



Implemented by:



Circular Economy oriented Value Chain Guideline for HORECA Food Waste Utilisation



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in association with



and



Circular Economy oriented Value Chain guideline for HORECA Food Waste Utilisation



In association with:



and:



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Table of Contents

Table of Contents	ii
List of Tables	iv
List of Figures	v
List of Abbreviations	vi
Executive Summary	1
1. Introduction.....	3
1.1. Purpose of the guidelines.....	3
1.2. Boundaries of the Guidelines	4
1.3. Food waste.....	5
1.4. Tools and instruments for the transition to Circular Economy	9
1.5. Benefits for the Public of using food waste	12
1.6. Circular Economy and Value Chain terminology used in the guideline	13
2. Existing Value Chain.....	16
2.1. Organic waste in Serbia	16
2.2. Identification of actors	21
2.3. Barriers to Circular Economy	21
3. Business potential for food waste utilisation.....	26
3.1. Baseline Considerations	26
3.2. Business Rationale for the Food Waste Value Chain	27
3.3. Business Opportunities and Actors along the Value Chain for Food Waste	31
3.4. Business potential for collectors/processors of food waste	32
3.4.1. Collectors and transporters of food waste	32
3.4.2. Processors of food waste	32
3.4.3. Best practices cases	33
4. Promotion of Circular Economy practices	36
4.1. Awareness creation among citizen, business and municipalities	36
4.2. HORECA Personnel.....	36
4.3. HORECA Customers	37
4.4. Sticks and carrots.....	37
5. Conclusions: Necessary changes	39
5.1. Basic elements of the proposed value chain	39
5.2. Basic requirements	40
5.3. Establishment of a regulatory environment that encourages utilisation of food waste as secondary raw material.....	40
5.4. Institutional framework	41
5.5. Operational resources and technical requirements	43
5.5.1. Food waste supply and distribution.....	43

5.5.2. Secondary Raw Material infrastructure	46
5.6. Business Model Rethinking	47
5.6.1. Tools	47
5.6.2. Green financing	49
5.7. Access to information	49
6. Financing options and sources	54
6.1. Financing Options	54
6.2. Investors and/or contractors with previous experience - Financial Institutions active in Serbia	55
7. Going beyond SRM utilisation	57
7.1. Food donations	57
7.2. Further CE potential in the Sector	59
8. List of references.....	60

List of Tables

Table 1: HORECA food waste categories (Khanh Linh, 2018).....	7
Table 2: Policy instruments outlined in Circular Economy Action Plan (GIZ, 2017).....	9
Table 3: SMEs and large companies actions related to circularity, based on a Eurobarometer survey, 2017 (Source: TNS Political & Social, 2018)	23
Table 4: Biogas Plants in Serbia (Source: GIZ 2017).....	26
Table 5: Business Potential acc. to CEVES (scenario 3), (2019).....	27
Table 6: VC Criteria Assessment - Biogas and Coposting	29
Table 8: HORECA customers’ survey results about the placement of messages (WRAP, 2020)	37
Table 8: Criteria types and procurement phases	41

List of Figures

Figure 1: Actors in HORECA food waste VC	3
Figure 2: The food waste hierarchy (Papargyropoulou et al., 2014)	6
Figure 3: Conceptual food waste cycle in HORECA (CEVES, 2019)	7
Figure 4: Food surplus and waste management options	8
Figure 5: Structural waste in the food system (Ellen MacArthur Foundation, 2015)	9
Figure 6: Waste composition in Serbia (Data from FTS-UNS, 2009, Table in Serbian from Statistical Office of the Republic of Serbia 2012, Table in English from Vemic et al. 2012)	16
Figure 7: Current Value Chain for food waste in Serbia	19
Figure 8: Proposed (future) Value Chain for food waste in Serbia according to CE principles	20
Figure 9: Overview of circularity metrics used by companies – results from WBCSD survey (Source: European Environment Agency, 2019)	24
Figure 10: Main CE barriers and their interaction (Kirchherr et al., 2018)	25
Figure 11: Food Waste Value Chain	31
Figure 12: Conceptual diagram of a detailed VC development action plan (from Valuelinks 2.0, Springer-Heinze, 2018)	43
Figure 13: HORECA food waste flow diagram	44
Figure 14: Business model rethinking for CE transition, according to the CE workbook (Jonker et al., 2018)	47
Figure 15: Basic objectives according to PREMA®	48
Figure 16: PREMA® cycle of change	48
Figure 17: Function specific components for adapting to CE culture (SITRA et al., 2018)	49
Figure 18: Conceptual framework for data collection and analysis (Papargyropoulou et al. 2016)	52
Figure 19: Food measurement in businesses according to WRAP (WRAP, 2018)	53

List of Abbreviations

AD	Anaerobic Digestion
BFB	Belgrade Food Bank
CBA	Cost Benefit Assessment
CCIS	Chamber of Commerce and Industry
CE	Circular Economy
CLO	Compost-Like Output
CRM	Critical Raw Materials
CSO	Civil Society Organisations
DKTI	Deutsche Klima- und Technologie Initiative
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ELV	Emission Limit Values
EPR	Extended Producers Responsibility
EU	European Union
FAO	Food and Agricultural Association of the United Nations
FEBA	European Food Bank Federation
GDP	Gross Domestic Product
GFA	GFA Consulting Group, GFA South East Europe
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GPP	Green Public Procurement
HACCP	Hazard Analysis and Critical Control Points Principles
HORECA	Hotel Restaurant Catering/Cafes
IFI	International Financing Institution
ISWA	International Solid Waste Management Association
LDK	LDK Consultants Engineers and Planners SA
MoEP	Ministry of Environmental Protection
MRF	Materials Recycling Facility
NGO	Non-Governmental Organisation
PAYT	Pay As You Throw
PREMA	Profitable Environmental Management
PUC	Public Utility Company
RDF	Refuse-Derived Fuel
SaS	Separation at Source
SDGs	Sustainable Development Goals

SEPA	Serbian Environment Protection Agency
SeSWA	Serbian Solid Waste Association
SITRA	Suomen Itsenäisyyden Juhlarahasto (Finnish Innovation Fund)
SMART	Specific Measurable, Achievable, Realistic, Time-Orientated
SME	Small-Medium Enterprises
SRM	Secondary Raw Materials
STE	Short-Term Expert
SWIS	Solid Waste Information System
SWM	Solid Waste Management
UN FAO	United Nation’s Food and Agriculture Organisation
UNECE	United Nations Economic Commission for Europe
VC	Value Chain
WBCSD	World Business Council on Sustainable Development
WFD	Waste Framework Directive
WM	Waste Management
WtE	Waste to energy

Executive Summary

The present **HORECA Food Waste Utilisation Guidelines** have been elaborated in the framework of the German Development Cooperation project **DKTI Climate Sensitive Waste Management in Serbia**, hereafter called “the Project”, implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. “A *waste circular economy contributing to climate change mitigation is introduced in selected regions of Serbia*” is defined as the module objective of the Project.

The sector specific guidelines aim to provide support to the user, both manufacturing companies as well as public authorities to utilize SRM in their production process and to monitor such practices. In addition, the guidelines highlight the business opportunities by the incorporation of CE principles in the evolving waste management sector.

This guideline introduces the reader to the basic definitions of HORECA waste and gives a brief analysis of the relevant sector on EU level. The document also focuses on the analysis of the existing data and studies pertaining to the specific waste stream, the situation of the SWM sector in Serbia, with special focus on the production of HORECA food waste, and identifies main actors within the sector. The current situation regarding the utilisation of SRM is analysed based on the existing data, leading to the identification of the potential value chains. Opportunities, basic tools and barriers for the transition to a CE model are thoroughly analysed and proposals are presented based on this analysis. Necessary legal and institutional reforms, and several technical and business aspects are discussed as well.

The document presents the requirements for the utilisation of SRM in the production processes of the Serbian companies and elaborates on general directions for the promotion of CE practices.

Finally, the guidelines analyse additional ways (apart from the SRM utilisation) that may be followed for promoting CE in Serbia, with special focus on the reduction/redistribution of HORECA food waste through the donations of excess food to the food banks, or the improvements to the current practices in the sector.

Most of the basic findings of the report are related to the fundamental legal and institutional deficiencies of the overall SWM sector operation in Serbia (e.g. harmonisation with EU legislation, availability of data, SWM best practices implementation, lack of infrastructure). One of the most important obstacles towards the full utilisation of the CE potential is the fact that currently there are no drivers for separation and utilisation of food waste as SRM. For this reason quantity and quality of food waste is not enough for establishing a market for food waste and thus moving towards a CE Value Chain. The road to the establishment of a circular Value Chain passes primarily through the closing of the gaps of the SWM system of Serbia such as the establishment of separation at source schemes, the use of economic instruments (Pay As You Throw schemes, tariff setting), institutional strengthening of municipalities and regional authorities, optimisation of data collection procedures especially at the initial levels of collection and transmission. Along with the above, there are several CE tools that can be applied, even at the present level of maturity of the system, such as the promotion of reduction of food waste production (via donations), the alternative methods and technologies for food waste utilisation (animal feed, energy production, composting, bioplastics etc), the rethinking of business models of SME's of the sector and the awareness raising among the SWM actors and primarily among the citizens in order to create drivers for the establishment of more circular Value Chains in the HORECA sector of Serbia.

More specifically the structure of the present guideline is as follows:

The first chapter (**Chapter 1**) is an introduction to the guideline and a presentation of the basic definitions of food waste, and a brief analysis of the relevant sector on EU level. Moreover, the target groups and the implementation boundaries of this guideline are defined.

The subsequent chapter of the guideline (**Chapter 2**) focuses on the analysis of the existing data and studies pertaining to the specific waste stream, the situation of the SWM sector in Serbia, with special focus on the production of HORECA food waste, and identifies main actors within the sector. The current situation regarding the utilisation of SRM is analysed based on the existing data, leading to the identification of the barriers to a CE Value Chain in food waste.

In **Chapters 3 and 6**, an analysis is done regarding the requirements for the utilisation of SRM in the production processes of the Serbian companies. Possible business benefits and opportunities are presented, financial requirements are defined, and specific proposals are made for the possible financing options and sources.

The basic directions for the promotion of CE practices are elaborated in **Chapter 4**. Along with the “greener SMEs” part of the campaign, special attention is given to the incentivisation of all basic actors and, especially, the HORECA personnel and customers.

Chapter 5 presents the set of proposals. This chapter describes all necessary changes that have to be implemented. Proposals are based on how the identified barriers can be overcome. Furthermore, the necessary legal and institutional reforms, as well as several technical aspects are analysed.

Finally, the last chapter (**Chapter 7**) discusses possible alternative ways that can be followed (apart from the SRM utilisation) to promote CE in Serbia, with special focus on the issue of reduction/redistribution of HORECA food waste, through the donations to the food banks.

1. Introduction

1.1. Purpose of the guidelines

The Project **DKTI Climate Sensitive Waste Management in Serbia**, hereafter called “*the Project*”, aims to support both local authorities and organisations active in SWM sector in Serbia, to tackle the existing challenges hindering the development of a sustainable and integrated SWM system. This is primarily done through the introduction of modern CE practices. The objective can be achieved by setting the foundations for the establishment of circular value chains by a set of practical steps that address all levels of value chain development:

- a) by enhancing the collection of materials considered as waste, which should be deemed as inputs (or “nutrients”) to other processes under the concept of CE;
- b) by ensuring the introduction/utilisation of these materials in the production processes of the SME’s; and
- c) by the **elaboration of a strategic/policy framework** (taking into consideration the existing work already done by GIZ and other organisations active in this field) **in order to coordinate the various stakeholders and lead the change towards the desired outcomes.**

In the framework of the Project, the GFA-LDK consortium compiled two reports with guidelines for the development of CE oriented Value Chains for two priority SRMs (the present report is for HORECA food waste and the other report cosubmitted in this framework is for Plastic Packaging), including sector-specific guidelines for their utilisation. The sector specific guidelines aim to provide support to the user, both manufacturing companies as well as public authorities to utilize SRM in their production process and to monitor such practices. In addition, the guidelines highlight the business opportunities that can be triggered by the incorporation of CE principles in the country’s evolving waste management sector. To this direction, the team of GFA-LDK will use the guidelines to support Serbian SME’s in the introduction of CE through preparation of CE Action Plans. Three of these SMEs will be supported further by the GFA-LDK local experts to develop CE business models.

The selection of the two priority SRM was based on the preparatory analysis provided by GIZ. GIZ had already researched the existing situation and developed a proposal for the transition to circular value chains for the two waste streams that have significant contribution to the percentage of waste landfilled each year in Serbia, notably HORECA food waste and Plastic Packaging. The aforementioned priority sectors were chosen for the development of the SRM utilisation Guidelines.



Figure 1: Actors in HORECA food waste VC

All actors dealing with HORECA waste (see previous figure and mentioned in detail in paragraph 2.2) should be considered in a plan for the implementation of CE principles in the HORECA sector. That can be done, though, at different phases of its implementation. The immediate target groups of this guideline are the members of the first four categories of actors, which will play a central role from setting the rules for a CE transition in HORECA sector (e.g. MoEP, CCIS) to the initiation of any Separation at Source (SaS) scheme for the biodegradable waste (municipalities, regional authorities). It is of utmost importance that also specific members of the civil society dealing with food donations to the people in need are well informed about the present guideline so that they undertake a role in the food redistribution (which is the most preferred method for food waste reduction) and at the same time provide their insights for the design and institutional support of such a system.

1.2. Boundaries of the Guidelines

As HORECA food waste falls under the broad category of biodegradable waste, the first issue that has to be clarified regarding the boundaries of the present guideline relates to the distinction of the HORECA food waste from other types of biodegradable waste that are produced or handled in the interaction between HORECA sector and the food production sector.

More specifically, a common confusion exists with the organic waste produced by the food production companies that supply primarily the HORECA sector. For example, the waste produced in a vegetable farm supplying hotels or restaurants chains is not considered HORECA waste. In the same manner, food co-handled with HORECA food can be confusing. This is the case with food donations from retailers (supermarkets, etc), which in many cases has the same characteristics with food donated by the HORECA sector. Finally, once food becomes waste, it can be used either as animal feed (see prerequisites stated in paragraph 2.1), as biomass for the production of biogas or as SRM for compost production. Other types of waste used as biomass or animal feed should not be regarded as HORECA food waste.

Finally, food redistributed as donation from HORECA sector is not considered as waste since it can be consumed without prior treatment. For this reason and according to Serbian legislation it does not fall technically under the term “food waste” or “SRM from HORECA waste” before it expires or it is wasted. However, due to the fact that the food donations play a central role in the reduction of HORECA food waste as the most preferable (the most “Circular”) method of HORECA food waste management, this issue is treated specially in chapter 7.

1.3. Food waste

Food loss and waste are a massive global problem: one-third of all the food produced in the world is lost or wasted every year between leaving the farm and reaching consumer's plates, which equals a staggering amount of 1,3 billion tonnes of perfectly good and edible food, or 216 kg per person (Ghamrawy, 2019).

Food waste can be found both at home (household) and in different segments of the out-of-home food service sector (also called hospitality sector), for example, catering, canteens (education, enterprise, hospital, etc.), hotels, and restaurants. These segments can be divided into commercial and non-commercial sectors. The non-commercial sector comprises the non-profit food services within the public sector and the self-operated canteens within the private sector. The commercial sector consists of hotels, restaurants, canteens and catering. Food waste can also be categorized as avoidable waste (the waste that is edible or potentially edible) and unavoidable waste (the waste that is not or has not been edible under normal circumstances) (Wang et al., 2018).

Food waste is generated at each of the stages in supply chain management. According to Ocicka et al (Ocicka and Raźniewska, 2018), food waste exists within agricultural production, post-harvest handling and storage, processing, distribution and final consumption. Food waste occurs across the supply chain, including all entities – farms, manufacturers, retailers, consumer facing business like HORECA services as well as individual consumers. Along the food waste supply chain, there are five general types of waste (Batista et al., 2015):

- Processing waste – all inedible materials generated from the production process, such as stems, leaves, bones, excess animal fat, spoiled food, spillages, contaminated products due to poor handling or processing failure;
- Wastewater – water at the end of food processing or cleaning processes, which usually carries dirt or debris;
- Packaging waste – different sorts of food packages that may be disposed along the way through the supply chain;
- Non-conformity waste – all edible products generated in the production process that have not achieved conformity with specifications of quality, consistency, flavour, aroma, size, shape etc., predetermined by organisation downstream the supply chain;
- Overproduction waste – food that meets industry specifications but has not been wasted because it no-longer has market value.

For better understanding of the food waste management preferable options Papargyropoulou et al (Papargyropoulou et al., 2014) applied the waste hierarchy in the food waste supply chain. The food waste hierarchy is presented in the following figure.

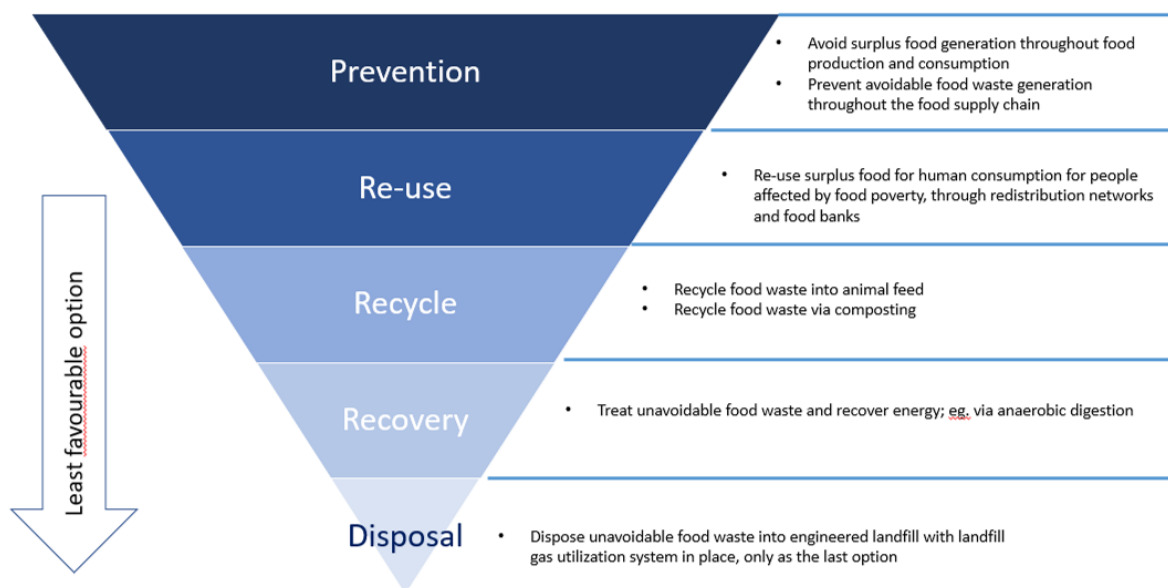


Figure 2: The food waste hierarchy (Papargyropoulou et al., 2014)

According to the food waste hierarchy, food waste prevention is the most preferable option and this can be achieved mainly in the early stages of the food supply chain by avoiding food generation surplus. Next preferable option for avoidable food waste that meets the requirements for human consumption is to be reused by food redistribution and donation activities.

Further option for avoidable food waste is recycling into animal feed, or composting as a secondary option. Once recycling efforts are exhausted, treatment of food waste with energy recovery, such as anaerobic digestion, is the next preferred option. Sanitary landfill disposal is the least preferable option for food waste (and not allowed according to EU Landfill Directive unless it is pre-treated).

