 to +3
Food waste management	+2	0	+1 to +2	0	+2	NR	NR
Food use optimization	+2	+2	+2	+2	+3	+3	+3
Environmental							
GHG reduction (magnitude)	+1	+1	+1 to 2	+1	NA	+1 to+ 2	+2
Creating of carbon sinks (magnitude)	NR	NR	NR	NR	+3	NA	NA
Increased provision of ecosystem services via ecosystem conservation (magnitude)	+1	+1	NR	NR	NA	+1 to 2	+2
Improved soil quality (magnitude)	+2	+1	NR	NR	NA	NR	NR
Reduced erosion (magnitude)	NA	+1	NR	NR	NA	NR	NR
Increased ecosystem resilience (magnitude)	+1	+1	NR	NR	NA	NA/NR	NA/NR

Market-based tools and incentives / Assessment Criteria	Grants for knowledge-exchange	Incentives for developing technology	Grants and subsidies for food waste prevention / reduction projects and research	Local policy measures to facilitate social innovation in food waste prevention	Subsidies for Gleaning and social innovation initiatives	Tax credits to stimulate voluntary agreements & social innovation	VAT exemption on donated food
Economic							
Implementation costs for EU institutions (governmental bodies)	-1	-1	-1	NR	0	-2 to 0	0
Implementation costs for MS (governmental bodies)	-1	-1	-1	-1	0	-2 to 1	0
Implementation costs for businesses/chain operators	0	-1	-1	-1	NA	0	0
Benefits to consumers/households (due to reduction of their own waste)	NR	+1	+1	+1	NA	+2	+3
Benefits to businesses/chain operators (due to reduction of their own waste)	+1	+1	+1	+1	NA	+2 to +3	+2
Impact on economic growth, change in GDP (due to an overall food waste reduction)	+1	0	0 to +1	0	NA	+2	-1
Social							
Job creation in public authorities	NR	0	0	0	0	+1	NR
Job creation in private sector	+1	+1	0	0	0	+1 to +3	NR
Job creation in civil society	NR	NR	+1	+1	+3	NA	+3
Practicability							
Is this practical to implement (Yes/No)	Yes	Yes	Yes	Yes	NA	Yes	Yes
Consistency with other regulations (Yes/No)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Degree of risk / uncertainty (in terms of results achievable)	Low	Low	Low	Low	Low	Low	Low

Grants and subsidies for food waste prevention / reduction projects, including through competitions and award schemes

These are rather broadly defined incentives and could be applied with different purposes. They could involve competitive calls for plans for food waste prevention/reduction projects, issued by national/local government or large food manufacturing companies/retailers. The aims of the grants/subsidies could include projects that involve social innovation, through design of the criteria for selection of projects including aspects such as new ideas, meeting social needs, involving many stakeholders, etc. The targeted supply chains could be retailers and perhaps food service companies that might adopt policy on grant schemes for food waste prevention projects. Actions by private companies are likely to be on voluntary basis. Legislative change is unlikely to be needed. It is expected that these incentives may have a significant positive impact on all four aspects of food waste (prevention, reduction, management and optimal use), but the actual scoring on food waste depends on types of waste prevention projects funded with grants.

The environmental impact is expected to be negligible and also will depend on the exact type of waste prevention projects. Although the expectations on the impact that such incentives may have on the implementation costs for EU institutions (governmental bodies) and for Member States (governmental bodies) are negative and impact on benefits for consumers are positive, the actual impact and scoring depend on the size of the grant, the type of the projects and the actual benefits derived from them. It is expected that such incentives are rather easy to be implemented and involve limited risks and uncertainty.

Local policy measures to improve the enabling environment for social innovation projects in food waste prevention

Particular examples for such incentives include policy measures of local government on provision of public services, such as access to buildings and equipment (e.g. for cooking, storage associated with redistribution, or for community activities such as cookery classes etc.), transport, printing materials, etc.

In addition, policy could include measures to encourage volunteering on food waste prevention projects. For example, private companies or public sector organisations could adopt policies to allow employees to take a number of paid days each year volunteering in a relevant area of work (e.g. redistribution projects; imparting skills to community groups etc.). The targeted group could be retailers and food service companies that might adopt policy to provide some services and/or to encourage volunteering by employees. Legislative changes are expected to be rather limited, however legislation could be introduced to require local authorities to provide some services. Action by private companies is likely to be on voluntary base. It is expected that these incentives may have significant positive impact on food waste prevention reduction and food waste optimization, however the magnitude of the impact depends on the type of the project. The costs for implementation of these incentives are expected to be for local government and/or for businesses depending on the services provided. Although benefits to consumers and businesses are expected, the magnitude of them will also depend on the type of the project implemented. Depending on the type of the projects such incentives may impact positively on the creation of jobs. It is expected that these incentives are rather easy to be implemented and do not involve actual risks and uncertainty.

Subsidies to farmers that adopt "Gleaning" procedures

These incentives will provide a motive to farmers to adopt the "Gleaning" procedure which intends to bridge the agricultural production that would otherwise be left in the fields to rot with those who suffer from food insecurity in Europe. Farmers that will adopt this procedure could be recorded, through an official governmental database, and government can give preferences to those farmers to get subsidies and consequently influence the cost of such commodities, that would otherwise been wasted. Such subsidies can lead to legislative changes, since they can become part of the Common Agricultural Policy (CAP).

