Definition of common framework methodology on a waste management in small communities

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1 Introduction

This Deliverable is one of the outputs of Activity 3.4 of the NETWAP Project and it is related to the definition of a methodology for organic waste and plastic management in small communities. This activity consolidates the realization of one of the outputs of the project. The definition of such a methodology is based on previous results from data collection and analysis (Activites 3.1 and 3.2) and also on the high-level political dialogue (Activity 3.3).

The methodology is aimed at defining a new approach for the autonomous and sustainable waste management in small communities and foresees procedures for:

- stimulate waste reduction and boosting recycling;
- promoting local small scale composting and reducing the use of landfills;
- waste collection using low technologies in coastal areas;
- quantify plastic collection and reduce their dispersion in sea water and coast
- quantify resources for waste collection.

During the last decades the sense of community has been depleted and too often our cities and even villages are only a sum of individuals. Strengthening the sense of community is the real advantage for this kind of practice. Community is a group of people that on a voluntary basis joint themselves to give raise to a legal entity to organize around a common aim (i.e. Association, condominium, NGO, … performing a composting activity to produce compost to improve the organic substances of the backyards of the members of the association). The municipality itself is not included in the definition of community but represents an administrative entity of the State.

Even if it is more precisely defined in the next chapters, for the purpose of this report, a “small community” could be intended as one with relatively small permanent population scattered across

the reference territory, that lie quite away from the main logistic routes and which is characterized by a lack of main infrastructures for waste management.

2 Typology of territory

2.1 Geographical/social context

The typology of small community that normally deal with issues on waste management similar to the ones here treated, and which could benefit of the evidences of this document, is represented by a territory (coastal area or an island, but not necessarily) in which there are relevant seasonal economic activities (e.g. tourism). Hence, a context in which there is:

- relatively small permanent population scattered across the territory in small urban and rural areas, with moderate local waste production during most of the year;
- significant seasonal variation in resident population and, consequently, in waste production due to tourist flows.

Contents and evidences of this Deliverable could be therefore useful in those remote locations that, due to the characteristics of the territory, also have limited capacity to metabolize waste flows from relevant economic activities, such as for instance tourism. Locations that, due to this peculiarities, face common challenges in waste management related to: seasonal fluctuation in waste generation, lack of infrastructures (limited or missing treatment plants) and consequent long-distance shipping/transportation of waste, higher environmental impacts and costs. In addition to these issues, other common matters relevant for the considered locations could be the ones related to marine litter and coastal pollution, as in the most insular and coastal areas.

Considering the relevance of the proximity principle in waste management, i.e. the principle according to which waste should be treated as closer as possible to its source point, a "reference context" could be considered the following:

- coastal area or island (but not necessarily);
- total number of inhabitants from few hundreds (200-300) to few thousands (5000-8000) distributed both in small urban and rural areas (with an eventual predominance of the last ones) across the territory;
- appreciable distances between the urban and rural areas placed in the territory;
- significant distance from treatment plants (greater than 20-100 km).

In terms of waste composition and management options, the "reference context" for which the evidences of this document could be considered relevant, could be a context characterized by the following approximate figures:

- total yearly municipal solid waste (MSW) production from tens tons (50-300 t/y) to few thousand tons (2500-4000 t/y);
- main part (60-70%) of total yearly MSW production during summer season;
- mixed municipal waste (EWC number 200301) represents a significant part (30-70%) of the MSW
- biowaste, i.e kitchen waste (EWC number 200108) and yard waste (EWC number 200201) represents one of the largest fraction of MSW (about 25-40%);
- landfilling represents one of the main option for MSW treatment.

2.2 Relevant institutions

Institutions that could use the methodology here presented could be administrative institutions and other Public institutions, as well as touristic operators. Given the national policy and legislative framework for waste management in their territory, eventual users of this document should also always take into account their specific local conditions and existing requirements, as well as specific local, provincial/territorial, or federal regulatory requirements. Moreover, this Deliverable could be also intended as a dissemination tool accessible to researches, technicians or even the general public to gather details on integrated/sustainable MSW management systems for small, remote communities.