According to CEVES (2019), in the EU, the food waste amounts are estimated at approximately 88 million tonnes. Households generated waste at 53% and HORECA at 12%, equal to almost 10.5 million tonnes. This means that the HORECA industry is a significant food waste producer. At the same time the industry consists of facilities (hotels, restaurants) characterized by high food waste concentration and therefore shows great potential for food waste reduction with relatively small interventions. This is the reason that for the majority of waste management plans the HORECA industry (together with other big food waste producers like hospitals, schools, universities and colleges) is among the first priority focus points for the food waste minimisation efforts, and for the introduction of organic waste source separation schemes.

The HORECA food waste cycle starts with the production and import of raw food and ends with the food waste disposal on sanitary landfills (see Figure 3.) (CEVES, 2019)



Figure 3: Conceptual food waste cycle in HORECA (CEVES, 2019)

Food preparation stations (kitchens) are the first points of food waste produced in the HORECA industry. The vast majority of the kitchen waste is unavoidable, and it refers to inedible food elements, such as eggshells, bones etc. A small amount of avoidable food waste is produced in HORECA kitchens, and it refers to edible waste due to poor planning, inadequate tools and skills of staff, or inadequate storing procedures and facilities.

Food consumption (customers) is the second food waste generation activity in HORECA industry. Customers produce both avoidable and unavoidable waste. Food waste from customers refers to the so called “plate waste”, the majority of which is edible and avoidable. Between “kitchen waste” and “plate waste” comes the food waste produced in the buffet style service. The “buffet waste” is mainly avoidable and edible and refers to the untouched leftovers from the buffets. Table 1 summarizes the types of food waste in HORECA industry.

Table 1: HORECA food waste categories (Khanh Linh, 2018)

Type of waste/origin of waste	Kitchen waste, preparation and cooking	Serving waste, left from cooked and prepared meals	Customer plate leftovers
Food waste Originally edible (OE)	Spoiled products, incorrectly prepared food, expired date products	Overproduction, food left from the buffet	Food leftovers by customers on plate
Bio waste Originally inedible (OIE)	Inedible parts of vegetables, coffee grounds and bones	Inedible parts of vegetables, bones	Vegetable peelings, bones

Food waste management options are presented in the previous Figure 3. Papargyropoulou et al (Papargyropoulou et al., 2014) presents a more analytical diagram of waste management options of food waste, linking it to the food waste hierarchy and the food surplus, which is the main barrier to food waste prevention (see Figure 4).

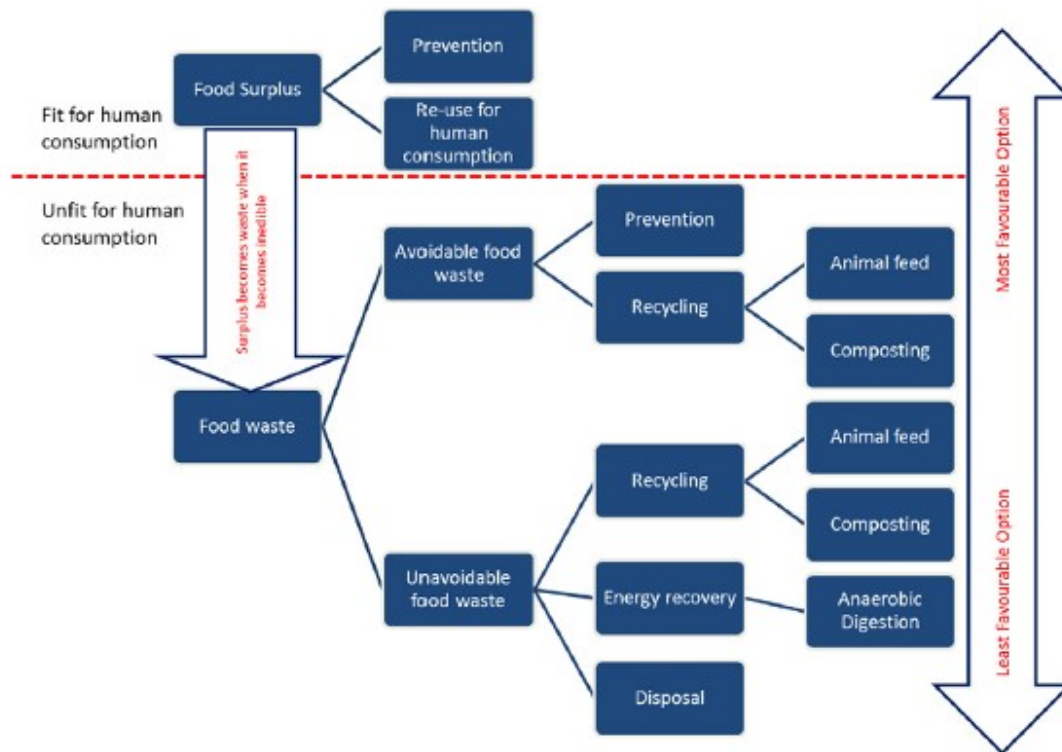


Figure 4: Food surplus and waste management options

Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2015), made an analysis in three key sectors of the EU economy: mobility, food, and built environment value chains. The results show that Europe's resource use still remains highly wasteful, often due to market and regulatory failures. The impacts are economic losses and depletion of natural resources and capital that could substantially limit the ability to generate prosperity in the medium-to long term.

Focusing on the EU food sector value chain, Ellen MacArthur Foundation points out that 31 percent of European food goes to waste along the value chain, according to research by the United Nation's Food and Agriculture Organisation (UN FAO, 2011). Categories like fruits and vegetables lose as much as 46 percent of their edible mass.

Moreover, food producing resources are also wasted. Only 5 percent of fertilizers actually go into nutrients absorbed by humans, not all of which improve health and well-being. Only 40 percent of irrigation water actually reaches the plants, and soil degradation affects 30–85 percent of European agricultural land. Finally, the average European citizen consumes 40 percent more calories than recommended, and more than 50 percent of the European population is overweight or obese.

These numbers show that even mature and professionally managed industries (like food production) present surprisingly high numbers of resources misuse. On the other hand, these numbers represent significant potential for waste minimisation and business opportunity through the proper management of the natural inputs.

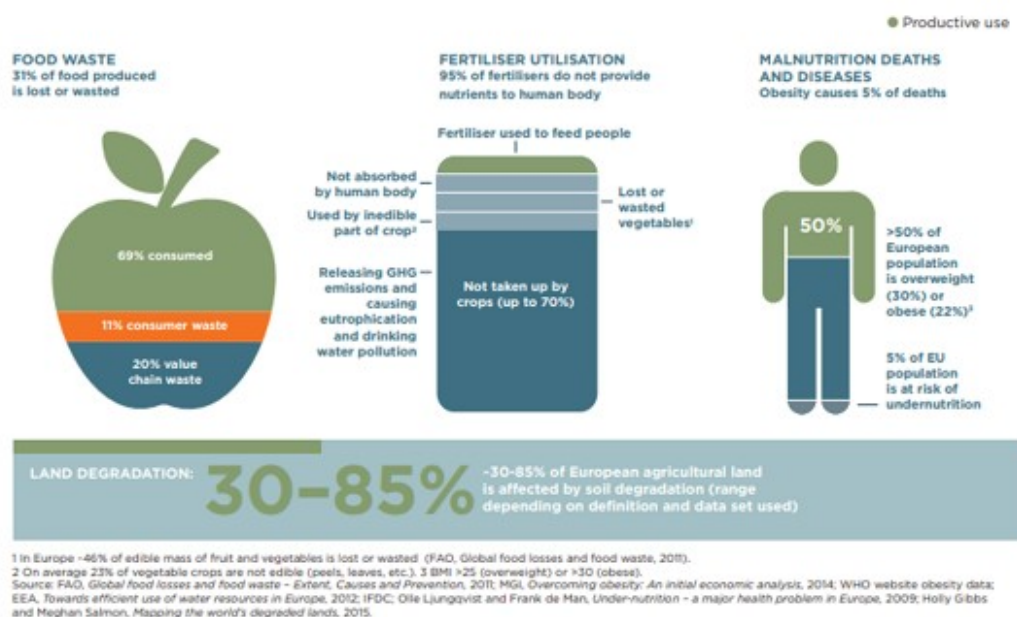


Figure 5: Structural waste in the food system (Ellen MacArthur Foundation, 2015)

1.4. Tools and instruments for the transition to Circular Economy

The transition from linear to circular economic system constitutes a major change to the whole existing economic system. According to European Environmental Agency (European Environment Agency, 2019) this transition is a “wide-society process, engaging multiple stakeholders and depending critically on the emergence of innovation in technologies, social practices, organisational forms and business models”. Governments play significant role in this transition but not just through policy planning and implementation, due to the complexity and uncertainty of this systemic change. Governments can contribute by promoting and facilitating the transition, by providing direction and consistency to society – wide processes, by developing policies and strategies with clear visions, objectives and targets etc.

In this direction, the European Commission has presented in December 2015 the new CE package containing an Action Plan that includes a variety of measures to strengthen the implementation of the circular economy in the EU member states. The Circular Economy Strategy paper for Serbia (draft) (GIZ, 2017) summarizes the instruments and measures of the Action Plan that are presented in the following table:

Table 2: Policy instruments outlined in Circular Economy Action Plan (GIZ, 2017)

Type of instruments		Rationale	Tools / instruments	Scope of instruments and comments
Production oriented policy instruments	Support for Ecodesign of products	The Action plan encourages the eco-design perspective during the production phase that promotes the reparability, durability and recyclability of products. A sustainable design may enable recyclers to disassemble	Ecodesign Directive	Alignment of different groups (producers, users, recyclers) interests
				Setting of minimum mandatory requirements so far mainly regarding the energy efficiency of products
				Prevention of trade barriers
				Improve product's quality

Type of instruments		Rationale	Tools / instruments	Scope of instruments and comments
		products in order to recover valuable materials and components		Enhance environmental protection
			Ecodesign Working Plans	Development of product design and marking requirements
				Integration of resource efficiency aspects into the evaluation criteria for products that so far are dominated by energy efficiency aspects
	Addressing planned obsolescence	A barrier to the circular economy is the planned obsolescence that occurs when a product is designed with the intention of it breaking, failing, or becoming unfashionable after a determined period of time.	No specific EU policy instrument and/or regulation is applied so far. Individual Member States can adopt a relevant law (e.g. France)	
	Extended Producer Responsibility (EPR)	The EPR calls for an environmental policy approach in which the producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. Accordingly, producers are responsible for collecting or taking back used goods to sort and treat them for recycling. Incentives for producers to design easier recyclable products will further support the implementation of the EPR. Additionally, the industry will financially provide for collection and recycling.	EPR is mandatory through WEEE, batteries and ELV Directives	In EU level, EPR is mandatory for WEEE, Batteries and End-of-life vehicles. Additional waste streams for which producer responsibility organisations have been most commonly identified within the European Union include tyres, waste oil, paper and card, and construction and demolition waste. However, a much broader range of waste streams are subject to obligatory or voluntary producer responsibility systems in some MS, including: farm plastics, medicines and medical waste, plastic bags, photo-chemicals and chemicals, newspapers, refrigerants, pesticides and herbicides, and lamps, light bulbs and fittings
Consumption oriented policy instruments	Support for SMEs	SMEs are the most important stakeholder to boost circular economy practices	The Commission has supported SMEs in their transition to the circular economy through the continued implementation of the Green Action Plan for SMEs	Especially the Executive Agency for Small and Medium-sized Enterprises manages programmes on behalf of the European Commission and turns EU policies into action. It manages significant parts of large-scale projects, such as COSME, LIFE, Horizon 2020 and EMFF.
	Strengthening reuse and remanufacturing	As one of the key objectives the Action Plan addresses owners and society to promote reuse. The role of re-use and preparation for re-use in a circular economy has been	The Commission aims to encourage reuse in different ways	Scope of the Commission is to establish quality standards for reused and remanufactured products, to support local and regional reuse networks in order to support the professionalisation of the sector and to create

Type of instruments		Rationale	Tools / instruments	Scope of instruments and comments
Policy instruments in the field of financing the circular economy		significantly strengthened by the five-step waste hierarchy that now clearly states that reusing or remanufacturing of products should be preferably over all kinds of recycling. Reusing allows maximal practical benefits from products and generates minimum amount of waste. Thus, the reuse of products or specific components will particularly efficiently help to reduce the demand for raw materials and especially maintain the physical assets and economic value of raw materials already contained in products.		economies of scale, to enable the access of reuse organisations to relevant waste streams for they get mixed up and to further strengthen reuse by general policy frameworks, such as the Green Public Procurement programme.
	Green Public Procurement	Europe's public authorities are major consumers. By using their purchasing power to choose environmentally friendly goods, services and works, they can make an important contribution to sustainable consumption and production - what we call Green Public Procurement (GPP) or green purchasing	GPP is a voluntary instrument - EC supports it by issuing GPP criteria for different products	GPP requires the inclusion of clear and verifiable environmental criteria for products and services in the public procurement process. The challenge of furthering take- up by more public sector bodies so that GPP becomes common practice still remains. GPP criteria helps the single market to provide equal opportunities that will accelerate and help drive the single market for environmentally sound goods and services
	Importance of innovative circular business models	Innovative business models based on closed cycles and resource efficiency are one of the most powerful drivers of the circular economy. Where successfully established, such business models will have a direct and lasting impact on the economic system and at the same time advance the adaptation of the necessary framework.	Policies and instruments that allow and promote of innovative circular business models is necessary	Different new innovative business models have been developed that can boost CE initiatives. For example "using instead of owning" concept, turns the ownership of a product to a service. This business model provides the incentive to manufacturer for the production of long-lived product including an optimised return systems using EPR. Other similar concept is the one sharing business model in which refers to sharing the use of a product with other customers instead of the limited use of the same product if owned.
	Investment strategies	The European Commission's Circular Economy Action Plan explicitly aims to shift public investments away	EU including EIB intends to modify investments' eligibility criteria and to finance CE	

Type of instruments		Rationale	Tools / instruments	Scope of instruments and comments
		from investments in end-of-pipe waste infrastructures into such innovative business models: “Shifting the focus of waste management funds from waste incineration to closing material loops will financially push the implementation of the circular economy.” (European Commission, 2015).	projects instead of waste management infrastructure	

The aforementioned list of tools is general and not all of them can be applied for the particular value chain and in the current conditions in Serbia. There are special prerequisites in order that they become effective (legal framework and infrastructure prerequisites – see chapter no.0).

Following the creation of the necessary legal substratum and the implementation of the necessary infrastructure, the most relevant (for the current situation in Serbia) policy tools are the support for the SMEs and the promotion of innovative business models via the use of CE funds of various donors (see paragraph 5.6 and chapter 6). Finally, the use of tools for the creation of competitive advantages to companies that have adopted CE principles should be considered during this stage (Green Public Procurement, promotion of circular economy-certified companies).

1.5. Benefits for the Public of using food waste

The main benefits of reuse, recovery and recycling of food waste are the following:

- Lower quantities disposed at the landfill, thus generating lower operational costs and longer life time of landfills as well as lower greenhouse gas emissions
- Production of safe and sanitised composting material, contributing to improvement of agriculture & land management methods (e.g. use natural fertilisers and less water use)
- CO₂ friendly energy production through biogas
- Full implementation of EU waste hierarchy (prevention, food banks, feed, industrial resource, AD, composting, renewable energy, incineration, landfill)
- Potential resource efficiency gains
- Potentially positive impact on land use requirements for food provision and biodiversity
- Substitute high impact products
- Reduce waste throughout supply chain

1.6. Circular Economy and Value Chain terminology used in the guideline

Waste streams

Waste is defined as any substance or object, which the holder discards, or intends, or is required to discard.

Value Chains can be defined as 1. The sequence of related business activities from the provision of specific inputs for a particular product or product range to primary production, transformation and marketing, up to the final sale of the particular product to the consumer, and 2. The set of enterprises that perform these business activities, i.e. the producers, processors, traders and distributors of the particular product. Enterprises are linked by a series of business transactions by which the product is passed on from primary producers to consumers in end markets.

Animal waste - animal by-products not intended for human consumption, whole bodies or parts of bodies from animals

Biodegradable waste means any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard,¹

Bio-waste means biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from food processing plants,

Construction and demolition waste - waste resulting from construction or dismantling of buildings, roads and other civil or industrial structures, which is not classified as hazardous waste,

Green Waste – waste from plants

Household waste - waste from domestic activities that belongs to classes 15.01 and 20 of the European Waste List,

HORECA food waste – food waste originating from Hotels, Restaurants and Catering/Cafes.

Hazardous waste – generic name for waste, which falls in the category of waste defined as hazardous and/or has at least one constituent or a property which is dangerous,

Household Hazardous waste – waste from households, which is hazardous.

Inert waste – waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn, or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the eco-toxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater;

Municipal waste – waste from households, as well as other waste sources which, because of its nature or composition, is similar to waste from households,

Packaging waste - any packaging or packaging materials that meet the definition of waste,

Recyclable waste - waste that may be material in a production process for obtaining the original or for other purposes,

Similar Waste from industry, trade, business or public administration, with composition and properties similar to household waste which is collected, transported, processed and stored jointly,

Solid Waste - components from domestic or industrial activities, which have no value or applicability for user, and are collected to be handed by the sanitation service operator,

¹ It is noted that biodegradable waste stream is wider than the bio-waste of the WFD. It further includes paper, cardboard, wood, textiles, etc.

Special waste - waste, whose handling, collection, transport and storage are subject to a regime governed by legal acts in order to avoid adverse effects on human health, property and the environment,

Street waste - waste from the daily activity of the population on green spaces, from animals, from the filing of solids from the atmosphere,

WEEE - Waste Electrical and Electronic Equipment.

Products

Compost - the product resulting from the fermentation and aerobic/anaerobic processes or by microbial decomposition of organic component of waste.

Waste Management and Waste Operators

Public sanitation system - all the technological facilities, equipment and specific function facilities, construction and related land through which the service sanitation operates.

Waste management – collection, transport, recovery and disposal of waste, including the **supervision** of such operations and the **aftercare** of disposal sites, and including **actions taken** as a dealer or broker.

Broker - any undertaking arranging the recovery or disposal of waste on behalf of others, including such brokers who do not take physical possession of the waste.

Dealer - any undertaking which acts in the role of principal to purchase and subsequently sell waste, including such dealers who do not take physical possession of the waste.

Holder - the producer of the waste, or the natural or legal person who is in possession of it.

Operator - the natural or legal person responsible for a landfill in accordance with the **internal** legislation of the country where the landfill is located; this person may be in charge from the preparation to the after-care phase.

Producer of waste - anyone whose activities produce waste (original waste producer) or anyone who carries out pre-processing, mixing or other operations resulting in a change in the nature or composition of this waste.

Performance of Service

Performance indicators - parameters of sanitation service operations, which set minimum levels of quality and which track operator performance to license conditions.

Service level - the waste must meet the level of users, the performance indicators approved by the local councils or, where appropriate, community development associations, based on performance indicators of the framework Regulation.

Facilities

Landfill - final disposal site for waste storage on the ground or underground.

Transfer Station - space specially arranged for temporary storage of waste collected from the same locality or in different localities in order to transport them to a central MRF, Pre-treatment facility, Incinerator, or a sanitary landfill.

Green Collection Points / Green Disposal Point – a bring to point space specially arranged for the temporary storage of waste fractions collected from households of in order to transport them a central MRF, Incinerator, or a sanitary landfill.