They are expected to have a major positive impact on food waste reduction, prevention and food optimization. Especially the reduction at production level will be significant. No implementation

costs are expected for EU or MS since the gleaning procedure could be probably incorporated as criteria for farmers to gain subsidies, as part of the CAP. Similarly no implementation costs are expected for businesses, since farmers should only afford their parcels for gleaning. Such subsidies may lead to reduction of market prices of fruits and vegetables. The subsidies for gleaning will lead to jobs creation and may lead to possible establishment of cooperative and social enterprises. It is expected that such incentives do not involve actual risks and uncertainty, however in case of implementation, a monitoring body should be established.

Tax credits to stimulate voluntary agreements and social innovation initiatives

Tax credits could be one of the most promising categories of incentives to stimulate voluntary agreements and to involve the community or parts of the civil society and the food supply chain operators in prevention and reduction of food waste. Tax credits are perceived to be a positive price based instruments: although they involve negative incentives such as mandatory payment of the tax, they allow eligible persons to subtract some or all expenses for specific items from the amount of taxes that have already been paid. It is expected that the implementation of these incentives will require some legislative changes. Participation in initiatives concerned with tax credits is voluntary. Tax credits can be used in different contexts of food waste. They can be combined with or can serve as substitutes for subsidies for different purposes. For example tax credits can be foreseen as (e.g. social innovation) initiatives or voluntary agreements aimed at:

- Food use optimization such as voluntary agreements between retailers and non-profit operators to stimulate the donation of surplus for human consumption
- Food waste reduction such as voluntary agreements between farmers and non-profit operators to promote gleaning practices
- Food waste prevention such as voluntary agreements between farmers and retailers to promote the sale of fruit and vegetable not meeting marketing standards
- Food waste management such as voluntary agreements between industries to promote the valorisation of industrial by-products and former foodstuffs in renewable energy production

The implementation of these incentives is perceived to have a significant positive impact on the environment, since a reduced amount of food waste (due to tax credits) means lower emissions of GHG. Reducing the amount of food waste contributes also ecosystem conservation.

With regards to implementation costs, these types of measures will involve costs and/or a decrease of revenues, however, they can imply positive externalities and benefits. No additional cost is expected for business operators, moreover they may gain some benefits/profit or savings by participating to the initiative supported by tax credits. In addition, tax credits can encourage economic actors to undertake more activities. The private sector is the most stimulated one by such measures and agreements and initiatives often create more jobs, thus such incentives will have a significant positive social impact. It is expected that they are rather easy to be implemented and actual risks are very limited.

VAT exemption on donated food

VAT exemption on donated food is considered as a promising incentive in reduction and prevention of food waste. EU should harmonize the application of the EU VAT Directive (Council Directive 2006/112/EC) across the Member States, because in some Countries VAT payment is foreseen also for donated food. This incentive may have a major positive impact on food waste reduction, prevention and food surplus use optimization. If retailers are incentivised to donate unsold food, the amount of their own food waste will be reduced. A positive change on food waste prevention is evident: still safe and edible food is consumed before it is wasted. Food waste optimisation will also be stimulated, since food potentially wasted can be donated and consumed. The impact on environment is also perceived to be positive, due to reduced food waste amounts, which imply lower emissions of GHG and ecosystem conservation. Costs for operators who decide to donate food would decrease, while, consumers or households with a low purchasing power will only benefit. Slightly negative impact on GDP is expected, since if VAT is not paid GDP may decline, although one may expect that saving the food might have positive effects on GDP. In

order to implement this incentive a harmonization of the EU VAT Directive application (Council Directive 2006/112/EC) across the Member States is required. The degree of risk from implementation is low.

8.3 Assessment of informational instruments

Informational instruments such as voluntary agreements, marketing standards and/ or information campaigns (e.g. awareness campaigns) are often initiated by private organizations and supported by government and very often have voluntary character.
In some cases these tools also be mandatory (e.g. obligatory disclosure of food waste data). Nevertheless, there is a strong interaction between private and public initiatives.
Table 8.3 presents the assessment scores for informational tools for food waste reduction and impacts on socio-economics and environment. The detailed description of each tool selected by experts is presented below Table 8.3.

Put in place of "ugly fruits and vegetables" stands in all retail shops at discounted prices

Fruits and vegetables downgraded at the farm level because of not meeting the quality standards, should be redistributed either to charities, animal feed, or even retailers that should sell it at a discounted prince. For those groups of products which still fall under marketing standards, retailers could put in place permanent stands to sell these products at reduced prices. This should be accompanied by awareness raising campaigns on reducing food waste. The policy would encourage retailers to sell downgraded fruits at a reduced price.
The measure could lead to significant reduction of downgraded fruits and vegetables at the retail level that would also reduce the volume of food loss at the farm level. Reducing food waste at the farm level will increase conservation of the ecosystem. Consumers will benefit from this incentive since they will be more aware of food waste and will be able to buy nutritional fruits and vegetables at discounted price. The activation of such measure might require extra staff on the shop floor, meaning a creation of new jobs. For farmers potential savings could be expected, some costs might be considered with regards to logistics/infrastructure and possible job creation. Regulation change might be needed. It is expected that this incentive does not involve actual risks and uncertainty.

