



CLIMA

CLEANING INNOVATIVE MEDITERRANEAN ACTION

TOWARD AN INTEGRATED MUNICIPAL WASTE MANAGEMENT PLAN 2.0

LESSONS LEARNT, STRATEGIES, CHALLENGES AND PRACTICAL GUIDING



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The 2014-2020 ENI CBC Mediterranean Sea Basin Programme is a multilateral Cross-Border Cooperation (CBC) initiative funded by the European Neighbourhood Instrument (ENI). The Programme objective is to foster fair, equitable and sustainable economic, social and territorial development, which may advance cross-border integration and valorise participating countries' territories and values. The following 13 countries participate in the Programme: Cyprus, Egypt, France, Greece, Israel, Italy, Jordan, Lebanon, Malta, Palestine, Portugal, Spain, and Tunisia. The Managing Authority (MA) is the Autonomous Region of Sardinia (Italy). Official Programme languages are Arabic, English and French. For more information, please visit: www.enicbcmed.eu.

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INTRODUCTION

Embracing the Zero Waste Paradigm: Municipal Waste Management for a More Sustainable Future

The Zero Waste approach represents a comprehensive strategy that redefines our relationship with waste and envisions a future where waste generation is minimized, resource recovery is maximized, and a circular economy flourishes. It advocates for a shift away from the linear “take-make-dispose” model towards a system that prioritizes waste prevention, recycling, and the redesign of products and processes.

Across the Mediterranean region, numerous networks and municipalities have embraced and championed the Zero Waste approach, leading the way in sustainable waste management practices. For instance, the Zero Waste Europe network has been instrumental in promoting and supporting zero waste initiatives throughout the continent, advocating for policy changes and providing technical expertise.



Mediterranean municipalities, such as Capannori in Italy, Penela in Portugal have become inspiring examples of successful zero waste communities. These municipalities have implemented comprehensive waste reduction and recycling programs, encouraging citizen participation, fostering local partnerships, and

investing in infrastructure for effective waste separation and treatment.

Moreover, the Mediterranean Zero Waste Network has emerged as a platform for collaboration and knowledge-sharing among municipalities committed

to the zero waste paradigm. This network enables municipalities to exchange experiences, learn from best practices, and collectively work towards a common goal of waste reduction and sustainable resource management.

At the municipal level, the zero waste approach holds immense importance. Municipalities are at the forefront of waste management, responsible for designing, implementing and promoting strategies that can

effectively address waste challenges within their communities. By adopting the zero waste approach, municipalities can significantly reduce waste sent to landfills, minimize environmental pollution, save resources, and create new economic opportunities through the development of circular economy practices. The CLIMA project exemplifies this commitment to the zero waste paradigm at the municipal level. Through the project, municipalities in Italy, Tunisia, and Lebanon



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developed integrated Municipal Waste Management Plans, incorporating specific measures to manage organic waste, establish ambitious waste reduction targets, and promote the reuse of organic components.

By sharing knowledge, collaborating with local businesses, enhancing composting infrastructure, and conducting awareness campaigns, these municipalities are leading the way towards a more sustainable future. Their efforts within the CLIMA project demonstrate the potential for municipalities to play a pivotal role in shaping waste management practices and driving the transition towards

a zero waste society.

As we delve into the journey of transformative waste management within the CLIMA project, let us be inspired by the exemplary networks and municipalities in the Mediterranean region that have embraced and promoted the zero waste approach. Together, we can envision a future where waste is viewed as a valuable resource, and where municipalities serve as beacons of sustainable waste management, fostering thriving communities and preserving the beauty and integrity of our planet.

Zero Waste Theory and Approach... for Dummies

Zero Waste is a philosophy and design framework for communities, CSOs, but overall, for Municipalities ready to promote not only reuse, recycling, and conservation programs, but also, and more importantly, emphasizes sustainability. It is a holistic approach since it takes into consideration the entire life-cycle of products, processes, and systems, and it aims to impact individual, collective and territorial way of lives, including the economic and production systems.

Elaborated in the 70's, but widely re-discovered in the 90s, it is an approach adopted by an increasing number of actors and tested in a larger number of territories. One of the most attractive sides of such theory is its transformative and incremental nature: passing from conceiving Zero Waste not an utopic goal but a perspective to progressively target by completely re-thinking the way we look at the waste, is becoming a necessary

challenge to face, especially for local authorities. Today, in the whole world, there are territories which are adopting such approach and reaching results very close to the Zero Waste Goal, proving that such perspective, if correctly and pragmatically adopted as a state towards which to strive, is not out of the reality.

Paul Connet, was of the founders of the Zero Waste Theor, conceived and schematized the Zero Waste path with 10 steps, to be participatory tailor . The 10 steps are, as follows:

- 1) Source Separation
- 2) Door to Door Collections
- 3) Composting
- 4) Recycling
- 5) Reuse, Repair and Community Centre
- 6) Waste Reduction Initiatives
- 7) Economic Incentives
- 8) Residual Separation and Research Centre
- 9) Industrial Responsibility
- 10) Temporary Landfill

Background on the three municipalities from Italy, Tunisia, and Lebanon

This publication represents the final product, an overview, and as well 'a baton to pass' after the waste management efforts undertaken in and by three municipalities as part of the CLIMA project, a collaborative initiative implemented within the framework of the EU-funded programme ENI CBC Med 2014-20. The project's regional platform brings together municipalities, public agencies, and NGOs from Italy, Tunisia, and Lebanon to address the pressing environmental, economic, and social challenges associated with organic waste mismanagement.

The three municipalities involved in this groundbreaking project are Mahdia in Tunisia, Bickfaya in Lebanon and Sestri Levante in Italy. Each municipality represents a unique context, yet all share a common commitment to sustainable waste management and the principles of a circular economy.

Through the CLIMA project, these municipalities have developed integrated Municipal Waste Management Plans, introducing specific measures to effectively manage organic waste and establish targets for waste

reduction and organic component reuse. Additionally, the project has focused on enhancing composting sites, empowering local businesses in the circular economy sector, and conducting extensive awareness-raising and educational campaigns.