A Civic Amenity Site or household waste recycling centre is a facility where the public can dispose of recyclable materials, hazardous waste, and bulky waste. Civic amenity sites are run by the local authority in a given area. Collection points for recyclable waste such as green waste, metals, glass and other waste types are available. The site is staffed with trained personnel, who can guide and monitor visitors behaviour. In Denmark, Sweden and Germany waste may be sorted into more than 20 different factions.

Activities

Collection - the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport to a waste treatment facility.

Separate collection - the collection where a waste stream is kept separately (ideally already at the source) by type and nature so as to facilitate a specific treatment.

Recovery - any waste management operation that diverts a waste material from the waste stream, which results in a certain product with a potential economic or ecological benefit. Recovery mainly refers to the following operations:

- Material recovery, i.e. recycling;
- Energy recovery, i.e. re-use as fuel;
- Biological recovery, e.g. composting; and
- Re-use.

Disposal - any waste management operation serving or carrying out the final treatment and safe disposal of waste:

Circular Economy:

is an economic system aimed at minimising waste and making the most of resources. In a circular system resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing energy and material loops; this can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling.

This regenerative approach is in contrast to the traditional linear economy, which has a 'take, make, dispose' model of production. The circular economy is not in contrast with the concept of economic growth, e.g. the same “output” can be achieved with less primary resources.

Nutrients:

In this definition, the distinction between the types of flows (technological or biological) is significant. According to Aldersgate (2012) “A circular economy is a restorative industrial economy in which materials flows are of two types: biological nutrients, designed to re-enter the biosphere safely, and technical nutrients (non-biological materials), which are designed to circulate at high quality, with their economic value preserved or enhanced”.

2. Existing Value Chain

2.1. Organic waste in Serbia

In 2015, Serbia produced 1.840.000 tonnes of municipal solid waste, whereas its population was 7.095.383 (Eurostat 2017).

As it is stated in the majority of the studies and articles used as references in the present report, data regarding SWM management in Serbia are very scarce. The most cited study which has been used for the estimation of the waste composition in Serbia (e.g. UNECE, 2015, Nicolic, 2012, Vemic, 2014, EEA, 2018) is the one elaborated by the Faculty of Technical Sciences in Novi Sad, Department of Environmental Engineering under the title: “Determining the Composition of the waste and the Amount Assessments in order to Define the Strategy of Managing Secondary Raw Materials as Part of the Sustainable Development of the Republic of Serbia” in 2009.

According to the paper of Vemić et al. (2014), “the results of the project indicate that the organic waste (garden waste, “other biodegradable waste” and paper) makes about 50% of the morphological composition of the waste in the Republic of Serbia.” In the total weight of the waste, the so-called “other biodegradable waste” is represented by 31,0%. The “other biodegradable waste” includes the remains of food (all kinds of bread, meat, vegetables), dead animals and animal organs.

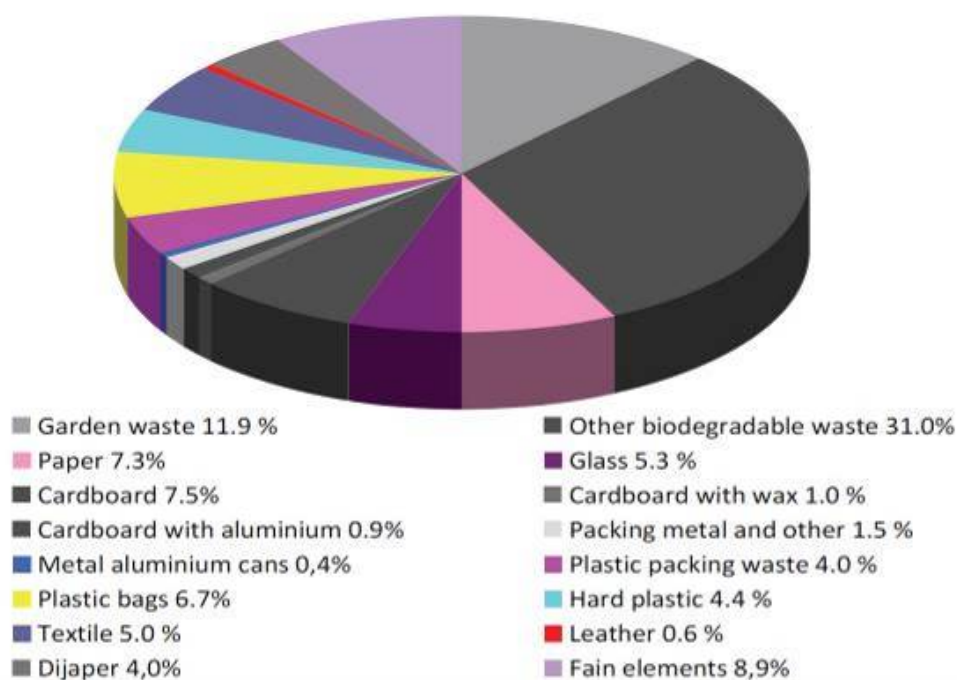


Figure 6: Waste composition in Serbia (Data from FTS-UNS, 2009, Table in Serbian from Statistical Office of the Republic of Serbia 2012, Table in English from Vemic et al. 2012)

Currently, most of the biodegradable waste in Serbia is being landfilled according to the recent published reports (CEVES, 2019, SeSWA, 2018). Moreover, sporadic attempts have been recorded for the utilisation of specific streams of discarded biodegradable materials. These attempts are being reflected in the legislation with the amendments on the “Law on the waste management” (initially issued in 2009 and amended in 2010 and in 2016). A relevant amendment is the definition of waste, and more specifically the exclusion from the definition of waste of the straws or animal waste that can be used for energy production (Kovačević 2013). Extensive work has been done by GIZ on the issue of biomass and biogas production (Živković et al. 2014, Wieser and Milijic, 2017). A full list of studies here: <http://www.bioenergy-serbia.rs/index.php/en/publications>.

Regarding agricultural waste specifically, according to a report (Building-Z, 2014), it is used as soil fertilizer, some of it for cattle farming, and an extremely small amount, approx. 2%, is used as fuel for producing heat and electricity. Unfortunately, the practice of burning biomass at the field of production is still common. The last practice is confirmed also by many of the experts interviewed.

In the same manner, special attention is given (especially in the framework of the DKTI project) on the launching of foodbanks in order to reduce the produced food waste. Food, safe for human consumption and according to the standards specified in the legislation, could be donated to food banks so that it does not become waste. According to CEVES (2019), currently only a small amount of food is donated to food banks, whereas another small amount is used for biogas production (and eventually electricity generation and district heating) and composting.

As part of the wider grouping of biodegradable waste, HORECA waste, is currently being diverted from landfilling in the following ways:

Donations to food banks: Approximately 1.200 tonnes of food (mostly fruit, vegetables, and juice, plus some pre-packed frozen food) in 2017 was sent to food banks (Banka Hrane, 2018). This amount was mainly donated by retailers. The CEVES (2019) report estimates that 34 tonnes of food from HORECA are donated annually, as Banka Hrane started only recently collecting food from the HORECA sector. Belgrade Food Bank (BFB, Banka Hrane Beograd) is a humanitarian, non-governmental, non-profit organisation founded in Serbia in late 2006 with the aim to diminish poverty and to take part in fight against hunger and food waste. Since 2009, BFB is the member of FEBA (European Federation of Food Banks), the only large-scale organisation operating to link surplus food demand and request. FEBA estimates that it is possible to feed about 10.000 people and save food from being discarded and that the value of saved food amounts to about 1.150.000 Euro per year (Serbian MoEP et al., 2018).

Utilisation as animal feed: Kitchen waste intended for the production of animal feed, biogas and compost production or processing in processing facilities (Rendering facilities) is regulated by veterinary regulations of Serbia in the field of animal by-products. Based on these regulations, this material is classified as Category 3 “animal by-products”. However, under the present guideline the boundary of wasted and non-wasted food is set with regards to the suitability for human consumption.

According to Veterinary Directorate (2020), the use of this waste for animal nutrition currently is limited. This type of waste or products derived from it may be used only for feeding fur animals and for the consumption of animals in exceptional cases (wildlife feeders). This can be done only upon obtaining a license from the Ministry of Agriculture, Forestry and Water Management.

According to the Building-Z (2014) report, some of the agricultural waste is used for cattle farming, but there is no clear estimation of the quantities. There is no specific law on animal feed, but the issue is covered by the Law on Veterinary Matters and the Law on Food Safety (EC, 2014). Serbian Law on Veterinary Matters prohibits the use of food waste for animal feed for the fear of transmission of diseases from the meat residues (articles 110 and 111).

The only exception stated explicitly is the food waste that has undergone thermal treatment. Not mentioned are specific streams of biodegradable waste from plantations/vegetable farms that do not pose the same dangers as food waste from HORECA. As the origin and the quality of such a raw material can be verified easily, it is a common practice in Serbia that these farms give their by-products (which are technically food waste) to animal farms. No estimation of these quantities is available, as this practice takes place directly between private companies and is not overseen by the state.

The use of insects and co-processes them with biomass. The amount of HORECA waste thus treated reaches 200 tonnes annually (ESOTRON, 2019). In general, only an extremely small amount from agricultural waste (approximately 2%) is used to produce biogas and then biogas is used as fuel for producing heat and electricity (Building-Z, 2014).

Composting: In terms of the treatment of biodegradable waste, only composting is represented to a certain extent, but at a very low level, although the share of organic fractions in the municipal waste is the largest. Only in some municipalities there are examples of pilot projects of biological treatment. Green Waste (trimmings / pruning of plants in public parks) is collected by the PUCs responsible. According to estimates, the amount of municipal waste currently composted in the three regions of the regional Waste

Management plans (Krucevac, Lapovo and Novi Sad) does not exceed 1% of the total generated quantity. Another form of composting in the municipalities of the region is home composting, mostly from rural areas, using the most basic techniques of biological waste disposal. Some examples of biodegradable waste composting are e.g.:

- Burying vegetable and home biodegradable waste in the fields;
- Stockpiling of stable fertilizers (piles are not turned, but after a few years, the compost fertilizer is used to improve the land).

In terms of food waste composting, CEVES (2019) reports that approximately 180 tonnes per year is composted nationwide and 135 tonnes/year of compost are being sold. Other sources claim that the compost produced from waste is not sold but given away (ESOTRON, 2019). In either case, the quantity of biodegradable waste treated is negligible.

Finally, the practice of **burning biomass** at the field of production as well as **illegal dumping/fly tipping** is still widespread.

On the following page, a conceptual diagram of the current value chain for food waste in Serbia is presented (Figure 7) based on the data included in CEVES (2019) reports. The current food VC is linear, since only an almost negligible fraction of food waste is being diverted from landfilling via energy recovery, composting and food donations. The chain begins from agricultural production, continues to food manufacturers and HORECA's and then it is consumed. From that point on, via the PUC's or private collection companies the food waste is collected and lead into the landfills which are owned by the municipalities.

In order to change the picture and move towards a more circular model, the VC presented in the subsequent figure should be established (Figure 8). More specifically, in this VC we have two major points of diversion from landfilling: one immediately after the consumption which entails the collection of food by non-state entities (such as charities in the case of food donations or private companies for the case of animal feed) and one after the discard of food waste to the communal bins, where it is collected and handed over to composting plants of energy production facilities.

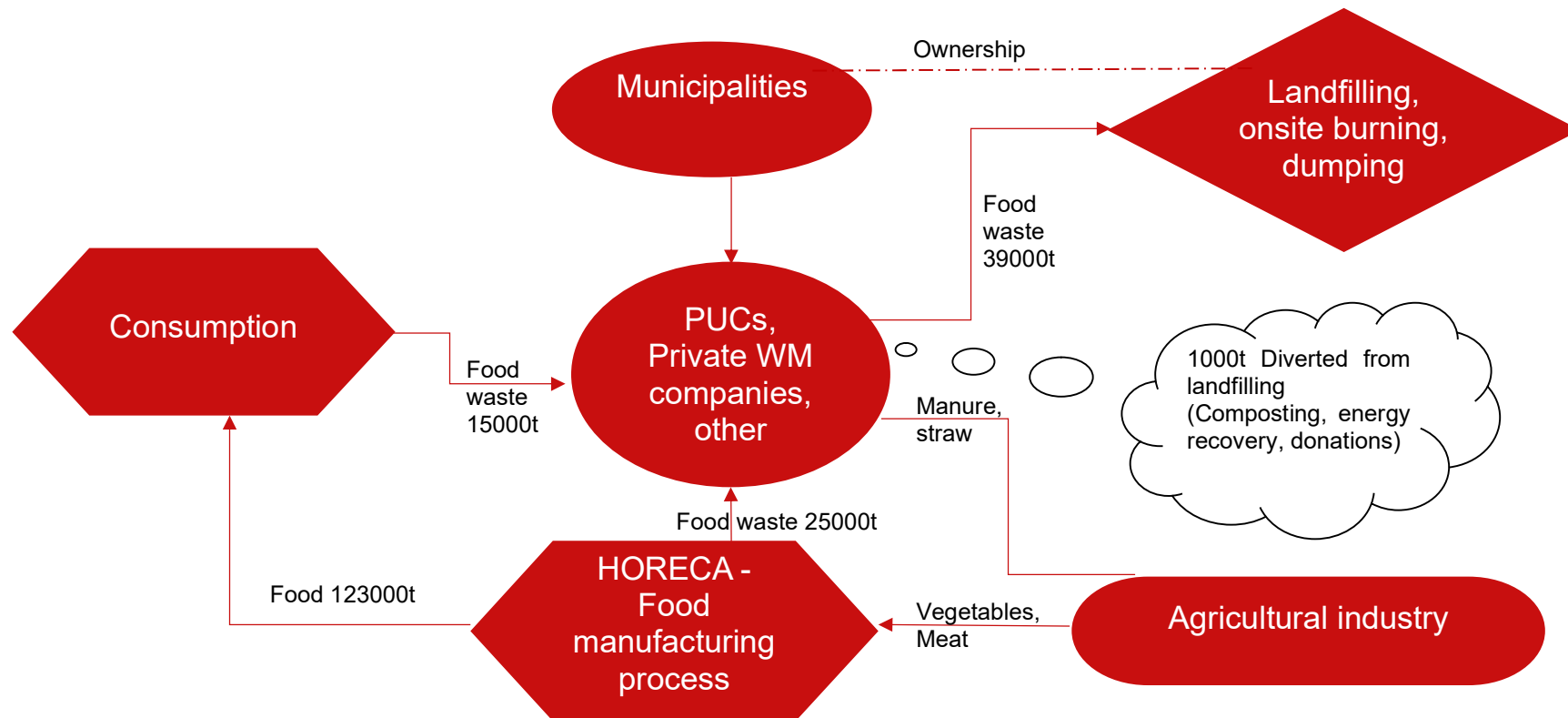


Figure 7: Current Value Chain for food waste in Serbia

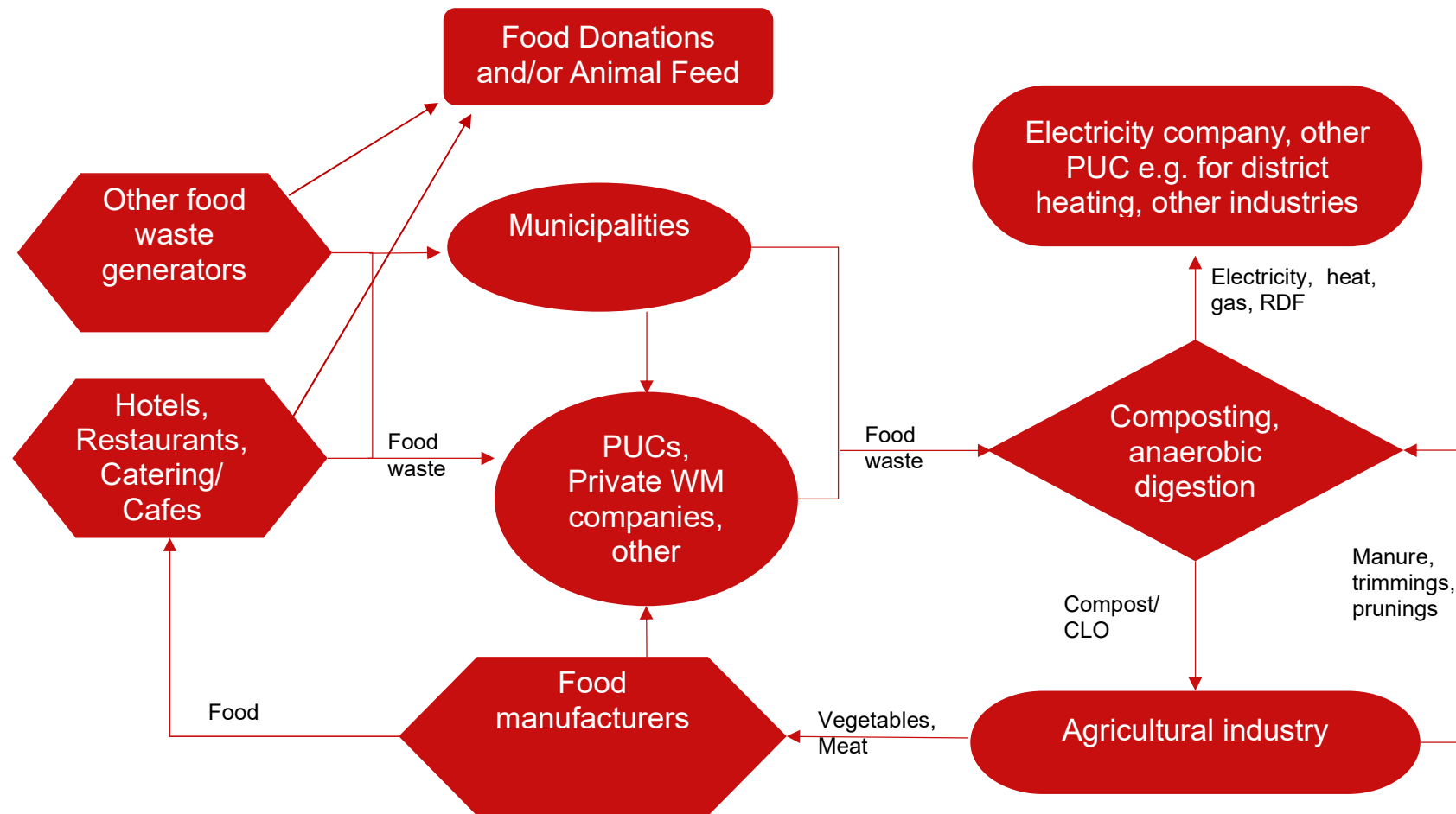


Figure 8: Proposed (future) Value Chain for food waste in Serbia according to CE principles

2.2. Identification of actors

The actors at the different levels of the value chain can be grouped in the following broad categories:

1. State entities or other nationwide organisations such as Ministry of Environmental Protection, the Chamber of Commerce, SEPA (Serbian Environmental Protection Agency), SeSWA (Serbian Solid Waste Association) that can play a central role in the coordination of activities and the enhancement of the regulatory and institutional framework;
2. Public Utility Companies (PUCs), municipalities and other state entities responsible for collecting and transferring the generated waste. They have a central role in the collection and handling the food waste, especially in case it is collected separately. Also the collection methods play significant role in the quality of the waste as SRM. It has to be noted here that the role of municipalities is very crucial for the reduction of food waste by organizing networks for food donation and redistribution;
3. Private companies either transferring or treating SWM (such as biomass treatment, compost or fuel production). This category includes also the companies handling special streams of waste (e.g. used cooking oils) or collect/treat biomass for fuel production;
4. Civil society of Serbia: charities, development NGOs, community groups, women's organisations, faith-based organisations, professional associations, trade unions, social movements, coalitions and advocacy groups. These organisations are central for the success of informational campaigns, as well as the organisation of food donations and in general the promotion of CE practices;
5. Producers of HORECA waste: this category includes all the producers in the various parts of food production and distribution in HORECA sector (Hotels, Restaurants/Cafes, Catering companies). This category includes also the suppliers of food to the HORECA companies, as they influence significantly the production of waste in the subsequent levels until the food is served to the consumers. For example, precooked food and packaged food producers determine the size of the rations served or provide packaging that could possibly ensure subsequent food donations or reuse of wasted food as animal feed;
6. Informal sector: As it is confirmed by the findings of a thorough study on the informal sector of Serbia conducted by GIZ (GIZ, 2018), informal collectors of secondary raw materials have been the base of the recycling pyramid in Serbia for decades. The informal collectors, “sakupljači”, are responsible for collection of most secondary raw materials collected and processed in Serbia. Data processed by the Association of Packaging Waste Recyclers indicates that out of the total amount of packaging waste collected for recycling, as much as 87% originates from the informal sector, while only 13% is collected by PUCs, or the packaging schemes directly. Since at the present time no income can be generated by the collection of food waste, the IS does not play a role but after the bases are set, any transition to Circular Economy in HORECA sector will potentially include it.