Guidance methodology for companies and voluntary/obligatory disclosure of companies' food waste data

These two measures are interrelated and therefore described as once.
According to an interviewed expert a main problem with quantification and reduction of food waste is where and how credible, reliable data on food waste can be found. Without such data it is not possible to know where the most important intervention points are. According to the expert, companies lack guidance on methodology in collecting data regarding food waste. A robust and detailed guidance methodology for companies should define:

- what is food waste (i.e. what exactly they need to measure)
- how food waste should be measured
- what kind of processes and structures should be used for reducing food waste.

Without such guidance material, companies' food waste data would not be comparable. This guidance material should be endorsed/issued by the EU/national governments.
At the same time having access to other companies' data (by disclosure of companies' food waste data) and being able to set a benchmark would be an effective motivation for companies.
It is questionable whether such information disclosure should be voluntary or mandatory. In the latter case it should be implemented in all subsectors simultaneously to avoid confusions. Implementation of guidance methodology for companies will require some financial investments from EU institutions and/or local governments. Some indirect benefits are expected from both measures for consumers and businesses due to reduction in their food waste. The expert expectation is that such measures are rather easy to implement, however no information is provided regarding the degree of risk involved.

Table 8.3 Informational instruments such as awareness campaigns and voluntary agreements and standards

Market-based instruments and incentives / Assessment Criteria	Put in place "ugly fruits" stands in all retail shops at discounted prices	Guidance methodology for companies and disclosure of food waste data	Voluntary / obligatory disclosure of companies' food waste data	Application of an example of a Social Fuel Stamp	Ecolabel on food waste reduction	Nationwide media campaign on best before date
General issues						
- Targeted supply chain operators, retailers. Food services, and households	All	All	All	Farmers	Producers retailers and food services	Households
- Legislative change	Maybe	No	NA	No	No	No
- Mandatory / voluntary	Mandatory	Could be both	Could be both	Voluntary	Voluntary	Voluntary
Food Waste						
- Food waste reduction	+1	+2	NA	+2	+2	+2
- Food waste prevention	+1	+2	+3	+3	+2	+2
- Food waste management	+1	+2	+3	NA	+1	+1
- Food use optimization	+1	+2	+3	NA	+2	+2
Environmental						
- GHG reduction (magnitude)	+1	+2	NA	NA	+2	+2
- Creating of carbon sinks (magnitude)	NR	0	NA	NA	NA	NA
- Increased provision of ecosystem services via ecosystem conservation (magnitude)	+1	NA	NA	NA	NA	NA
- Improved soil quality (magnitude)	+1	NA	NA	NA	-1	-1
- Reduced erosion (magnitude)	NR	NA	NA	NA	NA	NA
- Increased ecosystem resilience (magnitude)	+1	NA	NA	NA	NA	NA

Market-based instruments and incentives / Assessment Criteria	Put in place "ugly fruits" stands in all retail shops at discounted prices	Guidance methodology for companies and disclosure of food waste data	Voluntary/obligatory disclosure of companies' food waste data	Application of an example of a Social Fuel Stamp	Ecolabel on food waste reduction	Nationwide media campaign on best before date
Economic						
- Implementation costs for EU institutions (governmental bodies)	NR	-1	+2	NA	0	0
- Implementation costs for MS (governmental bodies)	0	-1	+1	NA	+1	+2
- Implementation costs for businesses/chain operators	-1	0	0	NA	+1	0
- Benefits to consumers/households (due to reduction of their own waste)	+1	0	+2	NA	+1	+2
- Benefits to businesses/chain operators (due to reduction of their own waste)	+1	+2	NA	NA	+2	+2
- Impact on economic growth, change in GDP (due to an overall food waste reduction)	0	NA	NA	NA	NA	0
Social						
- Job creation in public authorities	NR	0 to +1	0 to+1	NA	+1	0
- Job creation in private sector	+1	0 to +1	0 to+1	NA	0	0
- Job creation in civil society	NA	NA	NA	NA	NA	NA
Practicability						
- Is this practical to implement (Yes/No)	Yes	Yes	Yes	No	NA	Yes
- Consistency with other regulations (Yes/No)	Yes	Yes	Yes	NA	NR	Yes
- Degree of risk / uncertainty (in terms of results achievable)	Low	NA	NA	NA	NA	High

Application of an example of a Social Fuel Stamp

The social fuel stamp is a certification system which encompasses tax incentives, credit lines and technical support for small farmers in arid and semi-arid regions in producing oleaginous seeds such as castor oil and palm oil to supply the biodiesel processing plants. It could be a market-based instrument applicable for food waste reduction at production level. This stamp could be provided to small farmers that are implementing food waste reduction actions (gleaning or donations etc.) and thus could ensure greater subsidy, tax incentives, credit lines. The impacts on socio-economics and environment are not assessed since they will depend on the actions taken by farmers. The basic idea here is a stimulation of farmers in reducing food waste using a certification system supported by governmental programs and EU Funds.

