A review and assessment of implemented foodwaste prevention programs

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Article 4 of the Waste Framework Directive (WFD; Directive 2008/98/EC on waste and repealing certain Directives) established the waste hierarchy as the overarching principle of waste policies in the EU Member States. According to this, waste prevention has the highest priority, followed by reuse, recycling and other recovery methods. Disposal is defined as the least desirable option. Thus, tackling foodwaste is a main priority in the context of circular economy and Sustainable Development. EU is committed to achieving a 50% reduction of food waste by the year 2030. Cyprus has for the first time established a national waste prevention program (2015-2021) and has recently prepared the Municipal Waste Management Strategy 2021 – 2027.

The aim of this work was to collect and assess the existing foodwaste prevention programs and initiatives at national (in Cyprus), European and international level, seeking to a potential application in Cyprus. Thus, a classification system was put in place to categorize the actions of foodwaste prevention programs reported and identify common traits adopting the framework for the evaluation of food waste prevention actions and their assessment developed by the European Platform on Food Loss and Waste. This was based on the stages of the food supply chain that the waste is originated from; Primary production, Processing and manufacturing, Retail and other distribution of food or hospitality and Food service sectors and households. The actions were also grouped in five classes according to their goal and the means to achieve each of them and the following classes occurred: Redistribution of food for human consumption, Food valorisation, Consumer behavior change, Improvement of supply chain efficiency, Foodwaste prevention governance.

Evaluation process of sub-actions was a much more complex procedure, due to lack of information on progress monitoring and required tools to maximize the effectiveness when adopting best practices. The following key performance indicators were adopted, based on the recommendations of the European Platform on FLW:
- Quality of the action design reflects to which extent the action was well planned.
- Effectiveness reflects to which degree the action was successful in producing the desired result.
- Efficiency reflects the capacity to reach a desired result with the least time/cost/effort.
- Sustainability of the action over time reflects the potential of the action to be sustained over time.
- Transferability and scalability reflect to which extent transferability and were considered during the design of the action.
- Interpectoral cooperation reflects if the action was the result of a cooperation represented by a partnership between the private and the public sector and/or between different actors along the supply chain.

All continents were investigated separately, starting from their general strategy and their foodwaste reduction levels. The main focus of the study was Europe, for which all 37 countries were examined separately. In total 209 actions were listed from Europe. The majority of the reported actions were from Denmark (16), Italy (19) and Portugal (22). Some notable outcomes have arisen from this research that could either provide ideas about programs that might be applied in Cyprus or help in avoiding inefficient practices that have already taken place.

As presented in Table 1, the majority of actions reported are Behavior Change actions, reaching the number of 132. 91 of them are awareness/educational campaigns implemented mainly at a household and food service level. Moreover, 95 actions are reported as government implementations. However, their actual number is much smaller as every National program or legislation is usually referred to all the supply chain stages. Redistribution and Supply chain efficiency initiatives fluctuate around the same levels with 81 and 80 actions respectively. As for the Valorization actions, only 9 of them were reported, and this can be attributed in the urbanization and the intense transition from agriculture to industrial occupations, as food valorization refers to food originated from primary production.

Although several programs and initiatives were examined, the main barrier that is evident is that there exists lack of means of their assessment. Just 12 have been thoroughly evaluated. Some programs could not be assessed due to a lack of data, as the projects reported are still ongoing. Another case scenario is that the information reported described a research project, which for example could show the potential of a change in the production of animal feed that has not yet been put in practice by the industry.

The Cypriot policy on waste management is based mainly on waste hierarchy (prevention, reuse, recycling, recovery, disposal) and the correct environmental handling. The ultimate aim is to protect the environment and human health. This is achieved through the reduction/elimination of the negative effects of the generation and management of waste, the promotion of reuse, recycling and recovery and generally the environmentally sound

management in order to reduce the disposal in landfills and to reduce the overall impact of the use of resources by improving the efficiency and effectiveness of their use.

Table 1. Number of actions reported for each stage of the food supply chain and action sub-type in Europe.

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution	8	9	13	28	13
	Gleaning	6	0	0	0	0
	Digital tools R	0	0	1	2	0
Food valorization	Value added processing	0	0	1	3	1
	Animal feed	0	0	0	3	1
Behavior change (BC)	Awareness/educational campaign	3	2	6	23	57
	Digital tool BC	0	0	0	3	14
	School programs	0	0	0	0	12
	Awards	0	0	0	1	1
	Innovation of products - date marking	0	2	0	4	4
Supply chain efficiency (SCE)	Process innovation	0	1	0	8	5
	Innovation of products - packaging	1	2	3	3	3
	Training & guidelines	2	3	2	12	10
	Price discount	0	0	2	3	0
	Imperfect produce sale	0	0	0	1	0
	Certification	0	0	0	1	0
	Public procurement	0	0	0	6	0
	Digital tools SCE	1	1	2	8	1
Food waste prevention governance	Voluntary agreement	5	7	8	6	5
	Regulatory framework/policy	5	5	5	9	1
	National FW prevention program	5	6	7	6	6
	Fiscal incentives	2	1	2	4	0

In general, a rather limited public debate about important issue of food waste prevention was noted. Harmful habits that are related to increase food waste generation are still widely present, although probably diminishing. There are still many events offering buffet meals that are known to produce a high volume of plate waste. Taking a lot of food from a buffet or cooking food in greater quantities than those that can be consumed in a household are behaviors that are still widely present. Furthermore, the amount of food unnecessarily wasted is great due to the touristic development of the island.

On the other hand, most of the waste management actions recorded cannot be considered as real prevention measures, but intended rather to exploit, valorize or reuse materials. No waste prevention measures (production planning and estimation of market needs) has been operating in the primary production sector, and farmers complain that they have no assistance in doing so, as no official regulatory systems of amounts of agricultural produce was identified to restrict oversupply.

Conclusively, this analysis revealed important information gaps that hinder the systematic impact assessment of food waste prevention interventions. This is in agreement with what is reported by other studies in the literature. A key outcome of this research is that future programs should be designed and implemented ensuring the provision of the data required for their evaluation. Additionally, the database of actions collected could be expanded by means of tailored surveys developed for each type of action, to optimize the data collection and lighten the burden of the respondents in completing the survey. Last but not least, several success stories were identified from which a few were considered as potential replication studies for Cyprus. In this context, this holistic approach may lead to engrossing outcomes that can lead to a more efficient planning methodology in Cyprus.

Acknowledgements

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