2.3. Barriers to Circular Economy

In order to realise the potential which has been identified by the various studies and activities elaborated for the promotion of CE practices, the existing barriers must be removed or at least mitigated.

Circular Economy needs investments both in training the actors and the general public, as well as in infrastructure. As it is stated in a GIZ report (2017), a major consequence of the economic recession from 2008 included significantly less funds allocated for environmental improvements as well as for research and development in the environmental technologies sector. The economic factor - low GDP level is mentioned as the basic barrier for any kind of SWM-related activity (Vujić and Tot, 2020) – will define the boundaries of possible interventions towards a more circular model in Serbia. Although significant steps have been done for the amelioration of the financial situation with a steady increase of the GDP during the last years, it is estimated that this aspect will remain the basic barrier during the next few years..

The barriers can be summarized as follows:

- Insufficient SWM regulatory framework in Serbia. The situation becomes even worse if the focus moves to specific value chains such as the HORECA food. The lack of drivers for the reduction of food waste production or the separate collection of the particular stream, forms one of the most important barriers for the development of a more circular VC in Serbia. Special mention has to be made to the lack of specifications in Serbian legislation, for the implementation of various methods for handling food waste separately (e.g. treatment for use as animal feed, definitions regarding the operation of food banks).
- Inefficient waste management practices. Currently, SWM collection system does not include source separation schemes. For this reason the collection of waste does not ensure high quality materials that could effectively be used as secondary raw materials.
- Lack of central coordination of the attempts for the transition to CE-based model;
- Institutional deficiencies for the enforcement of necessary measures required for this transition;
- Lack of human resources in order to monitor the implementation of existing environmental and especially waste legislation.
- Insufficient investment in separate collection and recycling infrastructure (e.g. no composting plant were found to operate during the development of the guideline);
- Inadequate access to finance for SMEs due to the financing conditions, as well as the insufficient investment readiness and underdeveloped financial mechanisms adapted to small and young enterprises; Limited funding to finance renovation and modernisation of the technology and machinery of Serbian enterprises;
- The resource pricing (cost recovery and pricing for the resource itself) is volatile and not fully transparent, which can lead to distorted economic signals;
- Insufficient infrastructure for waste treatment provided by the market or the state;
- High uncertainty regarding the quality of the food waste as Secondary Raw Material (SRM);
- Lack of market coordination, especially for industrial waste that could potentially be used as secondary resource but is generated in various companies across the country and without an improved market and necessary bundling, doesn't justify investments into specific treatment technologies.
- Current laws and regulations are not yet fully harmonised with the EU circular economy package;
- The national strategies, which serve as the framework for the development of laws and regulations, have not been updated and are not in compliance with the goals of circular economy;
- High share of informal recycling especially for valuable waste streams;
- Insufficient use of economic instruments;
- Lack of sustainable procurement incentives for public authorities;
- Lack of knowledge and experience of the municipalities or regional authorities on best practices and implementation of the circular economy model;
- Lack of consumer information on origins of products (information on origins of products might for instance drive people to buy local products or products made from recycled materials);

Although the reduction of produced HORECA food waste does not fall directly under the scope of this guideline, this approach will have to be an integral part of any proposed model for the transition to CE, therefore barriers relevant to the reduction of food waste will be mentioned. Based on the report “Case Studies for Waste Prevention” (Serbian MoEP et al., 2018), the following barriers for food donation have been identified:

- Need to comply with food safety regulations and standards and the possibility of donors' liability in case of accidents or damages to persons deriving from food donations. Suitability of surplus food for food donation purposes can be affected by a variety of reasons, including; the labelling on expiring/ best before date; the methods of conservation and transport of the food; the exposition to the public (e.g. food from catering services); the safety of damaged packaging, etc.
- Lack of capacity and infrastructure to collect and redistribute food: redistribution of surplus food requires a considerable amount of resources in order to pick up and properly store the food, transport it to the distribution centres and hand it out to people. Many of the food distribution associations are NGOs or charity associations, with very limited budget and human resources and relying on volunteers to carry out their work
- At the moment, there is no specific law on food donation. Food donation activities, therefore, need to refer to the current law on food safety. The inclusion in the law of at least one subsection on food donations would be envisaged.
- According to the current Serbian law on food safety, many food products cannot be donated.
- Food banks, as FEBA, are not legally recognized (at the moment, they are classified as NGOs). No budget is currently dedicated to food banks as part of the government budget, i.e. for the implementation of dedicated projects. The whole process for food donation is not specifically regulated.
- Currently, a regular VAT tax is applied to food donations, which obviously hampers the willingness of food operators to donate surplus food.

The European Environmental Agency (2019), presented useful results of two surveys regarding the integration of circularity principles in business process; one conducted by Eurobarometer (TNS Political & Social, 2018) and the other by the World Business Council on Sustainable Development (WBCSD, 2018). The surveys' results show that large companies integrate more circularity actions than the smaller ones, and that the majority of companies reported that they took action in waste minimizing, but only few of them took actions regarding to materials circularity and modification of the products' design to improve reuse, repair or maintenance (see Table 3 and Figure 9)

Table 3: SMEs and large companies actions related to circularity, based on a Eurobarometer survey, 2017 (Source: TNS Political & Social, 2018)

Action	SMEs	Large companies
Minimise waste	65%	80%
Reuse waste within the company	42%	59%
Improve design for maintenance, repair or reuse	25%	27%
Sell scrap materials to other companies	21%	30%

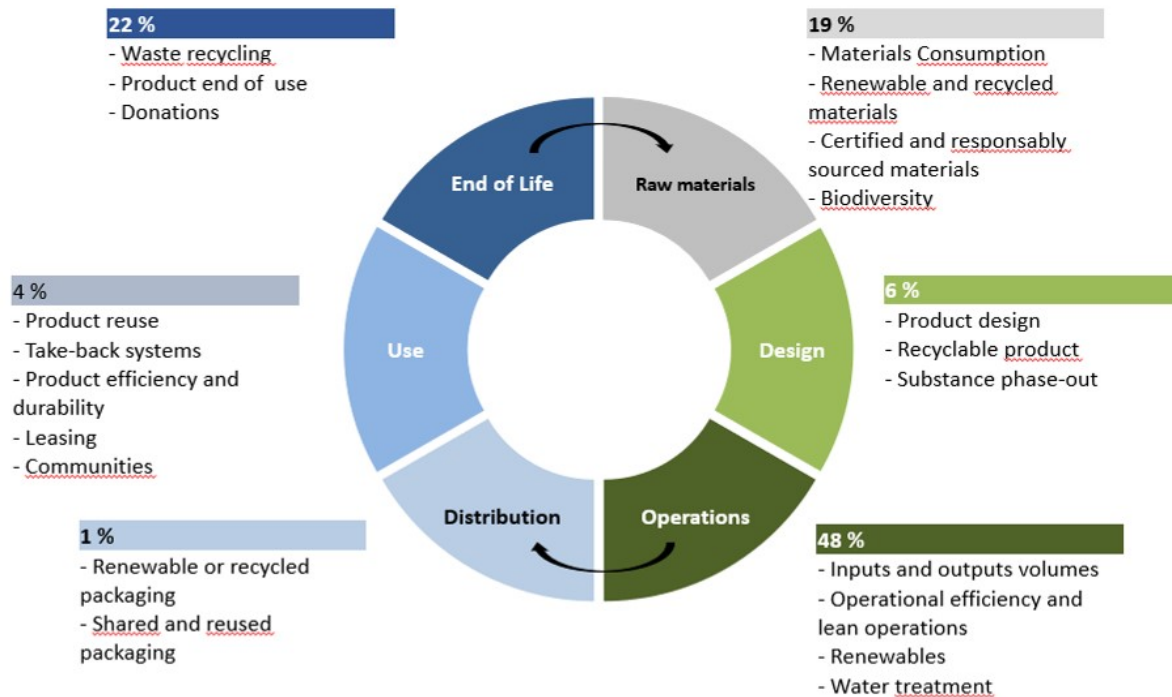


Figure 9: Overview of circularity metrics used by companies – results from WBCSD survey
(Source: (European Environment Agency, 2019))

The results of these surveys show that, despite the discussion and the policy debate done on the EU level about circular economy, there are barriers for companies to take circularity actions in their business process. According to the Eurobarometer survey, these barriers are mainly at operational level like complex administrative or legal procedures, the cost of meeting regulations or standards, and difficulties in accessing finance. However, more in-depth stakeholder analyses have revealed that the most prominent obstacles are corporate culture, market factors and system complexity.

A research regarding the barriers to the circular economy (Kirchherr et al., 2018) identified the main barriers and negative chain reactions for companies in the transition process to CE. The work done shows that cultural barriers and particularly: “Lacking consumer awareness and interest” and “Hesitant company culture” (see Figure 10), are the main barriers for a company to move forward and to adopt a CE concept in its operations. The author names that these barriers make transition to CE as a “difficult-to-implement” concept as it cannot bring direct and quick benefits to the company. Another category of barriers that slow down the transition to CE are the market barriers. More specifically the “Low virgin material prices” favours the linear type of production and “High upfront investment costs” make the companies reluctant to modify their current process.

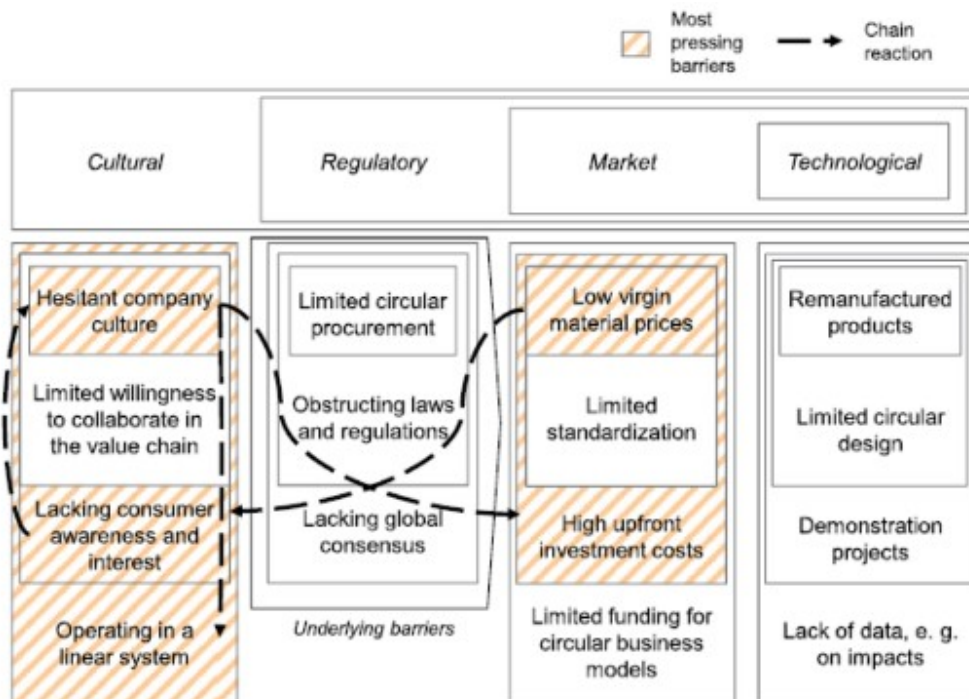


Figure 10: Main CE barriers and their interaction (Kirchherr et al., 2018)

The study also identifies the chain reactions between barriers that can lead to CE failure. For instance, “Low virgin materials prices” can cost the market position of the company in the market leading to “Hesitant company culture” barrier to the adoption of CE business models and the company continues “Operating in a linear system”. Interestingly, according to the conclusion of this research the technological barriers were not considered as serious barriers from the examined companies for their transition to CE.

These results create a totally new field for companies that they want to move forward and to make a real transition to CE. The changes that companies must make are deep, getting in touch even with the foundations of their organisations (and sometimes of their existence) i.e. their business culture and perception. Governments that want to motivate and support this transition must adopt policies and make the necessary real and practical interventions that will enable companies to achieve circularity in their processes, e.g. reduced taxation for CE activities (remanufacturing, reparation etc) or for CE supporting activities like transportation of SRMs etc. Kirchherr et al. (Kirchherr et al., 2018), expressed the opinion that current governmental interventions regarding the CE may be ineffective since many of them are focused to overcome the technological barriers that according to their research and the surveyed companies they are not considered as barriers to the CE. To support this argument, the study mentions the example that European Commission funds a number of proposals in the “Horizon 2020 Work Programme from 2018 to 2020” that focus on the engineering and technological aspects.

3. Business potential for food waste utilisation

3.1. Baseline Considerations

The reduction of food waste through the implementation of circular economy principles in the upstream supply chain (via manufacturing and wholesale) can produce significant savings (reduction of the cost of handling and transfer, less raw materials required, more effective use of materials).

For any remaining food waste that is unavoidable in Serbia, significant value can be achieved by the utilisation of waste for material (compost, RDF) and energy production (biogas). The food waste hierarchy includes:

- prevention of food waste;
- use in food banks;
- processing for food applications;
- use as animal feed;
- use as an industrial resource such as for compost production and biogas production.

No large composting or anaerobic digestion plants at a municipal level, are operating in Serbia yet. Only private biogas production plants (from biomass) have been constructed by private companies. However, the targets set by Serbian legislation for the diversion from landfilling are far from being achieved.

National targets regarding Landfill Directive are as follows: for Serbia 2022, 2026 and 2030 are proposed years to meet corresponding targets according to the Landfill Directive, i.e. to divert from landfill minimum 25%, 50% and 65% of the total amount of biodegradable waste generated in reference year. Organic waste, as well as wastewater from industries or households, and food waste, is used to extract energy using anaerobic digestion (biogas).

As far as biogas production is concerned, GIZ (2017) lists the following installations:

Table 4: Biogas Plants in Serbia (Source: GIZ 2017)

Plant	P(MW el)
Operating	
Dairy Lazar, Blace	1,00
Mirotin Energy, Vrbas (biogas)	1,50
Global Seed, Curug (biogas)	0,60
Under Construction	
Biogas Energy, Alibunar	3,60
BGS, Bac	1,30
Forkom, Aleksinac	0,30
Bioelektra, Botos	0,60

A study from CEVES (2019) commissioned by GIZ, identified considerable business potential in the HORECA waste sector. According to this study, approximately 40.000 tonnes of food waste is generated in Serbia every year. 99% of this waste is currently landfilled without any treatment. In three scenarios the food waste generation increases up to 77.000 tonnes per year and the landfilling rate drops to 80%, 60% and 40% respectively.

The Study assumed that there are two possible ways to cope with food waste in its optimistic scenario (T3):

- Donation to food banks

CEVES assumes that up to 12,2 million meals (6.100 tonnes) per year can be donated to food banks and thus not become food waste.

- Reuse of remaining food waste

CEVES further calculates that up to 46.200 tonnes per year can be reused through better collection and a lower landfilling rate, dropping to 40% in 2030. This scenario is the only one complying with EU regulations. This quantity is used in equal proportions for (i) biogas production and (ii) composting.

Under these assumptions the following CE impact in the HORECA sector has been identified:

Table 5: Business Potential acc. to CEVES (scenario 3), (2019)

Action	Number of Jobs (n)	Gross Added Value (million EUR cumulative until 2030)
Biogas	500	24,0
Composting	500	30,0

After numerous investigations and discussion with stakeholders it can be assumed that the mix for reuse would in effect be changed, namely to 80% of the reuse going to biogas production and 20% to composting. This is due to the assumption that on the one hand there is a considerable potential for renewable energy and biogas production by the private companies active in biogas production and on the other, the market potential for compost seems to be quite limited due to the soil conditions and agricultural practices in Serbia. Thus, the need for the use of compost as fertilizer seems not to have a widespread business potential.

3.2. Business Rationale for the Food Waste Value Chain

The rationale for application of a value chain for residual, unavoidable food waste comprising (i) biogas production and (ii) composting, and the arising business potential and opportunities has been assessed using four criteria:

- Economic criteria
 - National/international market demand prospects
 - Comparative advantages of production
 - Opportunities for employment creation
- Social criteria
 - Inclusion of disadvantaged groups
 - Need to improve working conditions
 - Impact of the VC on surrounding communities
- Environmental criteria
 - Impact of the VC on the environment
 - Impact of the environment on the VC
 - “Green” opportunities
- Institutional criteria
 - National policy priorities
 - Needs for public investment/new laws

Project “Climate Sensitive Waste Management (DKTI)”

- Evidence of own initiatives of VC actors
- Synergies with other programmes
- Feasibility and outreach of interventions

The results of this assessment for biogas production and composting are shown in the tables below:

Table 6: VC Criteria Assessment - Biogas and Coposting

Criterion	Fulfilment*	Remark	Fulfilment*	Remark
Economic criteria		Biogas		Composting
National/international market demand prospects	XXX	The demand for clean energy is high and will remain high; thus there is market for biogas.	X	The demand for compost from food waste is limited in Serbia; there is a relative abundance of fertile land and fertilisers are widely available on the market..
Comparative advantages of production	XX	The market is guaranteed and supported by the Feed-In-Tariff. This means that there is a competitive advantage in respect to other forms of energy production.	X	The market for conventional fertilisers is well developed and competitive. The comparative advantage of compost from food waste is limited.
Opportunities for employment creation	XXX	The CEVES has shown that up to 600 jobs can be created by the introduction of CE principles.	XXX	The CEVES has shown that up to 600 jobs can be created by the introduction of CE principles.
Social criteria				
Inclusion of disadvantaged groups	X	Disadvantaged groups can be included esp. in the collection of food waste.	X	Disadvantaged groups can be included esp. in the collection of food waste.
Need to improve working conditions	XX	Currently informal waste pickers and transporters often work under bad working conditions. Health and safety requirements are often not met.	XX	Currently informal waste pickers and transporters often work under bad working conditions. Health and safety requirements are often not met.
Impact of the VC on surrounding communities	XX	The separate collection of food waste can reduce the waste quantities in surrounding communities.	XX	The separate collection of food waste can reduce the waste quantities in surrounding communities.
Environmental criteria				
Impact of the VC on the environment	XXX	The production of biogas is CO ₂ neutral and has thus a positive impact on the environment. Further it can substitute other, non renewable forms of energy generation.	X	The production of compost is not CO ₂ neutral (see CEVES (2017)). Increased CO ₂ emissions reduce the environmental benefits in this solution.
Impact of the environment on the VC	X	This impact is limited.	X	This impact is limited.
“Green” opportunities	XXX	The application of the CE principles provides many green opportunities, for	XX	The application of the CE principles provides some green opportunities, for

Criterion	Fulfilment*	Remark	Fulfilment*	Remark
		instance in clean energy production and environmentally clean energy supply.		instance in clean fertiliser for agricultural use.
Institutional criteria				
National policy priorities	XXX	The increase of the share of renewable energy and the reduction of waste generation and esp. waste deposited at landfills is fully in line with national and EU policy priorities and requirements.	XX	Agriculture and food production is an important industry for Serbia. Hence, innovative and „green“ agricultural approaches are in the interest of the country. Also the market for organic food is growing.
Needs for public investment/new laws	XXX	Currently, public investment is limited. Hence there is a need for more public engagement, esp. in the separated collection of unavoidable food waste.	XX	Currently, public investment is limited. Hence there is a need for more public engagement, esp. in the separated collection of unavoidable food waste.
Evidence of own initiatives of VC actors	XX	There are already certain companies active in the biogas sector; also some private initiatives for the separated collection of unavoidable food waste are already ongoing.	X	Public and/or private composting plants using organic waste are still quite limited in Serbia.
Synergies with other programmes	XX	The renewable energy sector is closely interlinked with other sectors, in this case, specifically local PUCs for waste collection in the HORECA sector can benefit from demand for food waste.	XX	The composting sector is closely interlinked with other sectors, in this case, specifically local PUCs for waste collection in the HORECA sector can benefit from demand for food waste, esp. for the production of compost.
Feasibility and outreach of interventions	XXX	The production of biogas is an already well known and proved technology which is available in Serbia, so the feasibility of the intervention is given.	XXX	The production of compost from food waste is an already well known and proved technology which is available in Serbia, so the feasibility of the intervention is given.