Ecolabel on food waste reduction

Introduction of ecolabels for food waste prevention and reduction has been considered as another promising tool. The EU Ecolabel helps to identify products and services that have a reduced environmental impact throughout their life cycle, from the extraction of raw material through to production, use and disposal. Recognised throughout Europe, EU Ecolabel is a voluntary label promoting environmental excellence which can be trusted.

Applying such an ecolabel to promote food waste reduction in similar fashion as environmental excellence is considered to be a promising tool for food producers, retailers and food services.

It should be voluntary. The amount of food reduction and prevention due to the label will depend on the criteria of the eco label, but it is expected that high prevention and reduction potential is achievable. Food use will be automatically optimized, when ecolabel criteria to reduce and prevent food waste are met. Consequently less GHG emissions would occur in the disposal phase and less waste would be composted producing less compost.

If an ecolabel is launched by the government, then it is related with costs regarding implementation, evaluation, marketing etc. In order to fulfil the criteria of the ecolabel, these costs could be covered by the savings generated from proper food management.

For consumers, slight benefits may occur when companies can reduce their sales prices because of cost savings in food management. For business, it will mean an economic and competitive advantage. This measure might create jobs in public authorities (implementation, evaluation, marketing positions). For business, this will not create any additional jobs as companies would not create new jobs in order to fulfil the new eco criteria (this would be economically feasible). It is expected that the evaluation will be difficult and time consuming. However, when evaluation process is standardized there is low risk to achieve results.

Nationwide media campaign on best before date

Information based tools such as nationwide media campaigns on best before date to raise consumers' awareness on food waste are considered as one of the promising tools by an expert. A positive effect on food waste reduction is expected as those people who are not aware of food waste prevention get targeted and involved. Here media play a crucial role. A well-defined slogan in mass media can have a big effect on the general public (expert has mentioned an example from Austria on collection of old mobile phones, which was an enormous success, when promoted via a famous radio channel). The targeted group is households. This also contributes to food waste prevention and food use optimization.

Although nationwide media campaigns are related with high costs, they are needed to target as much people as possible to save more costs as less new products replacing the disposed one will be bought. The money which is saved by avoiding to buy new food products, may be spent on other goods, however it may be a zero-sum situation. This measure meets the objectives of Waste Framework Directive for waste prevention and could be easy to be implemented. However the achievable results are depending on the impact campaigns have on the public.

9 Conclusions

The objective of this report was to explore the potential of market-based instruments and other socio-economic incentives as specific policy measures for stimulating food supply-chain operators and households to prevent and reduce food waste. The analyses have been carried out using a four steps approach that comprised 1) an inventory of available information on food waste drivers, 2) a literature review, 3) expert interviews and 4) qualitative impact assessment of the tools.

The results showed that market-based instruments are important policy instruments for managing a wide range of issues. If designed well, these instruments offer the potential to decrease compliance costs, compared to command-and-control regulation.

The analysis identified a number of market-based instruments and incentives that could potentially be applied to the design of food waste reduction and prevention policies. The successful implementation of the identified potential instruments and incentives requires accurate advance planning and should include a detailed analysis of the possible impacts and barriers and risks (Salhofer et al., 2008). A good mix of different regulatory and voluntary instruments increases the possibility of successful implementation of food waste prevention and reduction policy. Moreover, the role of the government is essential in the introduction and implementation of market-based instruments and incentives for food waste reduction and prevention. The identified instruments are mostly price- based instruments based on positive incentives (e.g. subsidies for food waste reduction technologies, fiscal incentives for food waste donation) and negative incentives (e.g., tax on wasted food). During the consultation session with experts it was suggested that posing high taxes on wasted food may work less well than stimulating food waste reduction by using subsidies and other positive financial instruments.

Some examples of informational policy tools have also been proposed such as voluntary agreements similar to a new voluntary code of practice introduced in the UK, or improved consumers' awareness towards food waste, by increasing food waste campaigns and information. Hereby there is an interaction of actions between public governmental policies and voluntary improvements, where private incentives can be designed in combination with complementary policy initiatives.

Positive priced-based instruments are assumed to have a voluntary character, implying close interaction between governmental and private initiatives. In general these tools typically imply costs for governments and sometimes also for the chain operators. At the same time the benefits from waste reduction are assessed to exceed the costs, since implementation of such tools are assessed to be practically easy with low risks involvement, with economic and social benefits due to waste reduction and job creation.

Instruments that offer negative incentives are mainly represented by "pay-as-you-throw" (PAYT) schemes and various taxes. The PAYT principle was identified as one of the most promising tool and it is expected to have a major positive impact on food waste prevention and reduction. It is expected that in order to pay less, actors and consumers in the supply chain will reduce food waste and implement food waste prevention measures (e.g. catering and food services). At the same time this measure will stimulate the use of food in alternative ways (e.g. donation or as ingredient in cooking recipes). Depending on the type of PAYT introduced the waste management company may have partly high investment costs. At the same it is expected that any implementation cost would be compensated by higher revenue at state level.