Through this collaborative endeavor, these three municipalities have become beacons of sustainable waste management, driving positive change in their respective regions. By reducing the risks of unsafe waste disposal, fostering cross-border knowledge exchange, and creating new opportunities for businesses utilizing organic waste, the CLIMA project has set a promising precedent for future environmental cooperation in the Mediterranean.

Mahdia is a city located in Tunisia, known for its tourism and economic activities. The city experiences a significant increase in population during the summer months due to tourists and vacationers, resulting in a higher waste generation rate. The municipality of Mahdia expanded its boundaries after the decentralization of the country in 2016, incorporating small villages and

scattered residences. The cleanliness services in Mahdia are organized under the Sub-Directorate of Hygiene and Waste Management, which includes departments dedicated to waste management, green spaces, and hygiene. The municipality operates a fleet of vehicles for waste collection and municipal works, but there are logistical challenges, such as the absence of GPS systems and the distance between the worker's call point and the equipment yard. Mahdia, faces challenges in waste management due to the absence of a controlled landfill or transfer center. Waste disposal is carried out in a vacant lot, which is not an ideal solution. The municipality relies on voluntary drop-off and door-to-door collection methods, but these methods only account for a portion of the waste collected. There is a need to improve waste management infrastructure and increase efforts in source separation. Sestri Levante is a municipality located in the Liguria region

of Italy. Waste management practices in Sestri Levante are governed by national and regional regulations, and waste data is collected and processed by various public entities responsible for waste management information. The municipality has a higher per capita waste production compared to the national and regional averages. However, the waste management system in Sestri Levante has been successful in increasing the interception of recyclable materials through separate waste collection. The municipality follows regional regulations in calculating recycling and separate waste collection percentages, with specific targets set for waste management. The waste management data in Sestri Levante is regularly updated and revised based on evolving regulations and guidelines.

The Integrated Waste Management Plan... for Dummies

The Integrated Waste Management Planning can be defined as a participatory process, elaborating priorities and targets to be met in order to reduce the production of waste and to increase the reuse of organic component.

It is a process led by Local Authorities, usually Municipalities, since they are institutionally in charge of the elaboration, implementation and monitoring of the Waste Management Plan and related policies as well as services. The particular feature of an Integrated Waste Management Plan is to entail the participation of a various series of actors, from the citizenship, CSOs and more informal Groups, to the private sectors and technical expertise.

Following the experience of the CLIMA project, the Integrated Waste Management Planning usually implies some key steps, as follows:

- 1) External and Internal SWOT analysis of the existing Waste Management Plan and/or policies adopted and validated (WMP)
- 2) Participatory selection of outputs and measures to be integrated in the Waste Management Plan (i.e. Door to Door collection, Pay As You Throw system, Community Compost)
- 3) Feasibility Study of the selected outputs/measures and selection of the technical procedures, means and resources to make it adoptable in the plan
- 4) Integration of the plan and discussion with sample of technical and citizens' groups
- 5) Validation of the IWMP according to the local procedures, in order to commit the Local Authorities, and to strengthen the co-responsibility of the stakeholders implied along the elaboration process

Sestri Levante faces challenges in managing its higher per capita waste production compared to the national and regional averages. The municipality has been successful in increasing separate waste collection and recycling rates, but there is a continuous need to meet and exceed regional targets. The waste management system needs to adapt to evolving regulations and guidelines to ensure efficient waste management practices.

Bickfaya is a town located in the Matn district of Lebanon. The municipality follows the guidelines outlined in LAW Number 80 - Integrated Solid Waste Management. Bickfaya has various NGOs, associations, and institutions that contribute to community development and engage in environmental activities. The municipality manages waste collection and treatment at the Bi Clean facility without the assistance of a private contractor. Waste generation in Bickfaya experiences small seasonal

variations, with higher quantities observed during the summer season due to the influx of tourists.

The municipality handles municipal solid waste, including household and commercial waste, and has established a waste management plant to promote waste sorting at the source. The facility serves as a secondary sorting facility and handles waste from Bickfaya as well as a neighboring village. The municipality of Bickfaya actively collaborates with NGOs, associations, and institutions to address waste management challenges and promote environmental awareness in the community.

Bickfaya faced significant waste management challenges after the closure of a landfill site in 2015 and turned the problem into a challenge towards innovation on waste

management. To address the crisis, the municipality established Biclean, a sorting center, and launched an extensive education campaign to promote waste sorting and recycling. However, they encountered difficulties in managing organic waste, as there were no means belonging to the municipality finalized at treating organic material. To overcome this, the municipality was able to take part to the CLIMA project which secured the establishment of a municipal compost site at Bickfaya. Collaboration with neighboring municipalities was also pursued to optimize organic waste management. Despite limited expertise and resources, Bickfaya demonstrated the importance of local leadership and community engagement in finding solutions and establishing sustainable waste management practices.

Objectives and scope of the publication

This publication aims to share experiences and best practices from the CLIMA project, focusing on three municipalities from different countries. The target audience includes public and private entities, particularly Mediterranean municipalities seeking to improve waste management and adopt the zero waste approach. By providing guidance, showcasing different starting points, and sharing vital information, this publication aims to inspire and support practical steps towards the transition to zero waste.

Exploring Paths to Zero Waste

The publication delves into the journey of municipalities towards zero waste and highlights the diverse paths taken. It sheds light on the processes involved, emphasizing the importance of proper planning, stakeholder engagement, and setting clear goals. By showcasing successful strategies and lessons learned, the publication offers valuable insights into waste reduction, recycling, composting, and other waste management practices.

Learning from Experiences

Drawing from the experiences of the three municipalities involved, this guide presents a comprehensive and very practical overview of the challenges encountered and the solutions implemented. It emphasizes the need for financial and non-financial resources to support waste management initiatives, including infrastructure development, public awareness campaigns, and capacity building. The publication also highlights the importance of collaboration between public and private entities, fostering a supportive ecosystem for sustainable waste management.

Guiding the Path To assist other

municipalities on their Zero Waste journey, the aim of this publication is also providing guidance, by outlining the key steps involved in developing an integrated waste management plan, including data collection and analysis, goal setting, policy formulation, and implementation strategies. Additionally, it emphasizes the significance of continuous monitoring and evaluation to ensure the effectiveness of waste management practices. By offering a roadmap and sharing lessons learned, this publication aims to facilitate the transition to zero waste and foster environmental sustainability.