* X: low fulfilment of criteria, XX: medium fulfilment of criteria, XXX: high fulfilment of criteria

3.3. Business Opportunities and Actors along the Value Chain for Food Waste

Along the identified Value Chain the following business opportunities and actors can be identified:

- Collection and transport of food waste

This includes the provision of options for the HORECA sector for the separation of food waste at the source by making available standardised collection bags and/or bins. Also, the collection can take place in public collection points designed for the delivery of food waste. In the next steps the organisation of transport to receiving facilities (biogas and composting plants) takes place. For this, logistic arrangements and necessary investments in trucks have to be implemented.

In principle this business opportunity is available for both, public and private entities, whereby the collection at the source (hotels, restaurants, catering) might be more attractive for the private sector and the collection at public collection points might be more adapted to the public sector, e.g. municipal PUCs.

- Production of Biogas and Compost

This includes planning and implantation of investments in the respective plants, equipment and other installations as well as the conclusion of off take contracts.

A graphic representation is shown below.

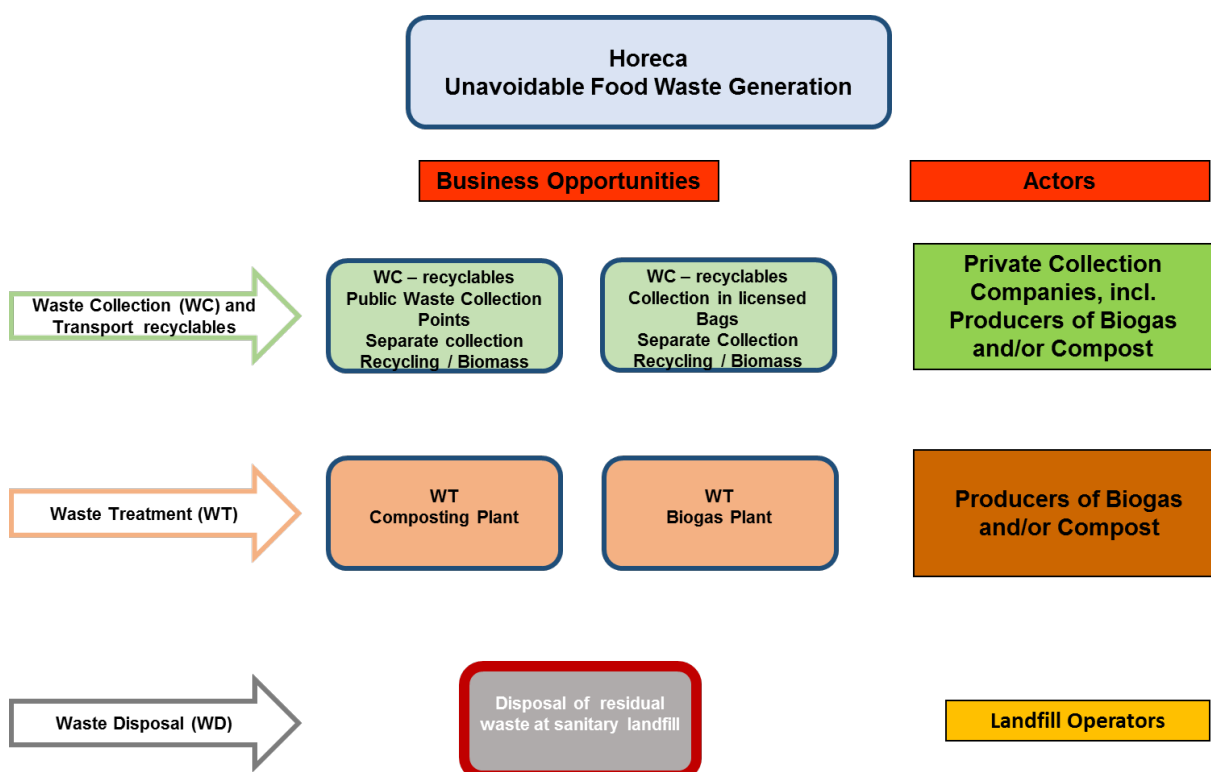


Figure 11: Food Waste Value Chain

In order to implement this value chain, the actors have to conclude several agreements, among others:

- Customer Service Contract between collectors/transporters and food waste generators
- Delivery Contract between collector/transporter and off taker of food waste (compost and/or biogas plant operators)
- Off take contract between biogas producer and biogas buyer

- Purchase contracts between compost producer and buyer

3.4. Business potential for collectors/processors of food waste

3.4.1. Collectors and transporters of food waste

In order to assess the business potential for collectors of food waste, the following assumptions are being made:

- No distinction is made between public and private solid waste collection companies.
- 60% of all food waste generated is used for biogas and/or composting, 40% is delivered to the landfill.
- According to CEVES (2019) HORECA food waste producers are willing to pay approx. EUR 203,00 per tonne of food waste delivered. This would be approx. EUR 9,378 million per year.
- Also, according to CEVES (2019), the fuel costs for transport amount to EUR 2,126 million and the wages for transport result in EUR 4,830 million per year.
- The investment in trucks and containers for separate collection is not included in this assessment. Further analysis and investigations are needed in regard to:
 - Existing transportation equipment and any shortages
 - Existing bins/containers for separate collection and any shortages

Estimates and model calculations are included in the Annex.

3.4.2. Processors of food waste

In order to assess the business potential for biogas and composting, a rough model calculation, using the optimistic scenario from CEVES (2019) has been carried out. The model calculations are included in the Annex.

The business potential for two streams can thus be estimated as follows:

- Biogas

Biogas is produced by anaerobic digestion. In this process, microorganisms break down organic materials, such as food scraps, manure, and sewage sludge, in the absence of oxygen. This process generates biogas (methane and carbon dioxide) and a solid residual. The solid residual can be applied on the land or composted and used as a soil amendment, while biogas can be used as a source of energy similar to natural gas.

CEVES uses the assumption that 1 kg of food waste contains 0,13 m³ of biogas (130 m³ per tonne) and that 1 m³ of biogas generates 2,85 kWh of energy. According to the methodology used by CEVES from 1 tonne of food waste 370 kWh (0,37 MWh) of energy can be generated. Using now a ratio of 80% use for biogas (approx. 36,7 million tonnes) this means that approx. 4,8 million m³ of biogas or 13.700 MWh can be produced per year. This corresponds to an installed capacity of approx. 2 MW.

Investment costs in biogas plants are in the range of approx. EUR 3.500 per kW (energypedia.info, suscon.org). For calculatory purposes only this would be approx. EUR 1,3 million per tonne of food waste.

Operating costs can be estimated at EUR 0,2 per m³ of gas (suscon.org), for calculatory purposes this would be EUR 1,53 per tonne of food waste. Yearly maintenance costs are assumed at 2% of the investment and depreciation at 5% per year.

- Composting

Composting implies a biological process during which naturally occurring microorganisms (e.g., bacteria and fungi), insects, snails, and earthworms, break down organic materials (such as leaves, grass clippings, garden debris, and certain food wastes) into a soil-like material called compost. Composting is a form of recycling, a natural way of returning biological nutrients to the soil. Compost can be used as a non-toxic ingredient in agricultural fertilizers.

CEVES (2019) uses the assumption that 1 kg of food waste contains 0,75 kg of compost (750 kg per tonne).

Investment costs in composting plants are in the range of approx. EUR 170,00 per tonne (Estimated/extrapolated from EU, 2001).

Operating costs can be estimated at EUR 40,00 per tonne of compost (Estimated / extrapolated from EU, 2001), with depreciation at 5% per year.

The realisation of this potential can happen also on a smaller scale and within smaller individual projects implemented by private and/or public companies.

3.4.3. Best practices cases

Best practices can be found in both food waste treatment and HORECA facilities that applied successfully programs towards minimization of food waste.

Food waste treatment best cases

Two best practice cases, one for biogas and one for composting are briefly presented below for illustrative purposes:

- Biogas - Vienna, Austria²

Food waste-to-energy is already applied on a large scale in Vienna, Austria. Vienna's first biogas treatment plant went into operation on 13.05. 2015. Based on a special chemical process, the new treatment facility turns Biogas produced from kitchen waste at the Simmering Biogas Plant into biomethane, which is distributed via the Vienna gas network. The facility processes approximately 22.000 tonnes of biogenic kitchen waste per year and has an annual output of over a million cubic metres of carbon-dioxide neutral biomethane. It provides eco-friendly energy for about 900 households in Vienna, avoiding over 3.000 tonnes of carbon dioxide.

Kitchen waste is mechanically processed and moistened to produce a suspension that subsequently undergoes a fermentation process. 1,7 million m³ of biogas with a methane content of up to 70% are produced every year. This goes directly into the local gas network.

- Composting – Cordoba, Spain³

Since 1993 waste has been separately collected in the city of Cordoba in different bins for citizens, HORECA, and all businesses which produce similar food waste (large waste produced are not included). SADECO manages MSW (including food waste) both from citizens and commercial (HORECA included). The waste collection is organized on a daily basis.

² <https://www.wien.gv.at/english/environment-leisure/vienna-biogas.html>

³

http://www.bin2grid.eu/documents/73603/136534/D2.1_Good+practice+on+segregated+collection+of+food+waste.pdf/6e83c282-dbbe-4753-8664-80a912e82c36

The Environmental Centre of Cordoba (CMC in Spanish) has a recycling-composting facility where SADECO, the municipal sanitary enterprise, treats the separately collected waste: organic waste (grey bins), and packaging and inert materials (yellow bins). SADECO is also in charge of the compost production. Waste is treated under aerobic conditions at the composting area. Once the composting process has been completed, the raw product is refined to remove all possible impurities. These impurities are removed through two processes: first one is with the usage of the sieve, and a second one requires a separator to obtain an ideal product for use in agriculture, forestry and gardening. The produced compost is of high quality and free of contaminants. Compost is well accepted by citizens under the brand name Compost SADECO. The annual production is around 25.000 tonnes.

Other success stories for composting are included in: https://ec.europa.eu/environment/waste/publications/pdf/compost_en.pdf.

Best business practices

A research implemented by the Food Loss + Waste Protocol in 1.200 business sites across 700 companies in 17 countries presented some successful business practices in the hotel and restaurants.

Hotels

Two successful practices in hotels are presented in https://www.flwprotocol.org/wp-content/uploads/2018/04/Report_Hotels_The-Business-Case-for-Reducing-Food-Loss-and-Waste.pdf

- Sofitel Bangkok Sukhumvit is a medium sized 5 stars hotel in Bangkok, Thailand which achieved 50% reduction in food waste in just 15 weeks, saving almost USD 60.000 per year.
- MGM Gold Strike Resort and Casino is located in Missisipi (USA) and serves more than 650.000 guests each year with different dining practices (buffet, on-demand meals etc.). Hotel management applied a food-waste reduction policy in the buffet and in 12 months achieved 80% decrease in food waste and 5% decrease in the food costs.

This was achieved in both aforementioned cases by the following measures:

- Weighing menu items to regulate portion size;
- Building food waste awareness into staff training;
- Holding daily chefs meetings to review what's being thrown away each day. Focus on high value items prepared in batches and identify where volumes can be reduced;
- Checking suppliers of perishables such as bread – see if on that is more flexible about order sizes can be found;
- Making the most of seasonality - using fruit that's in season, it costs less and it keeps for longer.

Restaurants

Two successful examples of food waste reduction in restaurants are presented in https://www.flwprotocol.org/wp-content/uploads/2019/02/Report_The-Business-Case-for-Reducing-Food-Loss-and-Waste_Restaurants.pdf

- The Ship Inn is a traditional pub near Barrow in Furness, Cumbria, in the UK. The restaurant's management noticed some routine plate waste from customers. They made gradual changes with the active participation of the staff and in a trial period of 4-weeks they achieved spoilage reduction of 84%, plate waste reduction by 67% resulted in a total waste reduction of 72%.
- IKEA has over 400 stores in 52 markets worldwide which are visited by 1 billion people per year. 660 million of them enjoy IKEA Food with an overall turnover of €2,15 billion and with 18.000 people working. In February 2015, four IKEA stores—two in the United Kingdom and two in the United States—started pilot programs for food waste reduction. The pilots were initially scheduled for three months but they were extended to six months to secure more reliable results. The pilot

program has an overall result of 23%–54% decrease in food waste over six months. The results of the pilot supported personnel engagement to an overall goal of 50% food waste reduction in IKEA Food stores by August 2020. At the same time, personnel changed behaviour regarding food waste and applied relevant reduction practices in home.

4. Promotion of Circular Economy practices

4.1. Awareness creation among citizen, business and municipalities

The active and massive participation of HORECA facilities plays important role in the success of a food waste CE initiative. For this reason, a detailed communication and awareness plan must be developed, first of all by the Group for the Circular and Green Economy that has been established by the MoEP (see paragraph 5.4 for details on the operation of the group), and subsequently by the direct implementor of each action (be it an SME, a local authority or an NGO). This communication and awareness plan has to be implemented in the direction that will encourage and motivate sector organizations to participate. Despite the fact that separate collection for packaging materials is already implemented in a part of the HORECA facilities, reluctance for participation in relevant activities regarding food waste separation is anticipated. This is due to the required additional effort and staff's workload, additional responsibilities and procedures, space requirements for special containers etc. Consequently, communication and awareness must not only focus on how separation and sorting of food waste must be done, or on the benefits of these activities, but also to include practical information on how the programme must be developed within the limited space of a HORECA facility and the restricted available time of the personnel.

The target groups for the communication and awareness activities are all those persons or groups of persons who have to be addressed because their support is required for the food waste CE program to be able to meet its objectives. The communication and awareness plan must have as an overall objective to inform, educate and train the target groups to change attitude and behaviour regarding the food waste in HORECA facilities. These target groups are facility staff and customers,

4.2. HORECA Personnel

The scope of the communication plan for this target group is to change behaviour within the HORECA organization, to adopt sustainable waste management practices and to be motivated to apply CE actions regarding food waste.

The best approach to effectively implement behaviour change and to proceed with those practices in the long term is to prepare a program which engages, motivates, associates with and empowers staff at all levels to effectively support and implement food waste CE initiatives.

In this direction (WRAP, 2015), the following principles for implementing a successful behaviour change programme are suggested:

1. At all stages, involve and harmonize your plans with key stakeholders.
2. Understand the current behaviours across the organization.
3. Define what your overall aim is and set Specific Measurable Achievable Realistic and Time-bound (SMART) objectives against which to measure progress.
4. Plan a strategy to deliver these objectives and targets in achievable and measurable stages.
5. Enable, engage and encourage full involvement from your stakeholders, as early and as openly as possible.
6. Lead by example (exemplify).

Communication and training for the HORECA personnel towards the implementation of the food waste CE program, is a continuous procedure. Starting from the activities that lead to more direct and visible results, the personnel is highly motivated due to the achievement of the program goals making them more positive to accept occupational and behavioural changes that will lead to long term results. Communication channels that are suggested to be used may include: training sessions, on-job training and suggestions through job supervision, briefings, emails, posters etc.

4.3. HORECA Customers

The success of an awareness and communication program in the HORECA facilities includes the customers' engagement to reduce food waste/losses and to encourage them to act according to the food waste CE program. In this direction, the designers of the awareness and communication plan must initially understand and identify the reasons that lead customers to leave food on their plates. This information is very important for the HORECA management team to take the measures and to make the necessary changes to reduce the amounts of leftovers, such as changes in menus, in portions, providing customers with options regarding the portion size, etc.

These changes must be communicated through messages to the customers which must be encouraged to discuss them with the HORECA staff. The UK initiative “Love Food Hate Waste” conducted a survey among the HORECA customers and published a relevant guide about engaging with customers to help reduce plate waste (WRAP, 2020). The survey resulted with tips that the HORECA management and staff must remember when communicating to the customers, i.e.:

- Customers do not want to think about food waste when eating out.
- People do not like being told what to do.
- Many of customers will think it is HORECA's responsibility to help them reduce the amount of food they waste.

Taking into consideration the survey results, the HORECA staff responsible for the program communication must select the most appropriate means and channels to inform and engage customers. The survey provides also the customers opinion about the placement of messages regarding portions variety and sizes that can encourage them to change behaviour (see following table).

Table 7: HORECA customers' survey results about the placement of messages (WRAP, 2020)

	Blackboard menu	Card or printed menu	Message on table card	Message on place mat	Posters	Drink/beer mat
Restaurants	✓	✓	✓	✓		
Pubs	✓	✓	✓	✓	✓	✓
Staff restaurants	✓		✓		✓	
Hotels	✓	✓	✓		✓	
Quick service restaurants		✓	✓	✓	✓	✓
Cafes				✓		
Leisure venues			✓		✓	

Other means of communication that can be used may include internet-based information (website, social media, paid ads in other websites related to leisure time, etc.), articles, advertisement and presentations that can transfer the messages to wider audience and potential future customers.

4.4. Sticks and carrots

Apart from the communication and awareness raising, in order the promotion of CE practices to be effective, each program must include an answer to the possible question of any stakeholder whose participation is required: “what's in it for me”. For this reason, a set of penalty-reward system has to be designed, first of all, for the direct implementors of such a program (SMEs in the sector and personnel). The rewards might be financial benefits for SMEs that handle their waste properly and hand them over to a relevant system for further utilisation, as well as to SMEs receiving this waste as SRM. The same goes for the personnel: highly performant employees with regard to CE should be rewarded. In the same

manner, any unsound behaviour that lead to excessive quantities of food waste being produced and lead to the comingled waste stream should be disincentivised.