2.3 Administrative and Other Public Institutions

Administrative institutions and regulators (Counties, Regions, Municipalities, Cities, …) and other Public institutions (development agencies, nature preservation agencies, MSW management operators, …) could benefit of this document in:

- developing waste management plans, allocate resources, and engage with consulting firms as well as service and technology providers;
- setting waste management policies, issuing permits or licences, and overseeing operations.
- developing public outreach and training materials;
- making incremental improvements to the operation of MSW treatment facility;

2.4 Touristic operators – Hotels, B&B, Touristic boards etc

Touristic operators, such as for instance hotels, B&B, restaurants, campsites, touristic boards, harbours, etc.. could benefit of this document in:

- defining internal waste management strategies;
- implementing waste management best practices;
- choosing specific treatment technologies/option and engage with technology providers;

3 Methodology

3.1 Stimulating waste reduction and boosting recycling

Avoiding and reducing the generation of waste at source is regarded as the highest priority according to the Waste Hierarchy, followed by re-use and recycling of waste. The following sections describe the proposal of a methodology aimed at stimulating waste reduction and boosting recycling through actions by/involvement of the different stakeholder in the territory. Such a methodology is based on measures essentially regarding three different levels, that are:

- Information and awareness of inhabitants and tourists (societal level);
- Legislative acts by local authorities (political level);
- Incentives and disincentives (economic level).

Also another level of intervention, that is the technical one, is very important, in particular for boosting recycling of different typologies of waste. The technical solution proposed in the framework of the NETWAP project, mainly focused on small scale composting and plastic waste collection, are described in detail in the following sections. This section, instead, is aimed at presenting the different issue in terms of waste reduction and boosting recycling and the methodology proposed to address them at the three levels above mentioned.

3.2 Information and awareness of inhabitants and tourists

In any waste management program, public awareness and participation represents a critical component, as well as others like appropriate legislation, strong technical support and adequate funding. Information and awareness-raising is crucial to stimulate changes in perceptions and habits of the public (inhabitants and tourists) and to encourage a real change towards more sustainable waste management practices, thus effectively and practically implementing the Waste Hierarchy.

Rationale: inform, educate and motivate inhabitants, tourists and also other stakeholders in the territory about the importance of not generating waste, through reduction, fostering sustainability, promoting responsible consumerism and prevention in all relevant areas of life and thus influencing positively their behaviors.

Relevant stakeholders: Local Authorities, voluntary environmental associations, hoteliers, restaurateurs, beach facilities managers

A non exhaustive list including some examples of relevant model actions regarding this specific theme is reported below:

- Thematic awareness-raising campaigns;
- Dissemination of informative material (leaflets, good practices guidance, etc.);
- Creation of networks among public institutions, voluntary environmental associations and citizens to involve the local community;
- Organization of recycling/re-use and awareness-raising laboratories;

– Pilot activities regarding specific typologies of waste in touristic beaches.

3.3 Legislative acts by local authorities

Local competent authorities are in charge with responsibility for planning, overseeing and controlling the management of wastes in their territories, according to higher order legislation. Therefore, they have to adopt waste management plans and strategy to ensure that there is a sufficient network of safe and legal waste disposal and recovery facilities to deal with the waste generated. Moreover, local authorities can use their legislative instruments to face specific critical issues to which their local ecosystems are the most sensitive and damaged by.

Rationale: adoption of legislative acts (law, ordinance, resolutions, etc.) by local authorities to ensure a correct management of specific typologies of waste and thus preventing the potential related damage to the local ecosystems

Relevant stakeholders: Competent Local Authorities (Regions, Municipalities), waste management companies, other service providers

A non exhaustive list including some relevant examples regarding this specific theme is reported below:

– ban on disposable plastic tableware (cutlery, plates, straws, glasses, bags and any disposable container);
– ban on plastics into the beaches;
– ban on cigarettes into the beaches;

- ban on single use packed food;
- ban on single use items.