Informational instruments such as voluntary agreements, marketing standards and/ or information campaigns (e.g. awareness campaigns) are often initiated by private organizations and supported by government and very often endowed with a voluntary character. In some cases these tools may also be mandatory (e.g. obligatory disclosure of food waste data). Nationwide media campaigns to increase awareness e.g. on best before dates or the introduction of "ugly fruits and vegetables" shelves in supermarkets" have been identified as the most promising informational tools. Marketing standards such as the use of Social Fuel Stamp and Ecolabel on

food waste reduction were identified to have a good potential in stimulating food chains operators to prevent and reduce food waste.
The results of this study on the most promising market-based instruments in reduction and prevention of food waste are presented in Figure 9.1.

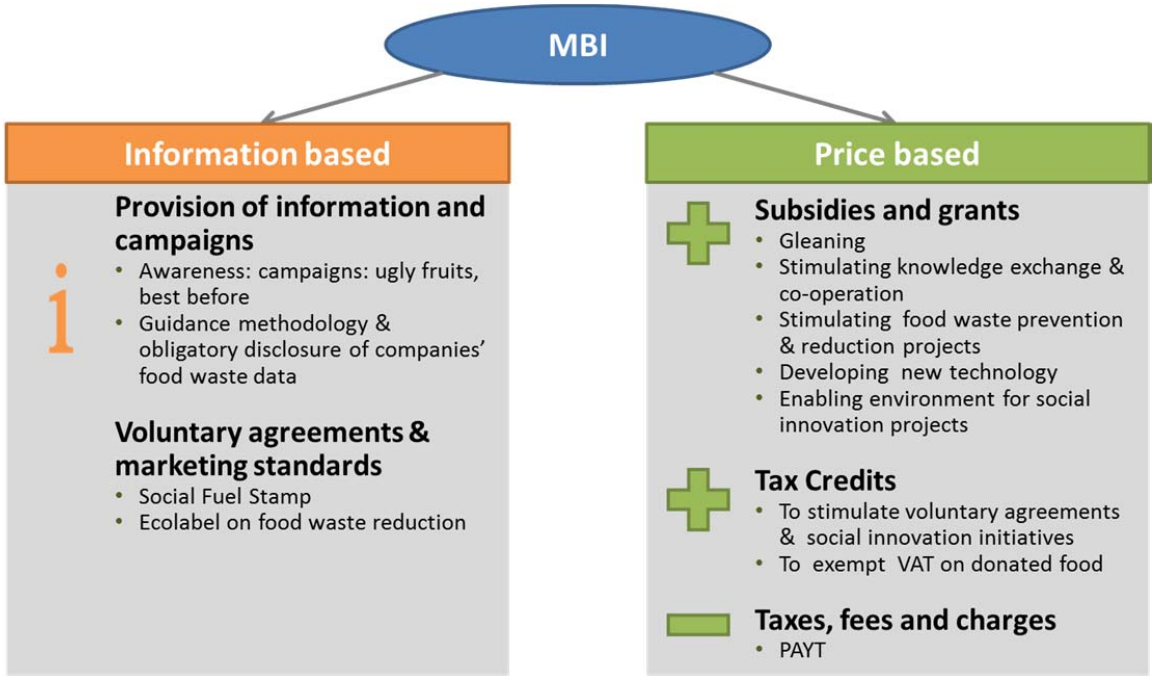

Figure 9.1 Overview of potential market-based instruments to reduce and prevent food waste

Some general principles could be applied to the implementation of the various market-based policy options, most notably:

- Subsidies for communication campaigns in the first stage to increase awareness;
- Tax schemes, subsidies and quality assurance and certification systems/schemes (obligatory and voluntary) in the later stages.

However, successful implementation of food waste market-based instruments poses challenges. Firstly, food waste reduction targets need to be set using a comprehensive assessment of all the costs and benefits implied by the targets. The targets should be implemented with full consideration of the economic and social trade-offs involved.
Overall, the existing literature suggests that the motivation for food chain actors to implement food waste prevention and reduction policies reflects the prior expectations of decision makers regarding the potential benefits and costs associated with adoption of a specific policy and related better practices (see, for example, Henson and Heasman (1998) and Henson and Caswell (1999) for the evidence from the food safety area). In cases where business decision makers perceive high costs of implementation relative to the expected benefits, and where the hurdles associated with adoption are not easily overcome, there may be less motivation to implement certain policies. In such cases, there may be a leading role for regulation. However, where regulatory and market-based inducements for the adoption of enhanced food waste prevention and reduction policies are interconnected and operate side-by-side (see, for example, Henson and Hooker (2001) for the evidence from the food safety area), it is important to understand the nature and magnitude of distinct public and private incentives (at the level of each chain actor) and the impact that government regulatory policies have on these. More generally, there is a need for

greater quantitative economic analysis of the entire set of incentives for food chain actors to implement enhanced food waste prevention and reduction policies (Jayasinghe-Mudalige and Henson, 2006).