One important aspect of such program is how the rewards can reach the customers/end users. Customer reward programs have to be designed and communicated effectively, such as promotional gifts that have been funded by the cost savings created for the company due to the implementation of a CE program.

5. Conclusions: Necessary changes

5.1. Basic elements of the proposed value chain

As presented in paragraph 1.3, the methods for food waste management are as follows (by order of preference):

1. reduction of food waste, primarily by donations to food banks and other methods;
2. utilisation as animal feed (under the specifications of national legislation as discussed in chapter 2);
3. use as organic substrate for CLO production and
4. use as biomass for biogas production.

The first method (as discussed in paragraph 1.2) does not fall under the definition “utilisation of HORECA food waste as SRM” so it will be discussed in Chapter 7. For this reason, in the current chapter the three last methods will be elaborated.

The use as animal feed, although most preferable, cannot be applied for all types of food as there are specific legal and financial barriers that restrict their use. However, under specific conditions presented in the following paragraphs, a fraction of the overall quantity of food that was wasted can be utilised as animal feed (primarily after thermal treatment or the separation at source of vegetable fractions). More specifically, the fractions of food not used or waste from food processing are:

1. vegetables that have no possibility of coming into contact with raw meat, such as waste from farms cultivating only specific types of vegetables or grocery stores;
2. food waste from HORECA sector that has undergone thermal treatment as there is possible contact with raw meat, which in turn may be the source of contagious diseases for the animals.

Special mention should be done here for the method of rendering which is a very old method for the separation of fat from animal tissues by the application of heat and pressure. This method can be also applied to raw meat by-products of HORECA food waste if they are collected separately.

The most widespread methods though, that can absorb the lion’s share of the food waste production are the last two. For this reason in the financial analyses presented in paragraph 3.4 the remaining fraction of food waste calculated by CEVES (2019) is divided between these two options.

Due to the high fertility of Serbian land, mentioned in several reports (Kovačević, 2013 and EC, 2011), as well as the direction of Serbian Government to increase the share of its renewable energy by introduction of incentives for usage of renewable energy sources by the Ministry of Mining and Energy (Wieser and Mlilijic 2017), indicate that in order to set up a more circular value chain in food production and consumption, a significant part of the wasted food should be utilized as biomass for biogas production.

As Mr. Antonis Mavropoulos (ISWA President) states: “Biogas is the link between renewable energy, circular economy and waste management. It is also one of the few ways to portray the tangible benefits of circular economy to citizens, as organics’ closed loops are primarily local. Finally, it’s a great tool to fight energy poverty involving communities and develop decentralised waste management options”. (German Biogas Association – GIZ, 2019).

It has to be noted here, that apart from the abovementioned options, which are the most prevalent ones internationally, there are many other innovative options that have to be considered:

1. Great advancements have been done in the area of the utilisation of black soldier flies larvae to compost waste or convert the waste into animal feed, utilisation of black soldier flies pupae and prepupae to be used as fodder for poultry, fish, pigs etc.
2. Significant research is being performed on field of bioplastic production. Bioplastics are used for disposable items, such as packaging, containers, straws, bags etc. Depending on their type, they

can be more biodegradable than the traditional plastics, helping thus in the protection of the surface water and marine environment from the pollution from plastics.

5.2. Basic requirements

After the interviews conducted with experts of the SWM sector in Serbia, the most relevant policy instruments are the ones that create drivers for both companies and users to adopt CE practices. More specifically, due to the lack of relevant legislation that promotes waste reduction and CE practices, it is difficult to utilize other tools that require the existence of legal drivers. For this reason, the enhancement of the SWM legislation with focus on the creation of financial drivers for the reduction of the waste produced and the waste ending up on the landfills, will be the cornerstone of the overall effort for the creation of circular VC's in Serbia.

After the regulatory base is set, the subsequent level of action is the coordination of the various actions, enforcement of the existing laws, as well as accurate monitoring of the results of the implemented strategy. This has to do with the institutional capacity of the state (mechanisms for control of environmental performance of the sector).

Based on a solid regulatory and institutional basis, the encouragement of the utilisation of HORECA food waste as an SRM has the following issues that have to be tackled in the framework of an integrated approach:

1. the utilisation of several policy tools either on a state level or on market level (see paragraph 1.4);
2. the implementation of the necessary infrastructure for the collection, management and distribution of the SRM (source separation, construction of treatment facilities);
3. the setup of the distribution networks and their rationalisation by the inclusion of the informal sector;
4. rethinking of existing business models for the utilisation of the SRM;
5. awareness raising for individuals, SME's and the capacity building in state and private entities to support the implementation of such a system.

5.3. Establishment of a regulatory environment that encourages utilisation of food waste as secondary raw material

The first issue that should be considered for the promotion of the utilisation of food waste as SRM is the creation of drivers for its alternative management and subsequently its diversion from landfilling. Currently food waste has little or no value (this is also corroborated by the fact that it is not being collected by the informal sector). The creation of value for the separate management of HORECA food waste has two aspects:

1. rethinking of the waste management fees paid by citizens and companies (especially of the HORECA sector) in Serbia, so that the inclusion of food waste in the comingled waste increases the fees. Thus the value is being created indirectly by creating the driver for the alternative management of the said waste stream. Currently, collection of SWM fees by the authorities is based on an outdated model: each household or enterprise pays a fee according to the surface area of the building/apartment (see Infostan aggregate bills in Belgrade) and not based on the actual amount of produced waste (Krnjeta and Aćimović, 2018). This situation does not create any need for reduction of SWM that is handed to the waste management chain by removing for example food waste and handing them to an alternative system. The establishment of Pay As You Throw system, requires detailed design and extensive legal reforms. If this type of legislation is put into place, then a solid base is set for the development of private initiatives and innovative solutions for alternative management of food waste;
2. implementation of all the necessary infrastructure for the creation of value by the subsequent utilisation of food waste as SRM. Necessary investments, especially by the private sector, with

regards to the creation of the necessary infrastructure cannot take place unless a stable environment is created by the tackling of the first issue.

One crucial point in the overall effort is the production of more detailed specifications for the regulation of various parts of the HORECA food VC:

1. in order to promote utilisation of food waste as animal feed, clear definitions are required for the option of thermal treatment or rendering of food waste and the source separation of food waste streams that do not require treatment prior to their utilisation as animal feed (e.g. vegetable waste that do not have any possibility of contact with raw meat);
2. tackling of the legal barriers for food waste production reduction (see paragraph 2.3);
3. full harmonisation with EU legislation for biodegradable waste management, biogas production, composting.

Apart from the legal reforms, the long anticipated new strategy for 2020-2025 represents a necessary step for the coordination of all the efforts towards CE. The previous strategy (2010-2019) has been rendered obsolete, whereas no detailed actions and goals were included for particular waste streams and especially for the HORECA sector. One other major issue is the achievability of the targets set by the existing strategy. Many actors in the sector noted that the targets set are not by any means attainable and this fact does not provide incentives for making any effort to achieve them.

A very useful tool at this level of reference, is the EU Green Public Procurement (GPP) set of criteria (EC, 2019). This set is designed to promote the use of CE practices by giving a competitive advantage in the public tenders to companies that can prove that they incorporate CE practices in their production procedures. The criteria have been formulated in such a way that they can, if deemed appropriate by an individual authority, be integrated into the authority's tender documents. The product group is divided into three parts: food procurement, catering services and vending machines. In each product group the criteria types shown in the following table can be applied.

Table 8: Criteria types and procurement phases

Types of criteria	Categories of criteria in each procurement phase
Core criteria - designed to allow easy application of GPP, focusing on the key area(s) of environmental performance of a product and aimed at keeping administrative costs for companies to a minimum	Selection criteria
	Technical specifications
	Award criteria
	Contract performance clauses
Comprehensive criteria - take into account more aspects or higher levels of environmental performance, for use by authorities that want to go further in supporting environmental and innovation goals	Selection criteria
	Technical specifications
	Award criteria
	Contract performance clauses

5.4. Institutional framework

The first prerequisite for the implementation of any CE policy, financial instrument, legal reform in the sector of the HORECA food waste management is the central coordination of all efforts in the various levels of administration (vertical) as well as horizontally between the CSOs, NGOs and international funding institutions active in the sector. To this direction, Serbian MoEP has launched the Group for the Circular and Green Economy within the Sector for Strategic Planning and Projects. This Group is in charge of managing CE issues on cross-sectoral level in order to facilitate gradual implementation of CE

in Serbia. Its current focus is the development of Program for CE with Action plan from 2021 – 2023, which represents the main public document for CE in Serbia and expected to be adopted in 2020. The Action plan is supposed to set the measures and activities to be implemented for the period of 3 years. To this day, there is still no cohesion legal or institutional framework that could properly generate and monitor programs to provide support for the CE (PLAC III).

Some of the current challenges include:

- inconsistency with EU regulations and directives,
- lacking local systematic incentive measures or an appropriate institutional solution,
- lack of understanding of the concept itself and its benefits.

Some of the steps that can be carried out include:

- establishment of independent financial institution in charge of financing and capacity building, and investments in various CE projects;
- development of national media plan for promotion of CE.

Apart from the above, this group could also plays a significant role for the clarification of roles between the various state authorities and avoid overlapping, as well as avoid duplication of work between the various non-state actors in the field.

The action plan under elaboration by the Group for the Circular and Green Economy (Vucinic, 2020) could also be further developed to elaborate further any existing guidelines (such as the one at hand) and define in more detail actions relevant to the local context. Each action should undergo a CBA analysis and feasibility studies should be elaborated for each proposed action. Each proposed action should have one or more owners so that the next day of the plans' approval, its implementation will begin.

On this field, significant work has been performed by GIZ with the elaboration of the ValueLinks 2.0: Manual on Sustainable Value Chain Development (Springer-Heinze, 2018).

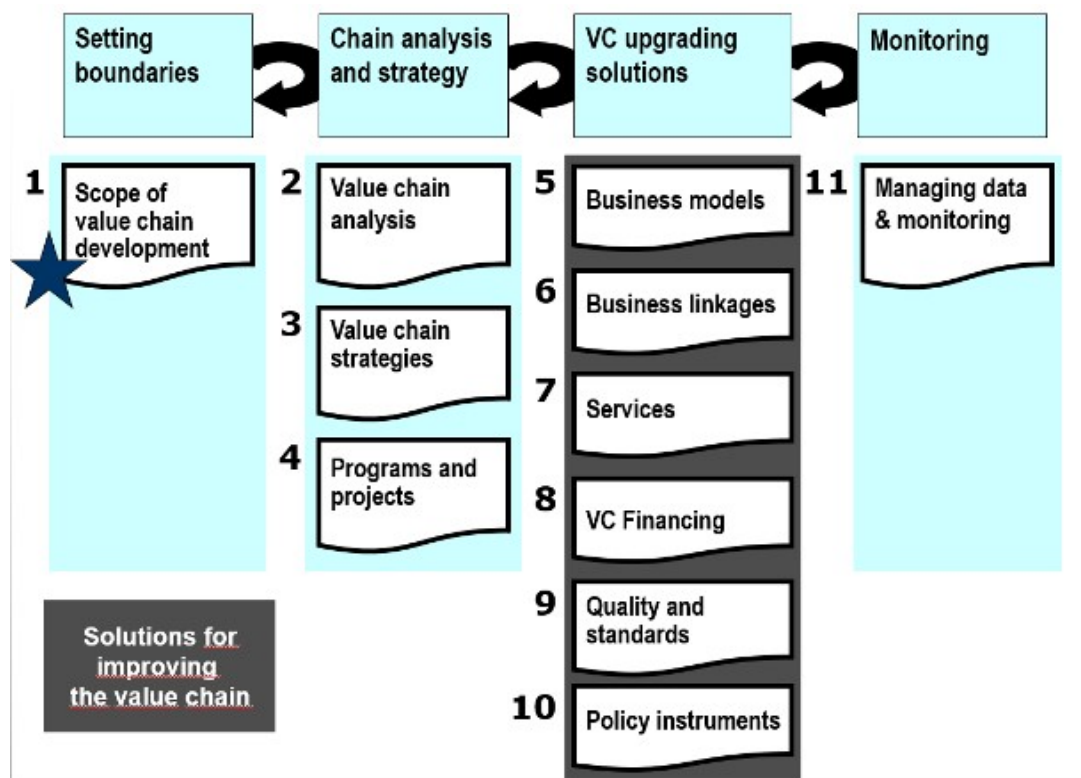


Figure 12: Conceptual diagram of a detailed VC development action plan (from Valuelinks 2.0, Springer-Heinze, 2018)

One other issue that has to be tackled in the institutional level is the monitoring of all the relevant activities, so that conclusions are drawn regarding the efficiency and the effectiveness each policy adopted. Moreover, monitoring will help in the enforcement of specific measures for SWM, clarify accountability of different actors and contribute to the collection all necessary data for future research activities or baselines elaboration.

In the same manner, if a sound monitoring mechanism is established, the best practices regarding SRM collection, distribution and utilisation will be identified. This monitoring mechanism will be the basis of any data collection procedure/system (see paragraph 5.7 for more details) and its implementation will enhance research and innovation in the sector.

In order to establish separate collection and management of HORECA food waste, so that it can be used as an SRM, several institutional adjustments have to be made on local and SME level:

1. Organisation of separate collection of HORECA food waste. Preferably, this issue has to be tackled in the beginning at a municipal level, since any kind of private investment at the present phase cannot be considered if there is no steady demand for this type of waste. The role of the municipalities is crucial, especially in the beginning of any transition to a CE model.
2. Creation and regulation of distribution networks. They will instantly sprout out after the primary condition is met. That value can be created by the specific waste stream. This part of the equation needs more detailed study after the first necessary steps to such a transition have been realized.
3. Capacity building and raising of awareness on the local level (municipalities and SMEs). This will ensure that any mechanism for separate collection will become efficient on the one hand, and on the other, that the SMEs will be able to be guided through the rethinking of their business models (see paragraph 5.6) so that they can handle the adaptation to a model in which wasted food is not considered as waste, but secondary raw material.

Finally, the overall operation and funding of waste collection and management services in PUCs has to be radically reformed. With the exception of Belgrade and other large cities, in most Serbian municipalities the activity of waste management is performed by mixed utility companies which, at the same time, perform other utility activities. Even in Belgrade, which is Serbia's largest city, the utility company conducts not only waste management activities, but also cleaning of public city areas and emptying of septic tanks, which means that it is not specialized for this activity entirely. This certainly has certain consequences in relation to the manner of financing, even collection of receivables, especially in the case when one company performs several activities which are financed not from the budget, but from the price of its services. The situation becomes dire due to the lack of funds which are a result of the current fee collection system. We can see that, as a rule, utility companies cannot collect almost one third of their receivables for the waste management service (Krnjeta and Aćimović, 2018).

5.5. Operational resources and technical requirements

5.5.1. Food waste supply and distribution

The basic challenge that has to be tackled in order to ensure the supply of food waste as SRM is the establishment of a collection system that ensures high quality of the food waste (no deterioration of the quality from mixing with other streams or due to the duration and the conditions of their transport).

In this framework the HORECA food waste management system must be effectively supported from a network that will enable the separate collection at source and its distribution and transportation to their destination for further use i.e. food banks, animal feed and treatment facilities.

This has two aspects that, in turn, have to be considered:

1. **Separate collection of streams.** Special streams require special handling. For example, food waste containing only vegetables that can be used directly without prior treatment must be

handled carefully so that it is not mixed with other waste that can contaminate it. Other streams (such as breadcrumbs that have high calorific yield if used as biomass for biogas production) should not be mixed with other inferior streams. In general, biodegradable waste that is to be composted should not contain plastic or glass residues.

2. **Storage facilities and transport infrastructure.** Food waste containing only vegetables that can be used directly without prior treatment should be transported quickly to the companies that will utilise it as SRM before it degrades. Also, in order to establish a financially feasible system of food waste collection and transfer to companies that will utilise it as SRM, the logistics should be affordable so that the price of the SRM does not become higher than the one of the primary raw materials.

The collection of food waste must be done in dedicated bins for food waste only. These bins will have to be located in different food waste generation points in the HORECA facilities. The following diagram presents the flow of separately collected food waste linked to the generation point within the HORECA facility.

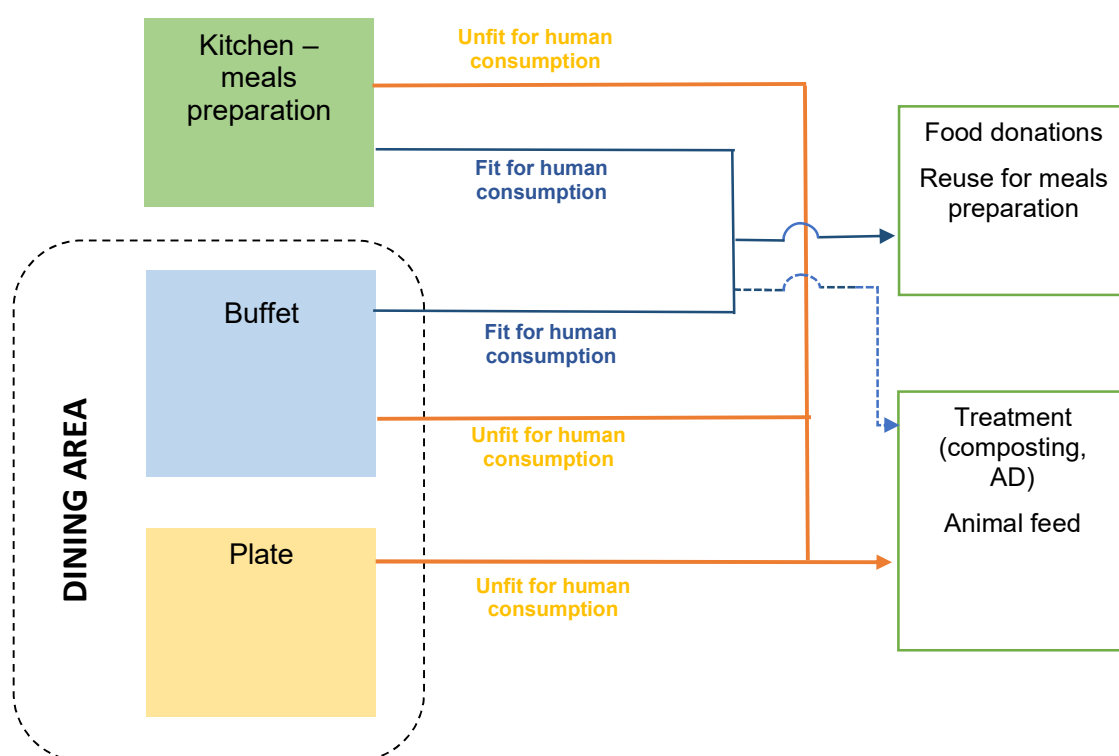


Figure 13: HORECA food waste flow diagram

Collection points

- A. **Kitchen – preparation:** The vast majority of the food waste generated in the meal preparation stage is unavoidable and includes inedible food elements (unfit for human consumption). The food waste bins options in the kitchens are in general either worktop or floor standing.

- a. Worktop containers: they are small size objects, usually already existing in the kitchen (such as trays, buckets etc.) and are used for the direct disposal of the food waste during preparation of meals. The worktop containers are emptied into larger food waste containers, usually located in a central point of the kitchen.
- b. Floor standing containers: these containers are used for the collection of larger amounts of food waste. These bins are usually slim, and their height is the same as the worktop surface in order to reach the maximum capacity in the smaller floor space. Depending on their use they can be equipped with lid and foot operated pedal for opening. Traditional plastic bins are typically used for separated food waste collection in kitchens.