3.4 Incentives and disincentives

As already stated, in any waste management system, the role of consumers represents a relevant component. Even if the major driver could be represented by a real belief in the benefits of waste reduction and recycling, the implementation of specific economic drivers to influence (and enhance) consumers' behaviors is another way to facilitate the achievement of a sustainable waste management. The financial incentive schemes that could be implemented to facilitate waste reduction and recycling, as prerequisites to attain specific waste management objective, are various and each local authority could apply the one(s) more suitable for its territory.

Rationale: defining rewards, penalties and pricing standards for several types of waste materials to stimulate more sustainable waste management practices

Relevant stakeholders: Local Authorities (Regions, Municipalities), waste management companies, ...

A non exhaustive list including some relevant examples regarding this specific theme is reported below:

- municipal taxes reduction for bathing facilities, little shops and supermarkets that adopt sustainable waste management practices;
- "pay as you throw" schemes with electronic identification and pricing system for the billing of waste charges;

- rewarding recycling stations (vouchers, public transport tickets, ...) for materials like glass, metals, plastics;
- "plastic free" bill;
- deterrent measures and sanctions in order to discourage negative behaviors.

3.5 Promoting local small scale composting and reducing the use of landfills

Small scale composting can be considered as a potential major opportunity for managing biowaste in those geographical areas where remote and small communities (islands, mountain, rural villages, etc.) lie away from the main logistic routes and deprived of a highly developed industrial infrastructure. In these cases, the municipal waste management companies have to employ costly waste collection and transportation systems while initiatives of small scale composting of biowaste could represent a cheaper and more sustainable alternative.

3.6 Auto-composting

Description: Treatment of bio-waste generated by individual subject (economical activities such as restaurants, campsites, hotels, canteens, etc.) or household in his own backyard. It implies usage of the resulting compost by the producer itself. Auto composting offers the possibility of a construction of the knowhow and of the capability to cope with your own waste. This practice can be viewed as part of a growing diffusion of do it yourself (DOI) and more in general the desire to control the things around us. It can be an occasion to change the way we look at our food, the soil protection, the recycling. Therefore, compost produced by auto composting is not a commercial product and the producer is not allowed to put his compost on the market. Compost from auto composting is not considered a fertilizer and is not subject to the Regulation (EC) No. 2003/2003 of the European Parliament and of the Council relating to fertilizers.

The required/allowed equipment to carry out auto composting depend on the typology of beneficiary and is reported in Table 1.

Table 1 . – Equipment for auto composting

Beneficiary	**Equipment**
Household	Domestic composter
	Farmyard animals feeding
Small business/enterprise such as: restaurant, hotel, harbor, campsite, …	Domestic composter
	Electromechanical composter

Relevant stakeholders: municipality, touristic infrastructures (hotel, restaurants, campsites, b&b…).

3.7 Community composting

Description: Usage of the composting-at-source technique so that bio-waste generated by several individuals, families or generators is jointly treated in a single module, within a common area purpose-set. It implies usage of the resulting compost by the producers or, at least, by some of them . All the above mentioned subjects are associated under a common organisation named “collective (or joint) entity”. Guidelines for specifications on composter can be found in the Chapter 4/Annex IV resources specifications, along with the equipment recommended for such a method.

Relevant stakeholders: free citizens associations, NGOs, municipality, touristic infrastructures (hotel, restaurants, campsites, b&b…)

3.8 Local Composting

Description: small composting plant provided with most but the input capacity of a larger industrial plant. Contrary to other approaches, bio waste is delivered by the waste collection system and not by the producer. The resulting compost can be used by anyone, not only the producers, it can be sold, given for free or used as component of a more sophisticated fertilizer. The public authority at local level (typically the municipal administration) is directly accountable for the management of the composter. When experience and confidence from citizenship has been acquired, the municipal administration can decide to allow citizens and local commercial operators of the territory (restaurants, hotels,…) to directly and autonomously drop off their biowaste into the composter, and consequently saving the money for the biowaste collection service.