In conclusion, this guide serves as a valuable resource for Mediterranean municipalities aspiring to improve waste management practices and embrace the Zero Waste approach. By sharing experiences, best practices, and practical guidance, it aims to inspire and support others on their journey towards sustainable waste management. Through collaboration, innovation, and a commitment to environmental stewardship, municipalities can make significant strides in reducing waste, promoting recycling, and creating a more sustainable future. Let this publication be a source of inspiration and practical support for the transition to zero waste, bringing about positive change for both the local community and the environment.



MUNICIPALITIES PROFILE

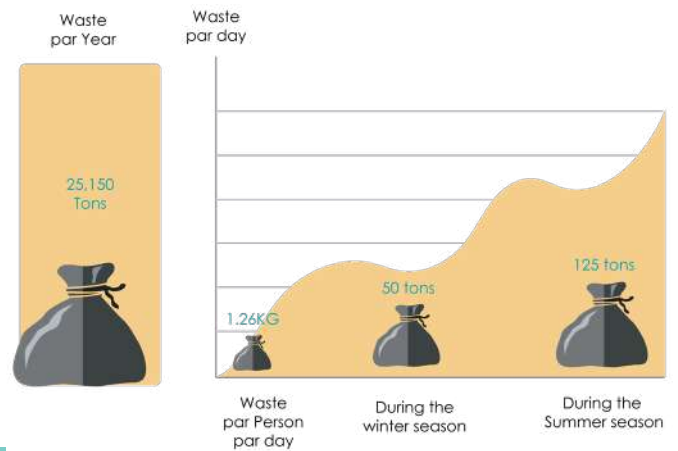
Profile of each municipality, including their current waste management practices, waste generation data, and other relevant information

Mahdia, Tunisia

Waste collection in Mahdia is partly organized and regulated, with collection taking place in the morning and evening. However, a portion of the city's waste collection is outsourced to private companies, which operate in the evening. During the winter season, an estimated 50 tons of waste are collected. However, during the summer months (June, July, and August), Mahdia experiences a significant increase in population due to tourists and vacationers, resulting in a multiplier effect of 2.5 on the population. Consequently, waste generation increases, reaching approximately 125 tons per day during the three summer months. The total annual municipal waste generation in Mahdia is approximately 25,150 tons. The average specific waste generation rate per capita is 1.26 kg/person/day, which is relatively high compared to the

national average. This can be attributed to the dynamic tourism and economic activities in the city.

Waste collection in Mahdia



The most efficient waste collection method in Mahdia is voluntary drop-off, utilizing collective containers of 770 liters and 340 liters, as well as compactor trucks. Door-to-door collection using tractors or tipper trucks covers a significant portion of the city, but it accounts for only 25% to 30% of the total waste collected. Additionally, around 5% of the waste is collected through sporadic cleanliness campaigns.

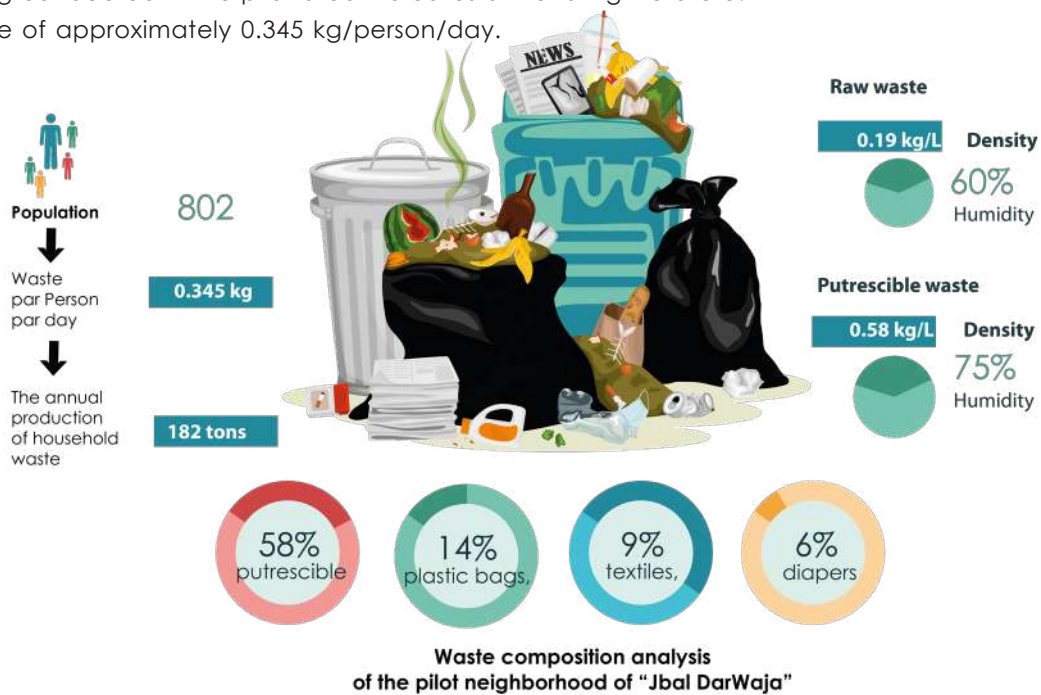
The average of the waste collected by different collection methods



The municipal boundaries of Mahdia expanded after the decentralization of the country in 2016, increasing the radius to 9 km. Several small villages and scattered residences joined the Mahdia municipality, with the largest settlements being Chiba, Dkhila, and Ouled Ammar.

The waste composition analysis conducted in the neighborhood selected as pilot area of the separated waste collection reveals that 58% of Jbal DarWaja's waste (where the CLIMA project start piloting the separated waste collection) is putrescible, followed by plastic bags, textiles, and diapers at 14%, 9%, and 6%, respectively. Waste weighing conducted in the pilot area indicates a production rate of approximately 0.345 kg/person/day.