Prepared and unserved meals that are properly stored and have not expired are not considered as waste and they can be either consumed by the HORECA facility personnel or donated to food banks to be consumed by people in need (see paragraph 7.1). They must be collected and stored properly in separate container.



Photo 1: Worktop food waste container (Source: <https://wrap.org.uk/content/sme-food-waste/4a-fitting-food-waste-bins>)

- B. Dining area: Edible and fit for human consumption is mainly the food waste generated in the HORECA facilities that offer buffet meals, while the customers' plate leftovers are considered as inedible and unfit for human consumption. Plate waste should be collected separately to food waste containers located either inside the dining area or inside the kitchen when it is collected by the facility personnel. Edible buffet waste should be collected separately and stored properly for consumption by facility personnel or for donation to food banks.



Photo 2: Plate waste (Source: www.hotelmanagement.net)

HORECA facilities must be covered by door-to-door collection system. Collection and transportation must be implemented by specialized vehicles, either through local authority or individual contractors. Usually individual contractors provide also the bins for the temporary storage of food waste, usually located in an open area. The HORECA facility needs to know the expected amounts of food waste collected between two consecutive collections in order to inform the contractor about the number of bins needed. The number of the bins also depends on the space available for installation of bins. Collection may be undertaken on a daily basis or just once per week, depending on the amounts produced, the storage capacity and the distance of the facility.

The majority of collection companies charge on a “per empty” basis. Therefore, good value for money can be achieved if bins are full when collected. Overfilled bins must be avoided because food waste is heavy; this is the reason why some contractors charge additionally in case of overfilled bins.

5.5.2. Secondary Raw Material infrastructure

The utilisation of food waste as SRM requires the construction of specific infrastructure. In the following paragraphs some basic directions are given, based on the research performed by the authors of the guideline. More specifically:

1. For **composting**: composting facilities have to be constructed all around Serbia, at least in the bigger municipalities. At the present time, apart from some small-scale pilot projects, no compost or CLO was found to be produced centrally from biodegradable waste treatment facilities.
2. For the utilisation as biomass and **biogas** and subsequent **energy production** several facilities currently exist in Serbia and experts in the field state (ESOTRON, 2019) that there is no immediate need for constructing new ones. The main deficiency of the system is the lack of facilities that can pre-treat food waste so that it can be mixed with the biomass for biogas production.
3. No facilities were found for thermal treatment of food waste for use as **animal feed**. Moreover, if this option is to be promoted, investments in transport and storage infrastructure are required.
4. No facilities were found for alternative uses of food waste such as **black soldier fly rearing**, **bioplastics production** or other innovative approaches for food waste utilisation.

As VCs are not technically “constructed” by an organisation but are the result of several interactions between a multitude of actors and new emergent structures not anticipated may arise, after the VC starts

moving towards a more circular *modus operandi*, new infrastructure requirements will emerge. In order to support and promote this movement, more investments in research infrastructure (laboratories, universities, innovative SME's) will be necessary.

5.6. Business Model Rethinking

5.6.1. Tools

During the last decades, as the environmental awareness increases among citizens, there is an increasing pressure to maintain appropriate levels of social, environmental and ethical standards in addition to producing quality products. As a result, more and more buyers are emphasizing green and ethical purchasing. Green purchasing involves applying environmental considerations, such as reducing waste, re-using, recycling, protecting biodiversity and using environmentally sustainable materials and energy sources (ITC, 2017). Based on this trend, all businesses eventually will have to rethink their business models so that they can stand their ground in the market and create a more competitive profile. SMEs can build their potential to upgrade by applying CE principles where relevant in their business activities and meeting the quality requirements, ISO benchmarks and codes of conduct of buyers.

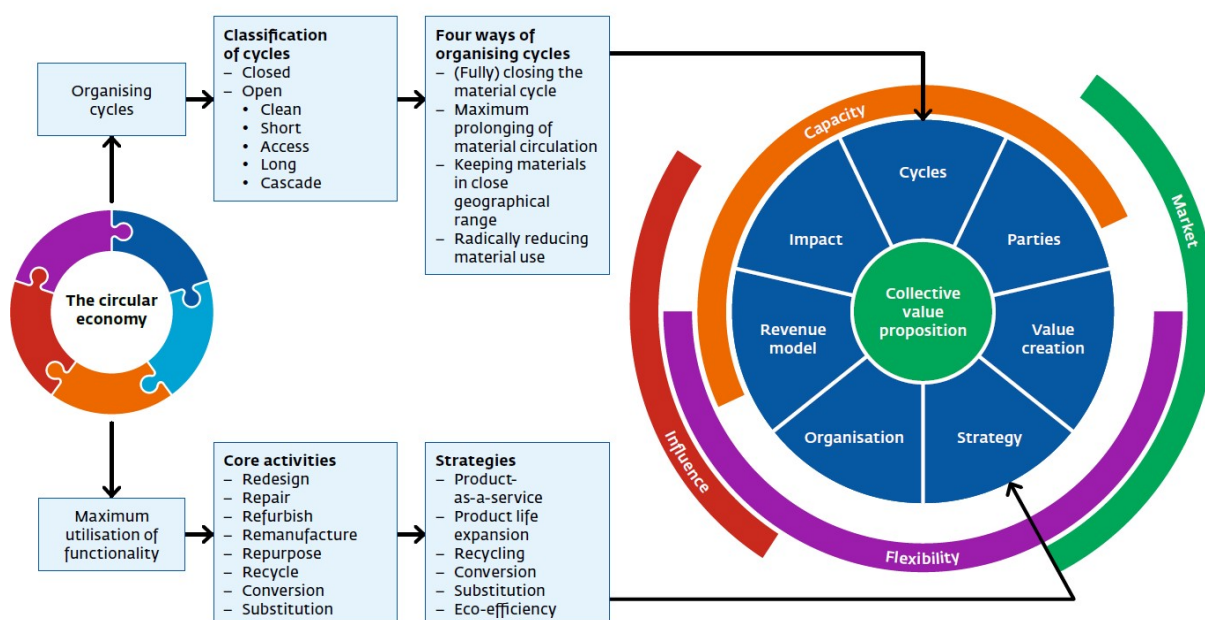


Figure 14: Business model rethinking for CE transition, according to the CE workbook (Jonker et al., 2018)

Several tools have been developed with guidelines and roadmaps on how to rethink and restructure business models and production chains, based on incorporating CE practices in the everyday operation of the company. In the present guideline, some basic guiding principles and insights will be presented. For more detailed information interested readers can refer to the material included in the following indicative list:

1. Profitable Environmental Management (PREMA®), developed GTZ-P3U and further elaborated by GIZ, for micro, small and medium-sized companies;
2. Playbook by SITRA, Circular economy business models for the manufacturing industry. Circular Economy Playbook for Finnish SMEs;
3. Organising for the Circular Economy. A workbook for developing Circular Business Models (Jonker et al., 2018);

4. Small Business Waste Reduction Toolkit, issued by Midwest Regional Waste Forum 2012.

All these tools, and several other approaches that are proposed in the literature, share some basic common objectives, some common approaches and some common methods to lead this change.

More specifically, all methods aim at the reduction of the production costs, the reduction of environmental impacts and enhancing the capacity of the company by resolving weaknesses and finding opportunities for improvements.

PREMA means a triple win for a company

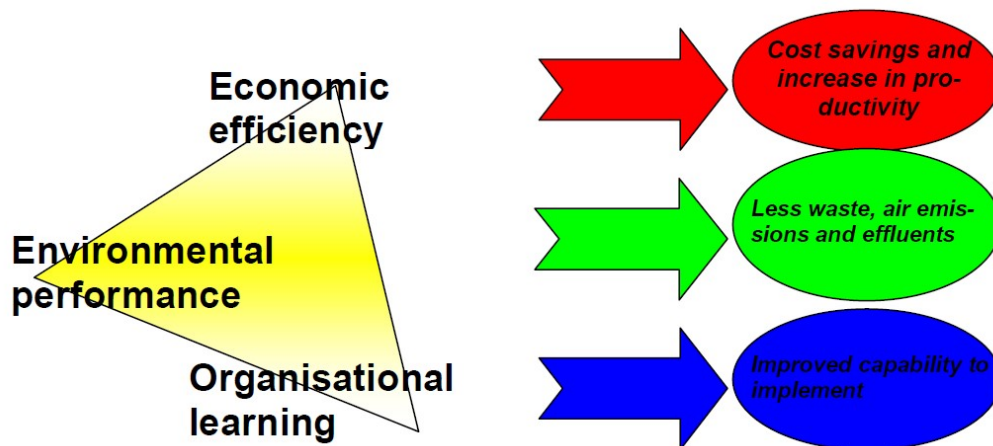


Figure 15: Basic objectives according to PREMA®

Initially, a desk phase is required for analysis of the characteristics, structure, products and position in the market of the company. Then, through a collaborative approach, all methods try to involve all stakeholders in the process of scrutinising the production chain and proposing improvements. This is done through workshops, one-to-one interviews, etc. Each method has several success cases, and their study gives several hints to the interested companies.

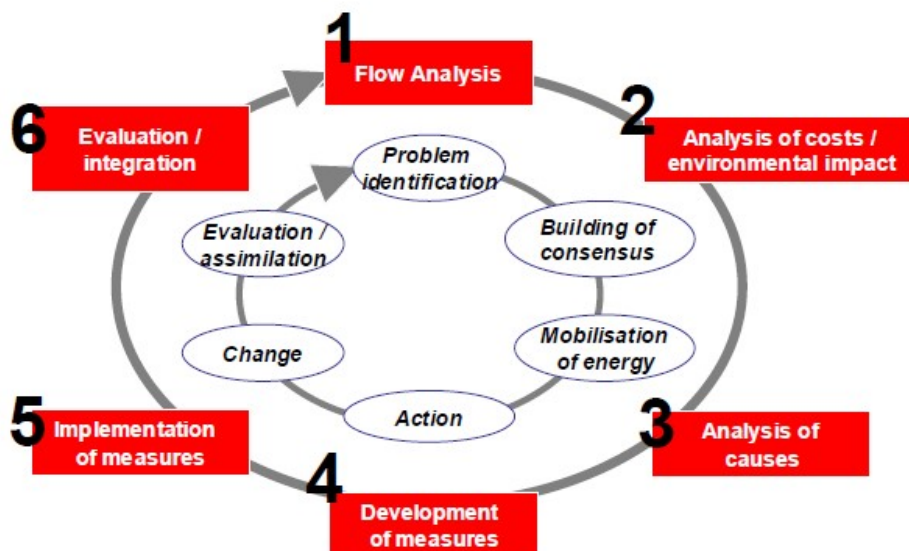


Figure 16: PREMA® cycle of change

Illustrative

		Culture		
		Values	Mindset	Behaviours
Function-specific	Company-level	<ul style="list-style-type: none"> Sustainability Customer value creation Collaboration/ Teamwork 	<ul style="list-style-type: none"> Minimising resource consumption and environmental impact is key for license to operate Things that increase client value are prioritised Sharing among colleagues is caring 	<ul style="list-style-type: none"> Voice new ideas Use impact on client value as measure to prioritise activities Share know-how and experience across functions
	Design/ R&D		<ul style="list-style-type: none"> The resource efficient way will be the better way in the long-run 	<ul style="list-style-type: none"> Apply circular design criteria Consider the whole life cycle in design
	Sourcing & Procurement		<ul style="list-style-type: none"> Recycled/ reused/ renewable material should be used where possible 	<ul style="list-style-type: none"> Explore new suppliers for material sources
	Manufacturing		<ul style="list-style-type: none"> Repairing a product or component is better than producing a new one 	<ul style="list-style-type: none"> Support designers in design for repair
	Sales & Aftersales		<ul style="list-style-type: none"> Every unmet request of a customer is a potential new solution 	<ul style="list-style-type: none"> Have dialogue with customers to explore unmet needs
	Take-back & Recycling		<ul style="list-style-type: none"> Failing high recovery rates is failing value capturing 	<ul style="list-style-type: none"> Aim at recovering and recycling as much as possible of products
	Strategy & Leadership		<ul style="list-style-type: none"> Leading by example is most effective 	<ul style="list-style-type: none"> Publicly praise employees for their contribution to the journey

Figure 17: Function specific components for adapting to CE culture (SITRA et al., 2018)

Apart from the issue of business model rethinking, which is a mainly internal issue of each company, there are two issues which cross the boundaries of each company.

1. The issue of the quality requirements that govern the quality of the end product which has incorporated SRMs in the manufacturing processes and the possible health and safety issues arising from the reuse of discarded materials. In all cases the standards imposed by national legislation have to be maintained. This does not mean that all possible quality problems have been foreseen by the legislation. The competent authorities overseeing this transition should proactively monitor all these processes and act accordingly if unforeseen problems arise.
2. The VCs into which the SMEs operate are not only local or national, but also international. As a more circular VC starts being created and several previously waste materials start gaining value as SRMs the interaction with the international market has to be monitored by the competent authorities (e.g. Group for the Circular and Green Economy – see paragraph 5.4) so that there are no distortions on the market and competition remains smooth.

5.6.2. Green financing

The rethinking of the business model involves also the financing sector and the way financing institutions may look at investments in the circular economy. This can be summarised under Sustainable or Green Finance. Green Finance instruments are also increasingly recognised and promoted by the EU. The recommendations for a greener finance and the enhancement of financing options for CE activities include, among others:

- elaboration of a taxonomy for sustainable finance
- establishment of a “quality label” for green finance products, as well as standards for green finance.

Furthermore, rethinking of the business model from a financing point of view must also comprise more stringent consideration and disclosure of risks inherent to linear business models and projects.

Financing should also encourage the broadening of the knowledge base in circular economy and risk sharing approaches for innovative approaches and first movers.

5.7. Access to information

Legal framework in Serbia regarding the reporting on waste is regulated by Law on Waste Management (“Official Gazette of the RS” No 36/09, 88/10 and 14/16), Law on charges for usage of public goods

(“Official Gazette of the RS” No 95/2018) and Bylaw on products that become specific waste streams after use, on the daily log form for records of the quantity and type of products produced and imported, and on the annual report, on the method and time frame for submitting the annual report, on the fee payers, the calculation criteria, the amount and the method for the calculation and payment of the fee (“Official Gazette of the RS” No 54/10, 86/11, 15/12 and 03/14).

All legal entities that produce or deal with waste are obligated to report data about waste production, disposal, reuse, export, import and collection on daily and annual basis, and waste movement when it occurs.

Serbian Environmental Protection Agency is the central authority in charge of collecting all the reports and include them in the National Register of Pollution Sources. Database on collected data within the National Registry is publicly available on the SEPA website. In addition, SEPA publishes annual Reports on Waste Management in Serbia, where collected data on waste is comprehensively presented.

Reporting on waste should be distinguished between municipal waste and commercial/industrial waste. The legislation requires that all required forms on waste must be filled in and reported prior to completing the trade. Therefore, data collection system on commercial/industrial waste is fully operational and accurate. On the other hand, there is an issue about reporting the data on municipal waste, which has to be conducted by public utility companies, or private companies in charge of waste management in municipalities. Most of the data available relies on record by the major operators and service providers, with no possibility (even if the mandate and the capacity existed) from any government counterpart to verify and act upon them in a scientifically sound way. Therefore, the accuracy of this information is not always fully ensured.

A very important prerequisite for accurate master planning and subsequent design and implementation the necessary SWM projects that will support the transition to CE, is the existence of solid baselines regarding all aspects of biodegradable waste production and management with special focus on the food waste VC. For this reason, it is of utmost importance that baselines for food waste VC are elaborated. At the present time, all quantitative estimations are based on outdated, scarce and many times contradictory data. The most important solid waste composition analysis on which most of the subsequent analyses based on? have been performed more than 10 years ago (RS, 2010, FTS-UNS, 2009). No stream-specific data exist that are universally accepted by the national scientific community. Hence, research has to be funded and detailed baselines for all streams and subsectors of SWM should established.

All research and studies elaborated in the sector has to be collected centrally (by the SEPA initially but also by the Group for the Circular and Green Economy) and all new data and studies should be readily available to the authorities, civil servants, professionals, researchers active in the sector. This information should be available online through the existing SEPA’s internet platform. The facilitation of data flow will also help in the institutional aspect related to clarifying responsibility and setting accountability measures. The data flow will be managed by SEPA in order to support the coordination, monitoring and management of the sector.

SEPA’s platform, after the inclusion of all data mentioned above, should have at least two levels of access:

1. Access to general quantitative information about the various SWM sectors, aggregated data on national, regional municipal level, studies elaborated, baselines produced etc. The access to this level will be free to any interested party;
2. Access to raw data from monitoring and ongoing activities. The access to this level should be available only to state or other specially authorised entities.

The information system currently in place should be enhanced so that it covers the full cycle of Solid Waste Management – from generation through transfer and treatment to disposal of each specific waste stream (currently there are some gaps regarding the data collection of some smaller waste streams). This means that apart from the institutional changes and enhancements of the existing platforms described above, several steps are required at corporate level for the most accurate production of raw data-sets. For this reason, several methods have been proposed by the scientific community. A very useful conceptual model for data collection in order to identify and explain the patterns and drivers of food waste

generation in the hospitality sector so that food waste prevention measures will be designed subsequently, has been proposed by Papargyropoulou et al. 2016. In the initial stages of the development of the conceptual framework, a waste audit features as the main tool for data collection, focusing primarily on quantitative data such as weight, composition and origin of food waste; however, the waste audit offers limited insights into the drivers for food waste generation. Building from ethnography, methods such as participant observation, interviews and focus groups were incorporated in order to collect qualitative data. Both quantitative and qualitative methods can be carried out simultaneously and the waste audit data can indicate which stages of the food preparation and consumption the qualitative methods should focus more on, and insights on the drivers of food waste generation are being provided as a result. This method is summarised in the following figure (Figure 18) which separates the overall process in:

1. the methods for data collection
2. the data to be collected and finally,
3. the methods and tools that can be used for analysis.

By following these steps, and most importantly by implicating all stakeholders to the procedure, insights will be gained by each company on how to reduce food waste produced.

All these results are founded on the quantity and quality of data collected. For this reason, it is of utmost importance that food measurement procedures are established in all food VC companies and especially the ones active in the HORECA sector. In order to install a food measurement procedure in an SME, the conceptual diagram presented in Figure 19 can be followed.