3.9 Application limits for each practice

The application field of each activity is related to the amount of biowaste yearly treated. Table 2 reports the corresponding limits adopted in Italy for the various schemes of small scale composting. These limits could be a useful basis of discussion for Croatian public authorities and stakeholders once completed the pilot actions of the project.

Table 2. - Application field for auto, community, and local composting in Italy.

Activity	**Italian legislation limits**
Autocomposting	nothing
Community composting	< 130 t/year
Local composting	<80 t/year

3.10 Administrative scheme definition for auto- and community composting

This paragraph briefly outlines some administrative steps that are supposed to be carried out in order to introduce small scale composting practices in the frame of the waste management organization of the municipality. Local composting is not considered because it is directly managed by the local waste management company, which is already authorised for biowaste management.

3.11 Register of composting operators and community composters

Auto composting can initially be seen as a voluntary and solitary practice. The adoption of a public compost register can transform this practice into a collective commitment with a municipal governance and support.

For this reason, the citizens and economical activities should be asked to voluntary register their involvement in the public compost register which should be the base for a public composting program.

Municipality should ask their citizens and economical activities to join the register through a public awareness campaign.

Also the community composting can be activated if the following requirements are fulfilled:

- The community should be a legal entity. In other words, it should have a formal constitution as, for example a condominium, an association or a consortium;
- A legal representative exists;
- One or more operators are appointed to manage the composter;
- Address of the site hosting the composter;

- The total material processed annually does not exceed 130 t/year;
- If the total material processed annually exceeds 10 t/year, then an electromechanical composter is used;
- The list of the members (single households or economical activities), enrolled in the community composting activity, are transmitted with the addresses of the participants.

The operators appointed to manage the composter must follow the training for Master Composter, if the composter is an electromechanical device then an adjunctive training should be carried out by the supplier company of the composter.

If there is not a "pay as you throw" based fee it should born in mind the organic waste public collection is suspended for the user enrolled in the register.

3.12 Local composting

For local composting a threshold for the definition of small plant should be stated. In other words what we intend for small. In Italy this threshold is legally 80 tons/year even if there were attempts to upgrade this threshold up to 250 tons/year. For the moment we suggest to keep the maximum annual capacity to 80 tons/year. For local composting it is important to nominate someone as a conductor. By conductor we mean every person in charge of managing an equipment like, in our case, the small plant. This professional figure should follow the "Training Master Composter" course (see below) plus an adjunctive training carried out by the supplier company of the composter (at least 2 hours). According to the Italian National law, the municipal administration, informs the Regional Agency for Environmental Protection (public technical institution which is accountable for environmental controls) about the description of local composting in the municipal territory asking for a positive opinion.

3.13 Control/monitoring/inspection program

Users enrolled in the public register should be randomly visited by the public authorities in order to offer support and to check the effective practice of composting. This kind of inspections are carried out by a team equipped with instrumentation able to support the control/support. The team is appointed by the municipality.

If the composting is not carried out by the inspected user, then its name is cancelled from the register.

At least 5% of the enrolled users should be annually visited.

3.14 Incentives program: economic benefits for the users

It is important that a consistent part, if not all, of the economical saving, produced by the auto or community composting practices, is given back to the users. This amount could be given to the final user in the form of:

- Discount over the tax/fee for the waste management service;
- Direct payment by means of a bank check once a year.

While the two options regard the same amount of money the last one is more effective under a psychological point of view.

In the following we assume:

- the cost of the waste management is entirely covered by the user's fee;
- the service is based on separate collection.