Furthermore, the legal basis of the market-based instruments must be thoroughly specified. Poorly designed market-based instruments can impose high transaction costs, particularly where the responsibility of monitoring and verification is also devolved. Therefore, it is important for governments to work together with private businesses and other chain actors to develop market-based instruments that are transparent in their operation. In food waste applications, there is a strong need for good quality science to underpin any potential market-based instruments. Finally, the introduction of new market-based instruments to stimulate food waste prevention and reduction will require new management skills and food chain actors will need to undergo a period of training (Jayasinghe-Mudalige and Henson, 2006).

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11 Annexes

11.1 Potential of MBIs and economic incentives: evidences from other areas of application

Table 11.1 Potential of MBIs and economic incentives: evidences from other areas of application

Price Based MBI applied to other areas			
Areas of application	**Market-based instruments and incentives**	**Implementation and effectivness**	**Applicability to food waste prevention and reduction [1]**
Environmental pollution	Emission tax: applied by EU, national governments EU, National, local governments	Implemented mainly in developed countries. Tend to provide a stronger incentive to invest in R&D and adoption of new technology as compared to emission allowances (permits).	Taxes on: **(a)** food waste generation or the amount of food waste brought to landfill **(b)** foods with the highest waste (in developed world) (Hodges et al. 2011; Buzby and Hyman 2012; Wilson et al. 2012; Jones et al. 2010; Huang et al. 2014)
	Cost-recovery tariffs (tariff to recover cost requirements of commercially-driven operators and the necessity of financing quality improvements): - Water sanitation tariffs - Industrial sewage tariffs based on organic matter and suspended solid matter (Da Motta et al., 1999)	Implemented in several countries These tariffs can contribute to expand environmental services, pollution control and to improve the resource use	Food waste volume and landfill tipping fees couldwork for food waste reduction (Hodges et al. 2011; Sasao, 2014)
	Resource use charges applied by national and local governments: - Forestry tax (for wood consumption when the harvesting is not compensated by equivalent reforestation activity) - Royalties (a small proportion of gross revenue) for natural resource exploitation (Da Motta et al., 1999)	Implemented yet in some countries, e, g,, a forestry tax in Brazil, Colombia and Venezuela	Natural resources are used for food production. Charges might be applied to food waster to enhance efficiency in the resource efficiency
	Feebate: (combination of fees on high-emission products and rebates on low-emission products (Johnson 2006), e.g. rewards for buyers of fuel-efficient cars and penalizes for those who purchase gas-guzzlers**.** applied by governments	Implemented in many countries, most cost-effective, technology-based emissions reduction strategies. It helps to incentivize development and commercialization of emission control technologies (Johnson 2006).	Can be implimted to stimulate adoption of better technologies (e.g. cooling technologies)
	Credit and tax incentives to subsidize environment related investments: Applied by government - Clean technology adoption in the industrial and tourism sector; - Reforestation activities; - Mercury emission control in artisanal mining; - Cleaner energy uses (solar, wind, and gas/ hydroelectricity sources) (Da Motta, et al., 1999)	Implemented in several countries. Supporting selected private businesses on an ad hoc basis can inappropriately skew competition.	Might enhance food waste prevention and reduction via stimulation adoption of better technologies.
	Refunded tax to mitigate emission taxes' cost by refunding tax revenue in such a way that emission	Implemente in several countries Marginal competitive incentives for commercializing emission-	Potencially workable for stimulation adoption of better technologies (e.g.

	reduction becomes profitable: applied by governments	reducing technologies would not be diminished by the refund, and the refund could actually make it politically and economically feasible to increase the incentives by an order of magnitude (Johnson, 2007)	cooling technologies)
Solid waste management	- Landfill tax (a levy charged by a public authority for the disposal of waste) and gate fees (a charge set by the operator of the landfill for the provision of the service); - Incineration tax (weight-based tax, carbon dioxide tax) and gate fees; - Tax on transporting waste to landfill (e.g., post-incineration ashes) applied by national governments, local governments	18 MS have landfill tax and 6 MS incineration taxes for the disposal of municipal waste. The landfill tax is higher than the incineration tax (Watkins et al., 2012). Higher incineration charges are associated with higher percentages of municipal waste being transported, recycled and composted (Watkins et al., 2012; Sasao, 2014)	Imposing landfill tax om food waste might encourage food waste reduction
	Pay-as-you-throw" (PAYT) schemes (volume-based, weight-based, frequency-based): applied by waste disposal company or local authority (Gellynck et al., 2011; Dresner and Ekins, 2010; Bilitewski, 2008; Puig-Ventosa, 2008)	17 MS employ PAYT systems for municipal waste (Watkins et al., 2012). Weight and frequency-based schemes are the most effective, with volume-based initiatives bringing up the rear; the effects (increase in recycling rates and overall waste prevention) of PAYT systems are well documented. (Holmes et al., 2014; Dahlen and Lagerkvist, 2010; Dunne et al., 2008)	Might encourage food waste reduction
	Producer responsibility schemes for specific waste streams, e.g., packaging, waste electrical and electronic equipment (WEEE), batteries and end of life vehicles (ELVs): applied by national and local governments	Implemented in various forms in many MS. The efficiency and effectiveness of the scheme depends on the proportion of costs of collection, sorting and recycling of waste (Watkins et al., 2012)	Ensures adequate disposal of food waste but not reduction.
	Waste charge on garden waste	Implemented, e.g. in the UK. Removing the charge and providing a free collection service may encourage more householders to use the service, which will in turn result in removing some organic garden waste from landfill disposal (Cole et al., 2014).	A waste charge for food waste may reduce the quantity
	Grants for research and development support for new technologies with projected waste-prevention benefits (e.g.., for using recycled materials to support smart product and packaging design, for producing biogas and electricity from waste incineration) applied by EU, National governments	Potentially workable, it saves scarce production resources; but, R&D support for new technologies with projected waste-prevention benefits has not yet been proven in practice" (Hodges et al. 2011; (Litwin et al. 2011; Wilson et al. 2012)	Might improve food waste recycling, but not directly applicable for food waste prevention and reduction
	Provision of bins and bags to households	Implemented in some municipalities. In Spain, the participation in selective collection of bio-waste would rise to 88.8% if bins/bags would be provided (Bernad-Beltran et al., 2014).	Might enhance separate collection of food waste, but not food waste prevention and reduction
	Grants for research and development support for new technologies with projected waste-prevention benefits (e.g., for using recycled materials to support smart product and packaging design, for producing biogas and electricity from waste incineration) applied by EU, National governments	Potentially workable, it saves scarce production resources; but, research and development support for new technologies with projected waste-prevention benefits has not yet been proven in practice" (Hodges et al. 2011; (Litwin et al. 2011; Wilson et al. 2012)	Might improve food waste recycling, but not directly applicable for food waste prevention and reduction
	Public investment in transport infrastructure; applied by national and local governments	Largely implemented in the EU. In developing countries, these investments would reduce the opportunities for spoilage and contribute to better-functioning	Might enhance improvements to the value chain, i.e. the introduction of cold storage; though negative