With a population of 802 in Jbal DarWaja, the annual production of household waste is estimated to be around 182 tons, distributed among different waste categories. Further analysis reveals a density of 0.19 kg/L for raw waste and 0.58 kg/L for putrescible waste. Based on these findings, a production rate of putrescible waste of approximately 2.5 liters/person/day is determined for Jbal DarWaja. The chemical analysis of waste from Jbal DarWaja highlights higher organic matter content (COT) in putrescible waste (75% humidity) compared to raw waste (60% humidity). Surprisingly, the heavy metal content is higher in the organic fraction, contradicting existing literature.



The Municipal cleanliness services in Mahdia are organized under the Department of Hygiene and Waste Management, which comprises three sub-departments: Waste Management, Creation and Maintenance of Green Spaces, and Hygiene. The municipal vehicle fleet and maintenance workshops are managed by an independent department. The municipal vehicle fleet consists of 29 vehicles, including compactor trucks of various capacities, tipper trucks, and agricultural tractors. Six vehicles are dedicated to household waste collection, seven for demolition waste and garden waste during cleanliness campaigns, and the remaining five for general municipal works, public lighting, and green spaces. The fleet does not currently have GPS systems. The condition of the vehicles is relatively good, with ongoing efforts to renew and modernize the fleet by acquiring new equipment.

A newly constructed municipal equipment yard in the Rejiche Industrial Zone serves as a maintenance, repair, and washing facility for the municipality's vehicles. However, the location of the worker's call point is far from

the equipment yard, situated in the EZZAHRA District. In terms of waste pre-collection, citizens in Mahdia present their waste in various forms, depending on the collection method. For door-to-door collection, there are no specific standards for the containers used by citizens. Some use bags, buckets, or bins, while others leave waste in bulk on the sidewalks or empty spaces.

According to data from the cleanliness service, the municipality has provided approximately 203 voluntary drop-off containers for citizens, including 143 metal containers and 60 plastic containers, with capacities of 770 liters and 360 liters. The majority of these containers are placed on public roads, but a significant portion is also located near hotels and public establishments.

The condition of the containers is often mediocre, particularly those placed on roadsides. Out of the total containers, only 23 are in good condition, 83 are in average condition, and 97 are in poor condition. There is currently no container washing program in place. Container locations often become problematic

as they are frequently insufficient in capacity, and non-household waste can be found around them. Based on the collected data, 91 containers require replacement, and 5 additional containers need to be added.

Waste collection and transportation for household and similar waste in Mahdia are partially handled by the municipality itself and partially for household waste collection and manual outsourced to a private company responsible for sweeping. Collection takes place in the morning starting at 7 AM and in the evening starting at 7 PM. The municipal services operate by zone or sector seven days a week.

A combination of door-to-door and voluntary drop-off methods is implemented in most collection areas, except for the tourist zone, where containerization is fully utilized.

Sestri Levante is a municipality located in the Liguria region of Italy. The current waste management practices in Sestri Levante are governed by national and regional regulations. The waste data is collected and processed by the ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale) and other public entities responsible for waste management information.

The Waste Registry, established by law, ensures comprehensive and up-to-date information on the production and management of municipal and special waste. The data on urban waste is acquired through questionnaires sent to various public entities involved in waste management, including Regional and Provincial Agencies for Environmental Protection, Regions, Provinces, and Waste Observatories.

If the requested information is not available, ISPRA estimates the waste production data using a standardized methodology based on the population of each municipality. The waste data is divided into different population ranges, and the average per capita production values are determined for each range. The quantity of non-differentiated urban waste is calculated by subtracting the data on separate waste collection and bulky waste from the total waste production.

In terms of waste generation, Sestri Levante has significantly higher per capita waste production compared to the national and regional averages. In 2019, the per capita total waste production was 652 kg/person/year, exceeding the average for the province of Genova (501 kg/person/year), the Liguria region (533 kg/person/year), and the national average (498.35 kg/person/year).

In terms of street sweeping and weeding, the municipality employs teams of around a dozen workers during the morning session. Mechanical sweeping is conducted in the evening. As a tourist city, Mahdia places great importance on beach cleaning and ensuring a consistently clean environment. In addition to installing beach bins and containers for collecting plastic bottles, the municipality annually tenders contracts for cleaning the tourist zone (tourist circuit and city entrances) and beaches, employing 16 workers, 6 wheelbarrows, and a tractor.

The APAL (Agence de Protection et de l'Aménagement du Littoral) also conducts beach sifting starting in April.

Sestri Levante, Italy

The waste management system in Sestri Levante has been able to increase the interception of recyclable materials through separate waste collection. In 2020, the system managed to collect 432 kg/person/year of recyclable materials, compared to 262.1 kg/person/year in 2017. This indicates a positive trend in waste separation and recycling efforts.



The calculation method for recycling and separate waste collection percentages in Sestri Levante follows regional regulations.

The Regional Law No. 20/2015 sets a minimum target of 65% separate waste collection, with penalties for exceeding the limit. The Law also introduced a recycling target of 45% for the period 2016-2019, except for the city of Genova, which had a target of 40% until 2020, when it was raised to 65%. Failure to meet these targets results in additional costs for waste disposal.

According to the waste census data of 2022, Sestri

Bickfaya is a town located in the Matn district of Lebanon, follows the guidelines outlined in LAW Number 80 - Integrated Solid Waste Management. According to Article 11 of the law, each local administration, including Bickfaya.

Bickfaya is home to various NGOs, associations, and institutions that primarily focus on humanitarian activities. Some notable organizations include Message de paix, which provides support to adults with special needs, Phénix Group Homes, offering residential care for individuals with mental disabilities and behavioral disorders, and Kelna Ayle, which provides support to affected families in Beirut and surrounding areas. Other organizations such as Dispensaire St Vincent de Paul, Bi Bickfaya, Mouvement Eucharistique des Jeunes (MEJ), and Scout - Groupe Notre Dame de la Délivrance also contribute to community development and often engage in environmental activities such as cleaning streets and promoting waste sorting at the source.

The municipality of Bickfaya covers an area of 5.5 square kilometers and includes the town of Bickfaya and Mhaydsee. It is led by Mayor Nicole Gemayel and has a city council composed of 15 members. Bickfaya is part of the "Federation of Matn El Chemali."