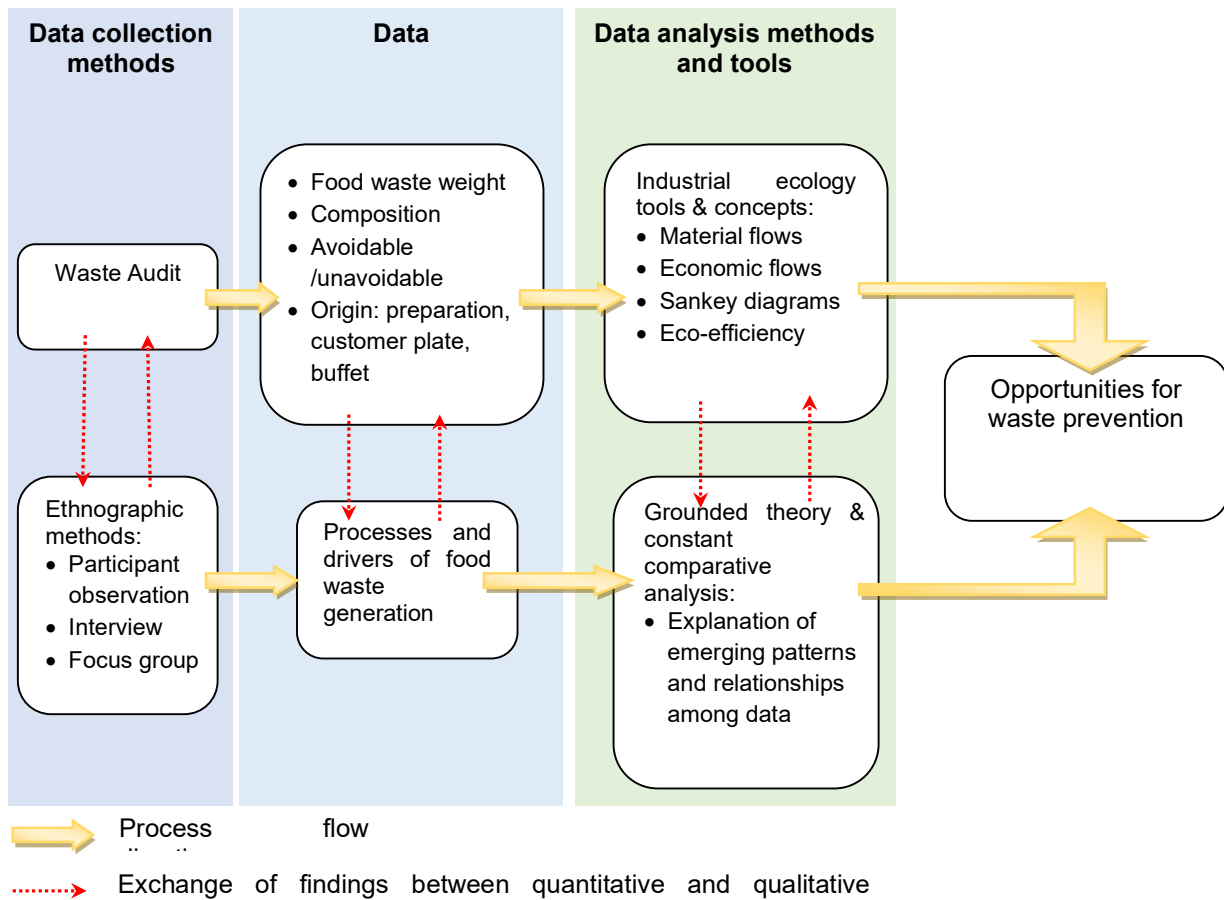


Figure 18: Conceptual framework for data collection and analysis (Papargyropoulou et al. 2016)

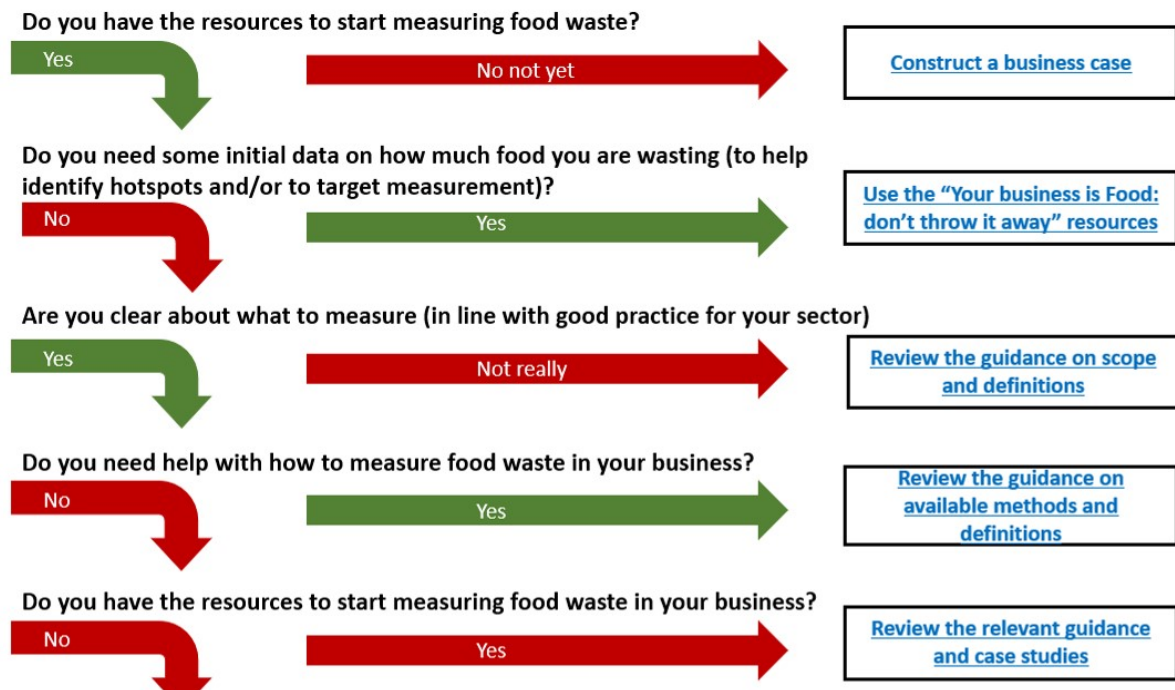


Figure 19: Food measurement in businesses according to WRAP (WRAP, 2018)

6. Financing options and sources

6.1. Financing Options

CE projects, as all innovative and new approaches, require adequate financing and funding options. In the same time, due to their innovative character, the risk is higher than with the traditional approaches. Hence, a combination of private capital, public funds and/or guarantees is required for mobilising the required financial resources.

The main options for investment financing are as follows:

- *State Budget*
Measures and activities, which are not directly financially viable, such as accompanying measures, parts of waste collection and recycling, remediation and/or construction of dump sites and landfills, as well as environmental protection measures can be financed from the state budget.
- *Grants*
Grants are used for enhancing and complementing state and private interventions. Grants are available from IFIs under different targeted programmes.
- *Loans and Guarantees*
Loans are used for financing of economically viable projects. Guarantees are for projects to make them more attractive to other investors. Loans and guarantees are available from IFIs and local financial institutions under different programmes.
- *Private Sector Investments*
Private sector can be interested in activities which are financially viable, such as solid waste collection activities, waste-to-energy projects and certain recycling activities. This implies that the tariff level is such to attract private sector investments.
- *Equity/Venture Capital*
Venture capital funds generally invest relatively small amounts of equity capital in companies. These investments tend to be in companies in their start-up or expansion phase that may also require access to managerial expertise and networks.
- *Insurance Products*
Insurance products can be used in certain limited circumstances to reduce project risks and so enhance the capacity/possibilities for investments.
- *Green Finance Instruments*
Green Finance Instruments are financial instruments specifically issued for financing of environmentally friendly investment projects.

The above-mentioned financing instruments are made available by (i) international financing institutions and (ii) local banks, usually in cooperation or joint partnership. Often a mix of different instruments is applied. The detailed design of a financing structure depends on a case-by-case basis, this means that each investment project has to be assessed separately and financing mix has to be adapted to the individual project.

In principle, the following options exist:

- Project finance (non-recourse or limited recourse financing)
 - Pledge on the project facility and revenues expected from the activity

- More common for IFIs
- Recourse financing
 - Pledge on the project facility and other assets or guarantees provided by the investor
 - More common for local FIs
- Mezzanine
 - Hybrid of debt and equity financing that gives the lender the rights to convert to an ownership or equity interest in the company in case of default

A very important aspect for the funding of projects is the set of criteria that has to be fulfilled so that the resources are used in an effective and efficient way and the projects are viable. This aspect becomes even more important in countries where the SWM and environmental licencing procedures are not yet fully developed and for this reason, each financing institution has a set of requirements for the selection of the projects to be funded.

The basic criteria for project financing by the institutions can be summarized in the following:

- Solid project concept
- Feasibility study including at least:
 - Institutional and planning framework - Existing situation of solid waste management
 - Project scoping - Demand analysis and design parameters
 - Site screening and evaluation
 - Preliminary design - Options analysis
 - Cost/revenue estimates - Financial and economic analysis
- Legal and environmental requirements fulfilled (Scoping, EIA study)
- Project implementation plans
- Reliable technology solution (Mature technical studies - Approval of design that details the basic technical aspects)
- Long term availability of raw material supply
- Vertically integrated fuel supply
- Availability of acceptable collateral

These criteria may vary slightly for the different institutions, but as a general guidance they are valid in Serbia as well.

6.2. Investors and/or contractors with previous experience - Financial Institutions active in Serbia

The following financial institutions are active in Serbia and provide financing, often in partnership for circular economy projects

- International Funds, International and Development Financial institution
 - GIZ – www.giz.de
 - Green for Growth Fund - www.ggf.lu
 - Regional Energy Efficiency Programme (REEP & REEP Plus) - www.wb-reep.org
 - European Investment Bank - www.eib.org
 - Western Balkans Investment Framework (WBIF) - www.wbif.eu

- Kreditanstalt für Wiederaufbau - www.kfw.de
- Deutsche Entwicklungsgesellschaft DEG - www.deginvest.de
- European Bank for Reconstruction and Development – www.ebrd.org
- World Bank – www.worldbank.org
- United Nations Development Programme – www.undp.org

Local Financial Institutions (Banks and Leasing companies) in Serbia which are indicated as sources of retail finance in Serbia by the Western Balkans Investment Framework (WBIF) and which have partnerships with some of the above mentioned international institutions.

- Addiko - <http://addiko.rs>
- Banca Intesa - <https://www.bancaintesa.rs>
- Erste - <https://www.erstebank.rs>
- Halkbank RS (Cacanska Banka) - <http://www.halkbank.rs>
- Intesa Leasing Beograd - <http://www.intesaleasing.rs>
- Komercijalna banka - <https://www.kombank.com/sr>
- NLB Bank – <https://www.nlb.rs>
- ProCredit Bank RS - <https://www.procreditbank.rs>
- Raiffeisen Leasing - <https://www.raiffeisenbank.rs>
- Sberbank - <https://www.sberbank.rs>
- UniCredit - <https://www.unicreditbank.rs>

7. Going beyond SRM utilisation

7.1. Food donations

Packaged food before it expires or spoils and bulk food unserved/unused and properly stored is not waste. Moreover, there are special categories of packaged food (such as dry and thermally treated food in aseptic or impermeable packaging) that can be safely used even after their expiry date. These types of food can be donated prior being wasted.

Food donations is a very important tool for transition to CE in general and in particular:

- it contributes significantly to food waste prevention;
- it is a priority area for waste prevention in the new EU Directive on waste;
- it can contribute to alleviating hunger and combat malnutrition of children, hence contributing to the social agenda by supporting vulnerable people, also complying with UN Sustainable Development Goals (SDGs).

Currently Belgrade Food Bank (BFB, Banka Hrane Beograd) is active in the sector of food donation doing very important work that reduces food being wasted and thus reducing biodegradable waste being landfilled and in the same time provides food to people in need. The potential in this field based on the findings of 2018 report “Case Studies for Waste Prevention Activity 3.5 Final draft 30.11.2018” (Serbian MoEP et al., 2018) can be significantly enhanced. Delhaize company estimated that by removing all barriers, their food donation might go up to 5000 tonnes and 50 % of total wasted food (whereas the remaining portion is not suitable anymore for consumption). Overall, it is estimated that the potential for food donations in Serbia is about 16.000 tonnes of food, with an expected value of savings of 16.000.000 Euro which could help 150.000 persons threatened by critical poverty. In particular, by addressing the full potential for food waste donation, the amounts of food which could be donated (and hence, which would be prevented from being discarded) would be ten times bigger than what it actually is. This would also be beneficial in environmental terms and reduce the amount of food waste to landfills, which is also a major contributor to CO₂ emissions. The main actors in this sector are the donors (suppliers), the recipients (organisations that distribute the food to the final recipients/ the people in need) and the coordinators.

Donors can be the restaurants, canteens in large facilities/offices buildings, self-service restaurants in shopping centres, hotels, catering companies, public kitchens (e.g. schools, hospitals), deliverers, supermarkets, cafes, bakeries, patisseries.

Recipients are independent charities, non-governmental organisations or public social organisations. Charities are often connected or maintained by church organisations. Independent charities might provide (and also get financed) some of their services in agreement with public bodies. Public social organisations are run and financed by governmental or municipal bodies. These organisations usually have standardised roles and responsibilities in their social work/activities (FUSIONS, 2015).

Coordinators play a key role in the distribution process as the food surplus redistribution “market” is not well developed. Potential supply and demand do not find often each other, even if a potential donor and a potential recipient organisation are in the vicinity. The key roles of the coordinators are (FUSIONS, 2015):

- Searching for potential suppliers (donors);
- Searching for potential recipients (organisations);
- Matchmaking; and
- Training, knowledge transfer, consulting on both sides.

Any action in Serbia will build upon the existing experience in the sector, both on EU level, where there is rich experience, and on national level, where some initiatives have already been developed. The focus should be initially on lifting the existing barriers such as the legal gaps for food donations and the lack of infrastructure for food collection and distribution (see paragraph 2.3).

The most important challenge is to increase the capacity for food waste donation with subsidies to recipient organisations (e.g. food banks). The funds can be found with international organisations (see chapter 6) or by allocating special CE funds (e.g. Green Funds). Moreover, cooperation and awareness on food donation among stakeholders in the food industry and retail sector should also be promoted, e.g. through organization of workshops.

Some immediate requirements for the tackling of this issue are:

1. Passing the Food Donation Act;
2. Include in the law a list of food that can be donated after its expiry date;
3. The Food Donations Act should abolish the VAT in donations;
4. Amendments to the Food Safety Law that relate to shelf life, for example “use by” could be substituted by “best before”.

BFB’s rich experience in the sector can contribute to the tackling of the barriers analyses in paragraph 2.3.

EU has issued the guidelines on food donation (2017/C 361/01) in order to facilitate compliance of providers and recipients of surplus food with relevant requirements laid down in the EU regulatory framework (e.g. food safety, food hygiene, traceability, liability, VAT, etc.) and promote common interpretation by regulatory authorities in the EU Member States of EU rules applying to the redistribution of surplus food (EU, 2017). These guidelines are a solid base that can be used in Serbia. Some basic insights of these guidelines are presented below.

Article 17(1) imposes on food business operators an obligation according to which they must actively participate in implementing food law requirements and verify that such requirements are met. This general requirement is closely linked to other mandatory requirements laid down by specific food legislation (for instance, the implementation of Hazard Analysis and Critical Control Points Principles (HACCP) in the field of food hygiene).

Therefore, it confers the primary responsibility for compliance with all requirements of food law (EU and national) on food business operators at all stages of production, processing and distribution within the businesses (or activity in the food supply chain) under their control. Given that a food business operator is best placed to devise a safe system for supplying food and ensuring that the food it supplies is safe, it holds primary responsibility for ensuring compliance with food law and in particular food safety. For all activities related to the production and distribution of food they need to assess on a case-by-case basis, the requirements that are appropriate and ensure, amongst others, that food safety and consumer information are not compromised.

Ensuring traceability of foodstuffs at all stages of production, processing and distribution is one of the key obligations imposed on food business operators under the General Food Law in order to protect consumers from any risks associated with the food supply chain and ensure food safety. When a risk has been identified which requires removal of a food from the market, traceability systems ensure that this process can be managed in a timely and effective manner.

As mentioned in the Food donation guidelines issued by EC (2017), food donors in Serbia, who are themselves food business operators, are required to set up a traceability system regardless of whether this food is placed on the market for the purpose of sale or made available free of charge to redistribution and/or charity organisations. Private persons who provide food on an ad hoc basis to the community or other charity events and charity organisations which occasionally receive food from private donors are excluded from obligations related to traceability. Receivers of surplus food, such as redistribution and charity organisations, as for all food business operators in Serbia, must also implement traceability measures needed to ensure safety of the food supply chain.

A good example of a law that instigated food donations on a large scale is coming from France that has become the first country in the world to ban supermarkets from throwing away or destroying unsold food, forcing them instead to donate it to charities and food banks. Under this law, supermarkets with a footprint of 400 sq metres (4,305 sq ft) or more will have to sign donation contracts with charities or face a penalty of €3,750 (£2,900).

7.2. Further CE potential in the Sector

There are several bad practices in the food sector that increase significantly the quantity of food being wasted. Tackling such issues should be the objective of further CE actions in the sector. One very striking example is mentioned in the book ‘Waste – understanding the global food scandal’ by Tristram Stuart (2009). Stuart visited several British farms in order to understand how quality standards affect the level of food waste. Among others, Stuart visited M.H. Poskitt Carrots in Yorkshire, a major supplier to the supermarket chain Asda. At the farm, the author was shown large quantities of out-graded carrots, which, having a slight bend, were sent off as animal feed. In the packing house, all carrots passed through photographic sensor machines, searching for aesthetic defects. Carrots that were not bright orange, had a blend or blemish or were broken were swept off into a livestock feed container. As staff at the farm put it: “Asda insist that all carrots should be straight, so customers can peel the full length in one easy stroke” (Stuart, 2009). In total, 25-30% of all carrots handled by M.H. Poskitt Carrots were out-graded. About half of these were rejected due to physical or aesthetic defects, such as being the wrong shape or size; being broken or having a cleft or a blemish.

Surveys do however show that consumers are willing to buy heterogeneous produce as long as the taste is not affected. For the prevention of food waste of this type, several options exist, such as selling farm crops closer to consumers without having to pass the strict quality standards set up by supermarkets on weight, size and appearance would possibly reduce the amount of rejected crops. This could be achieved through, e.g., farmers markets and farm shops (Stuart, 2009). Also, the creation of markets with second grade items or food donations can help to the same direction.

The last two practices (develop markets for ‘sub-standard’ products or charity organizations arrange for the collection and distribution) can help also tackle one other issue: Disposing is cheaper than using or reusing attitude in industrialized countries leads to food waste. Industrialized food processing lines often carry out trimming to ensure the end product is in the right shape and size. Trimmings, in some cases, could be used for human consumption but are usually disposed of. Food is also lost during processing because of spoilage down the production line. Errors during processing lead to final products with the wrong weight, shape or appearance, or damaged packaging, without affecting the safety, taste or nutritional value of the food. In a standardized production line these products often end up being discarded (UN FAO, 2011).

In general, poor storage facilities and lack of infrastructure cause post-harvest food losses. Fresh products like fruits, vegetables, meat and fish straight from the farm or after the catch can be spoilt in hot climates due to lack of infrastructure for transportation, storage, cooling and markets. For the prevention of this phenomenon, investment in infrastructure and transportation. Government could improve the infrastructure for roads, energy and markets. Subsequently, private sector investments can improve storage and cold chain facilities as well as transportation (UN FAO, 2011).

Waste tracking and analytics programs work on the principle that what is not measured is not managed. This approach focuses on logging discards and potential contributing factors, and aggregating findings to identify patterns and gain insight into the particular practice changes that may be most impactful for the facility in question. The act of tracking itself can draw attention to habitual or unquestioned practices. Further, by treating waste as a puzzle rather than a failing, it can contribute to a climate of openly exploring prevention opportunities rather than one of shame and denial about wastage (Baig, M.B. et al., 2018).

Finally, a lot of things could be done by research in the packaging design of food served in small portions (e.g. in hotels) or the promotion of selling/using products in bulk in some cases. The redesign of current standard practices in the HORECA sector by carefully analysing and meticulously tracking and measuring the food waste produced by each practice can provide several innovative approaches that further promote CE in the sector.

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