A first view for the cost of the waste service brings to identify two main voices of cost:

- Direct waste management, including collection, transportation to a treatment plant and eventually landfilling of the waste produced by single users;
- Indivisible charges, including administrative costs, street sweeping, public park and gardens etc.

A first estimation brings to the following conclusions:

- The two costs are mainly of a similar amount (50% each);
- The cost for organic waste represents about 50% of the cost for separate collections.

Thus, when the waste management is based (as it should) on separate waste collection, a base line for the estimation of the savings is around 25% of the total expenditure.

If the fee is built over a “pay as you throw” approach, then the computation of the saving amount is straightforward. As a matter of fact with this approach the amount of waste, of a single user, is weighted (often as volumes) and the user’s identity registered for each picking. As the cost of collection and treatment is known, it is easy to compute the amount of saving for a single user.

The “pay as you throw” approach forbids that the user could keep benefitting the organic waste withdrawal by the waste management collection company if the user is enrolled in the composter user register.

With other schemes of payment, in general, a 20% discount on the total waste fee should be on average recognized while the other 5% of the saving kept to support inspections, training and awareness building campaigns.

Because auto composting could be diffused (more expensive) in comparison of community composting, where it is possible to assume that the users are concentrated (more saving) at a neighbourhood level, some slightly different levels of discount could be suggested for the waste fee:

- 15% single auto composter;
- 20% community composter.

This kind of benefits should be clearly stated in the municipal waste regulation.

Local composting can also be benefitted with savings for waste tax payments in case the municipal administration manages to remove the biowaste collection service, allowing households and local operators to drop off autonomously their biowaste to the composter. These reduction depend on the achievable savings.

A concept flow-chart for the application of the above mentioned suggested schemes is reported below.

3.15 Master Composter training

Master Composters are highly skilled composter operators who educate and enthuse the public about the benefits and methods of composting. The Master Composter Program includes training sessions both in the classroom and through volunteering in the community. The responsibility for a Master Composter consist of:

- Attending meetings to plan events, share information and prepare for presentations;
- Planning and co-teaching classes, performing slide shows and composting activity demonstrations;

- Setting up and staffing interactive compost displays at community events;
- Assisting neighbourhood with composting at their sites;
- Creating fact sheets or posters, write articles for the public, promote composting on social media.

The Master Composter Program includes:

- Theory (4 hours):
  - Fertilizers and soil amendments;
  - the composting process;
  - composting tools;
  - monitoring and control parameters;
  - legal aspects;
  - use of compost;
- Laboratory measure (2 hours) : pH, temperature, humidity, density, free air space.

The prerequisite for participating are:

- Basic interest in composting and community outreach;
- Curiosity to expand understanding of the composting process;
- Enthusiasm to share compost knowledge and skills with others;
- Good communication skills – verbal or written;
- Willingness to participate in a variety of Program-sponsored events;
- Ability to honor the minimum time commitments to the Program.

3.16 Waste collection using low technologies in coastal areas

Short introduction

Plastics from beach or marine litter is associated with European Waste Catalogue (EWC) Number of 20 03 03 (residues from street and beach cleaning). On the other hand, plastic waste of municipal waste collection can be sent to a material recovery facility (MRF) only if it is classified under these EWC: 15 01 02 (packaging - including separately collected municipal packaging waste) or 20 01 39 (separately collected fractions - except 15 01). Nevertheless, whichever plastic item found on the beachside and included in the marine litter, can technically be recycled for the same reasons as waste plastic packaging collected by separate collection. Therefore, waste plastics from marine litter should be properly treated so that they can be sent to a MRF.

In fact, every initiative where volunteers, members of environmental friendly associations and even the waste collection service provide beach cleaning actions, waste plastics are not directed to recycling.

3.17 Best practice for prevention of waste production and marine litter management

The following procedure has been set to organise collection and valorisation of waste plastics collected from beach and marine litter.

1. The materials found on beaches have their own path, according to their composition and nature. Considering that, it is necessary to specify that the majority of beached debris are deposited along the coasts during sea storms.