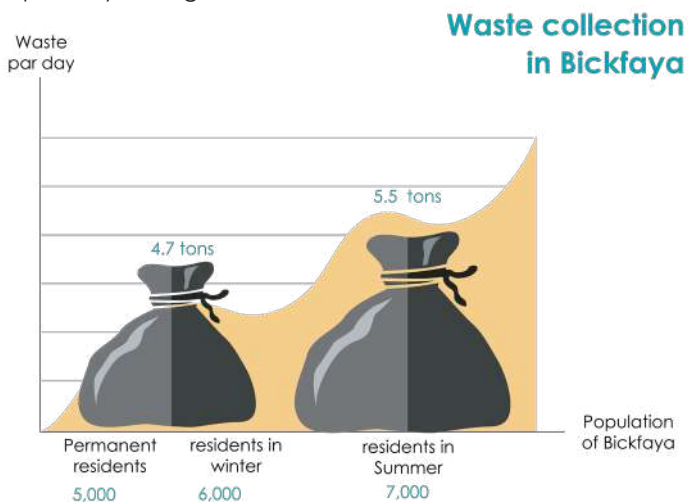
In terms of waste management, the municipality established the waste management plant called "Bi Clean" to promote waste sorting at the source. Currently, the municipality manages waste collection and treatment at the Bi Clean facility without the assistance of a private contractor. They also handle sweeping and overall cleanliness of the town. Waste collection is performed using two adapted trucks, with one dedicated to recyclable waste and the other for other types of waste. During the COVID-19 outbreak, the municipality ensured the separate collection of waste from COVID patients, appropriately labeled with red stickers to protect employees and ensure safe handling.

Levante is one of the municipalities that has achieved a significant level of differentiation in waste collection. With a rate of 72.79%, it ranks third among the six municipalities with a population exceeding 15,000. The municipality has made commendable progress in waste management, contributing to the reduction of landfill disposal and associated environmental impacts. The municipality is also involved in experimental waste collection methods, including the joint collection of various materials such as plastics, paper, and metals for a trial period of at least 24 months.

Bickfaya, Lebanon

The population of Bickfaya varies depending on the season. The permanent resident population is around 5,000, with an average population of 6,000. During the winter season, the population decreases to 5,000, while in the summer season, it increases to approximately 7,000. The influx of tourists contributes to the summer population growth, making Bickfaya a popular summer destination due to its pleasant climate and ecological tourism opportunities.

The municipality of Bickfaya manages municipal solid waste, including household and commercial waste. The daily production of waste varies depending on the season, with approximately 4.7 tons per day during winter and 5.5 tons per day during summer.



The average waste generation per inhabitant per day is 0.94 kg, with a minimum of 0.85 kg and a maximum of 1.10 kg.



The municipality handles the local treatment of waste at the Bi Clean facility, while final disposal of rejects is handled by Sicomo, a waste-to-energy plant. The municipality also takes care of garden cleaning and street sweeping at the Bi Clean facility. Other waste streams, such as industrial waste, construction and demolition waste, combustible waste, slaughterhouse waste, and infectious waste, have limited quantities and are handled accordingly.

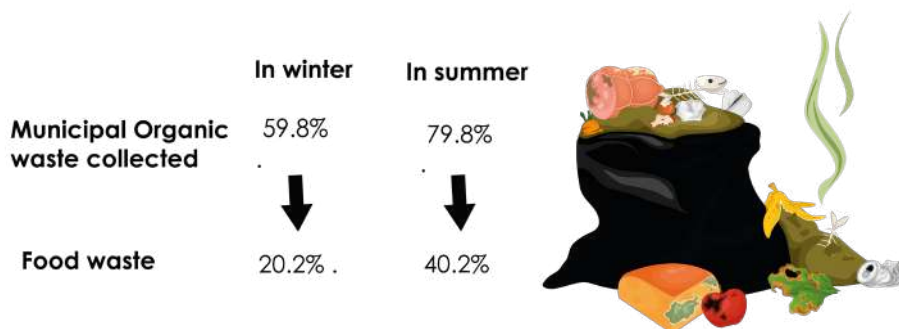
Bickfaya experiences small seasonal variations in waste generation, with higher quantities observed during the summer season. Organic waste represents the major fraction, accounting for 59.8% of the total municipal solid waste collected during winter and 79.8% during summer. Inorganic waste accounts for 40.2% in winter and 20.2% in summer. Food waste makes up a significant portion of the organic waste, generated mainly from households and commercial establishments such as restaurants and hotels. The weight of food waste is approximately 20% higher in summer compared to winter.

The Bi Clean facility, operational since March 2016, serves as a secondary sorting facility. It was established by the municipality of Bickfaya in response to the waste crisis in 2015. The facility handles all waste collected from Bickfaya and receives additional waste quantities from the neighboring village of Ain El Kharoube. The average weekly quantities of recyclable and organic

waste collected from Ain el Kharroube are 500 kg each. These waste quantities are delivered directly to the facility, with no additional transportation costs charged.

In terms of solid waste composition, the organic waste stream in Bickfaya is predominantly composed of food waste, including leftover food residues, vegetable waste, leaves, and decayed vegetables. The average density of organic waste is 0.534 kg/m³, which reduces to 0.513 kg/m³ after shredding. Shredding the organic waste improves uniformity, aeration, and handling, making it easier to compost and maintain moisture.

Overall, the municipality of Bickfaya is actively involved in solid waste management, with its own waste management facility and initiatives to promote waste sorting and environmental awareness in the community. The collaboration with NGOs, associations, and institutions further strengthens their efforts in addressing waste management challenges. By implementing local solid waste management programs and engaging various stakeholders, Bickfaya aims to achieve sustainable and efficient waste management practices while promoting a clean and healthy environment for its residents and visitors.



Challenges and issues faced by each municipality in waste management

Mahdia, Tunisia

The municipality of Mahdia, Tunisia, faces various challenges in waste management due to the absence of a controlled landfill or transfer center. Instead, a vacant lot near the Industrial Zone on the Boumerdes road is used as a dumping site for household waste, debris, green waste, and bulky items.