		markets. The availability of capital would increase the efficiency of the food chain (Godfrey et al., 2010).	implications for greenhouse gas emissions arise; improvement of food redistribution
Nutritional health and obesity	Increased prices / taxes EU, National and local governments (e.g. driven by regulations or voluntary agreements). Increased prices for drinks that are high in sugar content and for fast food items, aimed at healthier diets and reducing obesity (Leicester and Windmeijer, 2004; Faulkner et al. 2011; Jensen et al. 2011; Sacks et al., 2011, Powell et al. 2013; Britton et al., 2014)	Indications are that higher prices and taxes on unhealthy food products have not been widely implemented. Price rises on high sugar and high fat items would be effective on reducing obesity, but further work is needed to assess practical aspects of wider policy implementation.	Increase the price of food (theoretically potential, but practically not popular)
Product quality and sustainability (incl. biofuels)	Implementing green public procurement (GPP) to promote more sustainable consumption and production applied by government	Different MS have successfully launched 'green' tenders Potentially workable to skews of markets towards sustainability (Tsai and Chou, 2004; Tojo et al., 2011)	To make food waste issue as a part of good GPP practices
Informational tools and incetives applied to other areas			
Areas of application	**Market-based instruments and incentives**	**Implementation and effectivness**	**Applicability to food waste prevention and reduction**
Solid waste management	Recycling certificate schemes (similar to landfill tax credit scheme) http://ec.europa.eu/enterprise/sectors/wood-paper-printing/files/advisory-committee/20-11-2012/ms-certification-f-bi-ac_en.pdf	Potentially to be applied, there is a discussion in which form: voluntary or mandatory. No evidence yet for effectiveness, but it should increase the quantity of waste recycled and/or to target products/materials that present significant environmental risks when illegally disposed Grigg and Read, 2001; Morris and Read, 2001; Group and Associates, 2003)	Certification systems for supply chain operators, retailers, food services for efforts in food waste prevention and reduction. could be applicable
	Zero Waste Index (ZWI) to forecast the amount of virgin materials, energy, water and greenhouse gas emissions substituted by the resources that are recovered from waste streams (Zaman and Lehmann, 2013), as example: applied by governments	Not existing instrument so far, only for benchmarking. Requires clear management policies in place and long term initiatives. An innovative tool to assess waste management performance and materials substitution by waste management systems in different cities (Zaman and Lehmann, 2013).	Applicable to increase awareness for food waste and stimulate food waste prevention
Product quality and sustainability (incl. biofuels)	Social Fuel Stamp encompasses tax incentives, credit lines and technical support for small farmers in producing oleaginous seeds for the biodiesel processing plants: applied by government Brazil's Biodiesel Program (http://dc.itamaraty.gov.br/imagens-e-textos/Biocombustiveis-09ing-programabrasileirobiodiesel.pdf)	Implemented in Brazil, Besides the full or partial rollback of federal taxes, companies that have the Social Fuel	Such stamp could be provided to small farmers implementing food waste reduction actions (gleaning or donations
Nutritional health and obesity	Policy on food displayed at point of purchase. Some retailers in UK are introducing a voluntary policy to remove confectionery from displays at the point of purchase (i.e. near the check-out counters).	Implemented in UK at some retailers, and has been proposed by the Scottish Government in a draft policy framework. Limited information available on effects of such policy, but documents indicate a positive impact is likely. Hawkes et al. 2015, Scottish Government 2013	The concept of types of product displayed at point of purchase would have limited applicability to prevent food waste