2. Vegetable biomasses (wood, reed canes, seagrass wrack) should be prioritized to be retained on the beach to promote an ecological beach model. As second option, they should be moved to the backshore to protect the foot of the dune from wind, waves and storm surges

3. Waste should be removed periodically, thus insuring a clean environment that supports the conservation of ecosystems and pristine decorum of the coastal landscape. Waste of anthropogenic origin (plastics etc.) should always be collected before displacement of vegetable biomasses. Waste collection should be carried out manually by operators (volunteers or staff of companies responsible for collection), directly along the shores (both sandy and rocky). If the piles of marine biomass result in a large amount, waste separation can also be assisted by specific mechanical equipment.

4. Mechanized beach cleaning operation brings about the mixing of the waste with natural resources which in turn leads to the increase of urban waste production and prevent the sustainable use of beached vegetable biomass.

5. The mechanized cleaning of beaches should be regulated distinguishing natural and anthropized beaches, where roads, cliffs, sea-walls are extraneous elements; in these cases small temporary construction sites or the use of crawlers or wheeled vehicles would be useful for the separation of waste, beached biomass and sediment. This approach should be implemented in a manner that does not increase the anthropic pressure on the ecosystem.

6. In situ human use of beached plant biomass and sediment must not favor exploitation of natural resources but can generate many social, economic and environmental advantages.

Therefore, due to the specifics of locations, a “case by case” approach should be undertaken for the assessment of sustainable management in accordance to National legislation. If the legislation is non-existent we propose it should be defined as soon as possible.

7. The collection of waste from coastal areas should be carried out manually in order to separate different types of plastics as well and increase the separate collection of plastics. Therefore, it is suggested to collect 3 categories of materials:

a. Nets used for mussel farming may be mechanically recycled according to the experimental treatment specifications outlined in Deliverable 5.1.3. has an EWC 20 01 39 code;

b. Other plastics, usually mixed and deteriorated, cannot be mechanically recycled, but must be treated according to the schematic description in Deliverable 5.1.3; for their management also this category has an EWC 20 01 39 code;

c. The remaining material will be classified as "residues from street and beach cleaning" with EWC code 20 03 03

8. Complementary services can include selective waste collection along the coast. Coordination of periodic cleaning actions operated by volunteers, associations and the services provided by local authorities that periodically collect and transport waste should be promoted. All events that involve volunteers should also include and promote the value of informal and non-formal education which can be implemented through these events.

9. During the cleaning events, volunteers and workers can drop off the material to "green islands" specifically distributed along the beach during the summer months, in order to avoid problems of EWC code attribution to the collected waste. Alternatively, operators can deliver the collected material to the nearest collection point or beach resort. Both the options described above could increase the percentage of separate/recycling collection of non-domestic users.

10. Volunteers should be trained to collect the different fractions of waste and separate them. If necessary, they may perform some preparation work such as washing or separation from the sand. Sediments must not be removed from the beach.

11. All sandy material and vegetable biomasses that should be recovered during the treatment must be separated, preserved and they are a common asset owned by the community and not by the management body of the treatment plant. Therefore, at the end of the process, they must be returned to the beaches with no cost for the public administration and without additional income for the owner of the treatment plant.

4 Concluding remarks

Enclosed to this deliverable some annexes that explain in detail the regulatory schemes of small scale composting and techniques of valorisation of plastics are reported.

In particular as far as the small scale composting is concerned the following annexes follow:

1) Facilities used in small scale composting
2) Regulation scheme for community composting to be issued by a municipal administration (in english)

3) Regulation scheme for local/communal composting to be issued by a Croatian municipal administration (in english);
4) Resolution of local composting regulation issued by Fossalto municipal administration (in italian);
5) Regulation scheme for autocomposting to be issued by a municipal administration (in english);
6) Vademecum for optimisation of marine litter prevention of beached waste production and management issues