Therefore, the lack of comprehensive waste management

infrastructure, including a controlled landfill or a transfer station, poses a significant challenge. Within the uncontrolled landfill located at the southwest entrance of the city, the majority of organic waste collected by municipal services is transported and disposed of. Inside the landfill, waste is primarily managed in an improvised manner by informal workers who collect recyclable



material for subsequent sale. Many of the non-recyclable wastes are openly incinerated, causing significant environmental impact and posing serious health risks to neighborhoods closest to the landfill.

While the most efficient waste collection method in Mahdia is voluntary drop-off, utilizing collective containers of various sizes and compactor trucks, this method only accounts for 25% to 30% of the total waste collected. Additionally, around 5% of the waste is collected through sporadic cleanliness campaigns.

With the expansion of the municipal boundaries after the country's decentralization in 2016, Mahdia incorporated several small villages and scattered residences, including Chiba, Dkhila, through waste characterization in the pilot neighborhood for selective sorting, shows that there is a considerable potential for recyclable and recoverable waste, emphasizing the need for additional efforts in source separation (58% of organic waste, 14% of plastic bags, 9% of textiles, and 6% of diapers).

“

The main objective was to improve on previous strategies to achieve integral management of all types of waste in the municipality,

stated **Mohamed Boussafara** focal point of the project for the municipality.

“One of these strategies led to the creation of the

composting site, built as part of the CLIMA project. Boussafara emphasized that the primary challenge faced by the municipality was to “minimize the amount of rubbish dumped into the environment and to find a solution for its management”

To cope with resource limitations and maintain cleanliness standards, Mahdia opted for privatizing waste collection and sweeping services in certain zones. Street sweeping and weeding activities are conducted by teams of workers, and beach cleaning is prioritized in this tourist city. Efforts were made to install bins and containers for waste collection along the beaches, and contracts are tendered for cleaning the tourist zone and beaches.

Despite the challenges faced by Mahdia Municipality in waste management, efforts are being made to improve the infrastructure, address logistical issues, and promote sustainable waste practices in collaboration with various stakeholders.

The municipality of Sestri Levante faced several challenges and issues in waste management. The waste collection system before the beginning of CLIMA project, despite already achieving good performance, needed to be optimized to meet the demands for higher quality of differentiated fractions, reducing illegal dumping. Incidents of abandonment near the large container islands and collection points in zones 1 and 2, served by street and proximity collection, were quite frequent. Maintaining a mixed system often led to improper waste disposal by non-domestic users near the ecological islands and public containers.

On-site inspections revealed that, in some cases, assigned condominium bins were placed outside the buildings, near public areas, and were emptied by operators according to the collection schedule, regardless of whether they were full or not.

Achieving high quality in the collected materials was one of the indicators of effective waste management. The quality of materials depended on their purity and the low presence of non-compliant materials in the collected streams. According to data from the waste management company, the presence of impurities in the containers dedicated to street collection of glass and cans was currently at 10%, which was much higher than the average presence of foreign materials in household collection (1-2%).

The municipality of Bickfaya faced significant challenges and issues in waste management, stemming from the closure of a large landfill site in 2015. This closure occurred without any alternative plan or intervention from the central government, resulting in a waste accumulation crisis throughout the country, including Bickfaya. Determined to find a solution, the municipality took matters into their own hands and established Bclean, a sorting center, to address the pressing waste problem.

“All began in 2015, when a huge landfill site closed without any solution, any other plan from the central government. Trash started piling up over all the streets, including our village. So, from that moment, we decided to create Bclean, our sorting center, and to solve our problems

Roula Chikhany, project focal point for the Municipality of Bickfaya.

For paper recycling, the data also indicated a presence of impurities at 10%, which was much higher than the average presence of foreign materials in household paper collection (2-3%).

To improve the quality of differentiated waste disposal, it was evident that the street containers for glass collection needed to be removed and a curbside collection for glass introduced. It was also considered necessary to remove the proximity containers in zone 3, where the closure devices were often tampered with, forced, and damaged, allowing unauthorized users to dispose of waste. In this zone, an “on-demand” collection service described in the following paragraphs could be introduced.

“Since the implementation of door-to-door waste collection in 2015, we reached a stagnation phase by early 2019. Although recycling rates were consistently good, they were not increasing, and there seemed to be a lack of motivation among citizens. Therefore, we decided to introduce changes that would address the most sensitive issues for the population, leading us to intervene in waste tariffing,

Annalisa Fresia, Manager of technical department - environment and public works of Sestri Levante Municipality.

Bickfaya, Lebanon

One of the primary obstacles encountered by the municipality was the need to educate the local population about waste sorting and recycling. At the time, sorting waste at home and having separate bins was not a common practice for residents. Recognizing the importance of raising awareness, the municipality launched an extensive education campaign. Through door-to-door initiatives, distribution of flyers, brochures, stickers, videos, and seminars, they successfully educated the community about the benefits of waste sorting and its positive impact on the environment.

Although Bickfaya made significant progress in waste management, they faced challenges regarding the treatment of organic waste. Initially, the municipality sent organic waste to local farmers as a temporary solution. However, this approach proved to be unsustainable in the long run. To address this issue, the municipality proposed the CLIMA project, which aimed to implement a composting membrane system for effective organic waste management.

However, the implementation of the CLIMA project encountered obstacles along the way. Lebanon's economic crisis and electricity shortages posed significant challenges for the proper functioning of the composting membrane system. To overcome this hurdle, the municipality and Arcenciel reallocated part of the budget of the CLIMA project to install solar panels, ensuring a continuous power supply for the waste treatment facility.

Another issue that the municipality of Bickfaya faced was a decrease in organic waste quantities due to the ongoing crisis in Lebanon. As people reduced their consumption of organic products, the amount of organic waste generated decreased accordingly. To address this concern, the municipality collaborated with neighboring municipalities to find effective solutions and optimize organic waste management.

Prior to 2015, waste management in Lebanon was primarily the responsibility of the central government. However, the lack of a contingency plan became apparent when the landfill site closed, triggering a waste management crisis across the country. Faced with this challenge, Bickfaya, along with other municipalities, took on the responsibility of waste management independently, demonstrating their commitment to finding local solutions.