	Measures on portion and pack sizes. Mainly voluntary measures by retailers and restaurants, for example offering a wider range of portion sizes, stimulated by the Public Health Responsibility Deal (calorie reduction targets).	There has been less implementation of these voluntary measures than have been expected. Limited information available on effects. (Steenhuis et al. 2009, EIRIS, 2006, Steenhuis and Vermeer, 2009, Dobbs et al. 2014, Quested and Murphy 2014), Quested and Luzecka, 2014).	Measures to reduce portion size and pack size would be very relevant to reducing food waste, enabling people to buy the amounts of food appropriate for their households and lifestyles (particularly relevant for those living alone).
	Measures using supermarket loyalty cards. The loyalty card systems of retailers can track healthy purchases and could provide rewards to customers that make healthier purchases.	Such measures have been discussed in the sector, but not widely implemented (several retailers are running pilots). Doak (2013). No information found on effects.	Loyalty card schemes could be applicable for prevention of food waste, for example encouraging people to purchase tools to help manage their food better, provide information and advice based on actual purchases and help to mitigate against price barriers (for example smaller packs may be relatively more expensive than larger ones).
	Labelling on nutrition of food products. Traffic light labelling scheme indicating high / medium / low amounts of fat, sugar and salt in products; implemented on a voluntary basis by some retailers.	Some implementation by retailers, particularly in UK. Sacks et al. (2011). Some research has been carried out, mainly indicating the potential for a positive effect on nutrition (Lobstein and Davies, 2008; Sonnenberg et al. 2013).	Labelling to raise awareness on food waste prevention is applicable, in particular guidance on storage, freezing and clarity on date labels. A specific traffic light scheme on food waste, identifying products that have high environmental impact if wasted, is unlikely to be practical.
	Labelling of nutritional information on menus in restaurants. Nutritional information (e.g. calories) on menus in restaurants, particularly fast food restaurants; implemented on a voluntary basis by some restaurants (e.g. in UK and USA).	Implementation by some restaurants on a voluntary basis. Research concludes that nutritional labelling on restaurant menus is likely to have a positive impact on nutritional health Ellison et al. (2013).	Information in restaurants is unlikely to have impacts on food waste prevention (except for information on portion sizes).
Food Safety	Voluntary and mandatory quality assurance and safety schemes/systems (Holleran et al., 1999). Voluntary and mandatory traceability systems. Voluntary and mandatory forms of certification by other parties (Henson and Caswell, 1999).	Implementation by government (when mandatory forms apply) and chain actors. Food chain actors' responses to the above market-based instruments in terms of compliance mainly depends on the expected economic benefits. If the benefits of, for example, certification to a quality assurance and safety theme/system exceed the adoption and maintenance costs, then the standard is worthwhile. However, identifying and quantifying costs and benefits of a specific standard may present a challenge (Henson and Caswell, 1999). The quality assurance schemes, traceability systems and certification process itself might become a barrier to trade (Holleran et al., 1999).	Traceability systems make it a lot easier for retailers to track their close-to-expiry stocks and thus, to reduce food waste. Also, quality assurance and traceability systems help optimize the production process and in this way may prevent and reduce food waste along the chain. Government may prefer "food waste" certified producers in government procurement programs.
	Incentive-based contracts: contingent payment contracts where the buyer offers heterogeneous suppliers a payment to implement costly additional practices to improve food safety (Resende-Filho and Hurley, 2012).	Implementation by chain actors. Research shows that firms can find it advantageous to voluntarily set up incentive based contracts (Resende-Filho and Hurley, 2012).	Implementation of specific practices to prevent and reduce food waste might be stimulated by contracts.
	Standards and specifications of large food companies http://www.ers.usda.gov/media/494222/aer831h.pdf.	Implementation by government (when mandatory forms apply) and chain actors.	Large food companies may include food waste issues in their

	Part III. Market and Regulatory Incentives for Food Safety	In the market for hamburger, fast food restaurants have adopted the role of channel captains, monitoring the safety of products up and down the supply chain. They have created markets for food safety that have stimulated demand for safety and provided processors with mechanisms for appropriating the benefits of food safety innovation	specifications .
	Labelling of products: the government and producers have a number of tools at its disposal to reduce asymmetric information and transform credence attributes, such as food safety. http://www.ers.usda.gov/media/494222/aer831h.pdf. Part III. Market and Regulatory Incentives for Food Safety	No specific information found on effects	Labelling programs may provide general "food waste" information like the food waste handling labels on retail product packages.

(1) These are suggestions of the FUSIONS team members as based on the performed rapid literature analysis.
MBI = market-based instrument

11.2 List of interviewed experts

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12. Alexandros Theodoridis
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11.3List of abbreviations

DRS	Deposit–Refund Systems
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPP	Green public procurement
PAYT	Pay As You Throw
PPP	Polluter Pays Principle
MBI	Market Based Instrument
VAT	Value-Added Tax

Market-based instruments and other socio-economic incentives enhancing food waste prevention and reduction

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