In addition to waste management challenges, municipalities in Lebanon, including Bickfaya, grappled with limited expertise and technical resources required for efficient waste management. Despite these limitations, Bickfaya took the initiative to establish a sorting facility, setting an example for other municipalities and showcasing the importance of local initiatives and community engagement in addressing waste management challenges.



All the Lebanese municipalities were under this stress, since the Naame landfill reaches its full capacity and was closed, it was serving a very high number of municipalities within Beirut and Mount Lebanon areas. Bickfaya is one of the few municipalities who took this initiative of creating the sorting facility in order to solve the waste problem.

————— Lama Nehme, project focal point for the Lebanese NGO Arcenciel.

The determination and resilience displayed by the municipality of Bickfaya in establishing Biclean, educating the community, and seeking innovative solutions for waste management highlight the crucial role of local leadership and citizen participation in tackling environmental issues. Through their proactive efforts, Bickfaya has transformed waste management practices, creating a cleaner and more sustainable environment for its residents.



INTEGRATED WASTE MANAGEMENT PLAN

Description of the process of developing the integrated waste management plan in each municipality, Stakeholder engagement and involvement in the planning process

Mahdia, Tunisia

The process of developing the integrated waste management plan in the municipality of Mahdia involved stakeholders' engagement in the whole planning process. In Mahdia, there was already a waste management plan in place, so the focus was on evaluating the existing plan and its implementation, as well as analyzing the key areas to enhance and integrate. The evaluation of the plan focused on several criteria, including a critical review of the previous waste management plan, the degree of program implementation, citizen and local stakeholder involvement, mobilization of funds and resources, adherence to timelines, and the quality of expected and observed impacts.

To assess the plan, a critical review of the diagnostic reports and the action plan was conducted, with a focus on the process of its development and verification of basic data for updating. Qualitative and quantitative data were collected through interviews with technical officials and municipal councilors using an evaluation questionnaire designed to meet the set criteria. The analysis and recommendations from the International Forum on upgrading the waste management plan of the Municipality of Mahdia held in October 2020 in the framework of the CLIMA project were also taken into account.



Firstly, in order to update the MWMP, it was necessary to evaluate the results of the actions planned in the previous plan. Secondly, we involved citizens and local actors in order to reflect together on the construction of the new plan 2.0. We then proceeded with the mobilization of financial and other resources to be able to implement the plan and comply with deadlines and planned actions. Finally, we start observing the achieved results and impact

— Lamyia Sayahi, activity coordinator at CITET.

In addition to the review of documents and interviews with municipal officials, fieldwork was conducted to monitor waste collection and transportation routes. The state of cleanliness, management and operation methods, as

well as difficulties and constraints encountered, were observed during this process.

The development of the waste management plan followed a participatory planning process led by the Municipality of Mahdia with the assistance of experts from various technical, organizational, financial, accounting, and communication domains. The director of cleanliness was designated as the project lead and played a crucial role in project coordination. The process involved regional and local stakeholders, including representatives from the National Waste Management Agency (ANGEd), as well as citizen representatives through focus groups and the integration of external stakeholders in the planning process. Consultation meetings were also held with private actors active in the municipality such as hotels, cafes, industries, and private waste collectors for household and recyclable materials.

The diagnostic phase of the waste management plan resulted in a comprehensive diagnostic report, which provided valuable qualitative and quantitative information on waste management, including technical, organizational, financial, cost, communication, and participation aspects. The collection of data was challenging due to the absence or lack of available data, leading to the use of estimations in some cases, especially regarding waste quantities.

The diagnostic report served as a valuable database for the municipality but was not utilized to create a dynamic information system. The report's results were synthesized in the waste management plan report, which included the strategic and operational planning based on the recommendations from the diagnostic phase.

The waste management plan report consisted of various chapters, including the strategy and future vision, strategic axes and intervention areas, improvement program, and action plan. The action plan detailed specific activities for each of the four components of the waste management plan, including technical waste management, organization and human resource management, financial management and



cost calculation, and internal and external communication.

The action plan included a total of 41 action sheets spread over a five-year period. Each action sheet provided information such as objectives, content, expected impacts, potential actors and partners, estimated costs, sources of funding, duration, indicators for monitoring, and responsible persons for execution and monitoring.

However, there were some shortcomings in the waste

management plan. The content of the action sheets was described briefly, making it challenging for the responsible individuals to initiate and implement the actions effectively. The proposed funding options were limited, and it was recommended to explore additional sources of financing. The communication and sharing of responsibilities within the plan were not conducted officially, and the prioritization of actions. Therefore, the update MWMP strongly focused on ameliorate these aspects.

Sestri Levante, Italy

The development of the integrated waste management plan in each municipality involves a comprehensive process that includes stakeholder engagement and active involvement. In Sestri Levante, this process has been crucial for ensuring the plan's success and effectiveness. Various components were considered to create an inclusive and participatory approach that takes into account the perspectives and needs of different stakeholders, such as citizens, businesses, and local organizations.

To engage stakeholders, the municipality conducts public consultations, meetings, and workshops to gather input and feedback. These interactions provide an opportunity for stakeholders to voice their concerns, share their ideas, and contribute to the decision-making process. Partnerships were also established with local community groups and environmental organizations, fostering collaboration and leveraging expertise to develop a well-rounded waste management plan.



The development of the integrated waste management plan in the municipality of Bickfaya involved a collaborative effort between the municipality, the Lebanese NGO Arcenciel, and various stakeholders. While Bickfaya already had an ongoing waste management system in place, the objective was to create a comprehensive waste management plan that could serve as a blueprint for other municipalities as well.

The process began with thorough research and data collection to assess the existing waste management practices and identify any areas that needed improvement. This involved gathering data on waste quantities categorized by type. By understanding the current waste management operations, the municipality, with the support of the NGO Arcenciel, could identify gaps and determine the necessary interventions.

Developing a financial model for the waste management plan proved challenging due to the fluctuating exchange rate between the US dollar and the Lebanese pound. However, despite the difficulties, the team persevered and successfully created a financial model that could be

replicated in other municipalities. This model provided a framework for sustainable financial management within the waste management plan.

After drafting the waste management plan, a section was dedicated to recommendations for the municipality to enhance their existing practices. The goal was to help Bickfaya improve upon their already operational waste management system and consolidate all the information and processes into a comprehensive document. This document could then be used by other municipalities as a guide to replicate successful waste management interventions.

Throughout the planning process, various stakeholders played a crucial role. The involvement of a sample of citizens from the town ensured that the plan considered the needs and perspectives of the local community. Representatives from local NGOs and municipal councils also participated, bringing their expertise and insights to the table. Arcenciel, as the NGO responsible for writing the waste management plan, played a significant role in facilitating the process and contributing their knowledge and experience.



Additionally, the municipal waste management team provided valuable data and financial schemes to support the development of the plan. The CLIMA project coordinator from the municipality was involved in coordinating efforts and ensuring alignment with broader environmental initiatives. A select group of experts from Arcenciel, including members of the environment team, who had previously worked on waste management plans for other municipalities, contributed their expertise to enrich the plan.

These stakeholders, representing a range of perspectives and expertise, actively engaged in the planning process, ensuring that the waste management plan was comprehensive, practical, and tailored to the specific needs of Bickfaya. Their collaboration and involvement paved the way for a more effective and sustainable waste management approach in the municipality, while also providing valuable insights for other municipalities to replicate successful interventions.

Key Components of the Integrated Waste Management Plan

The integrated waste management plan in Mahdia is a comprehensive strategy aimed at improving waste management practices in the municipality. It encompasses various components that focus on enhancing governance, stakeholder engagement, waste collection, recycling, composting, and involving the private sector. By addressing these areas, the plan aims to create a sustainable and efficient waste management system for Mahdia.

One crucial aspect of the updated waste management plan is the establishment of a monitoring committee. This committee will oversee the implementation of the plan, ensuring that all proposed measures are executed effectively. By having a dedicated body to monitor progress, the plan can be regularly assessed, and adjustments can be made if necessary.

“One of the main outputs of the plan was the creation of a committee to concert the steps to implement the integrated Waste Management Plan, define priorities, monitoring results and facilitate obtaining funds”, Mohammed Boussafara.

To ensure effective communication and stakeholder engagement, the waste management plan in Mahdia emphasizes the importance of involving the community. Regular meetings, workshops, and awareness campaigns have been conducted to educate residents about the significance of waste management and encourage their participation in waste reduction and recycling initiatives. By fostering a sense of ownership and responsibility among the community, the plan aims to create a collective effort towards sustainable waste management practices.

A fundamental component of the plan involves the development of a local regulatory framework for waste collection. Clear rules and guidelines were established, including schedules and methods for waste collection. This will help streamline the process and ensure that waste is collected efficiently and in a timely manner. The plan also proposes the collection of green waste and demolition/construction as paid services, in order to create an additional revenue stream for waste management.

To expand waste collection coverage, the plan aims to establish agreements with private entities. By involving the private sector, the municipality can leverage their resources and expertise in waste management. This partnership will not only improve waste collection services

but also create opportunities for innovation and technological advancements in the sector.

“Within the CLIMA project, the importance of circular economy, beside being present in the Integrated Waste Management Plan, were not central as we wanted. Therefore, thanks to the project Med4waste, aiming at capitalizing among the others, the CLIMA project, we made further investment toward an approach and a municipal plan having the circular economy at the center”, Mohammed Boussafara.

Efforts will be made to optimize waste collection routes and processes in Mahdia.

A comprehensive study has been conducted to analyze the current collection routes, evaluate performance parameters, and identify areas for improvement. By utilizing data-driven analysis, the plan aims to create an optimized collection plan that maximizes efficiency and cost savings.

This optimization will help reduce fuel consumption, minimize collection time, and decrease the environmental impact of waste management operations.

The technical component emphasizes waste prevention and reduction measures, such as promoting the sale of products with minimal packaging and implementing regulations to restrict the use of certain types of plastic bags. Source separation and sorting of waste are also essential, enabling the recycling and recovery of materials. Optimizing waste collection and transportation services, particularly through the use of new technologies and information systems, helps enhance efficiency.

Another significant component of the waste management plan is the establishment of a composting station. This facility will have the capacity to process organic waste from a pilot neighborhood that implements selective sorting, as well as green waste from the municipality. The composting station have been located in an agricultural zone, ensuring proper utilization of organic waste and promoting sustainable agricultural practices. Different composting methods have been tested and evaluated, allowing for the implementation of the most effective and efficient techniques. At the end the best methodology assessed was a traditional pile composting.

The waste management plan in Mahdia also places emphasis on promoting recycling practices. Recycling bins will be strategically placed throughout the municipality

to encourage residents to separate recyclable materials. Educational programs have been foreseen to raise awareness about the importance of recycling and provide guidelines on proper sorting techniques. The plan also explores partnerships with recycling industries to establish efficient recycling processes and create a

market for recycled materials. The valorization and recycling component focuses on promoting the circular economy by reintroducing materials from waste into the production of new products. This includes developing extended producer responsibility (REP) programs, creating eco-organizations, and



implementing projects for recycling paper, metals, plastics, and glass. Additionally, the recovery and valorization of organic waste present significant opportunities for environmental preservation, revenue generation, and job creation.

knowledge sharing, organizing regional forums and training sessions, and strengthening cooperation with international partners.

Proper waste treatment and disposal of residual waste are essential. Establishing waste treatment facilities, such as waste-to-energy plants, and rehabilitating uncontrolled dumpsites are crucial steps in this regard. It is also important to ensure adequate monitoring and control of waste management activities, including both proximate control by environmental police and specific control for classified facilities.

In conclusion, the integrated waste management plan in Mahdia encompasses various components aimed at improving waste management practices in the municipality. Through effective governance, stakeholder engagement, waste collection optimization, recycling promotion, composting facilities, and involvement of the private sector, the plan seeks to establish a sustainable and efficient waste management system. By implementing these measures, Mahdia can reduce waste generation, increase recycling rates, and minimize the environmental impact of waste disposal. The success of the plan relies on the active participation and collaboration of the community, private entities, and local authorities, all working together to achieve a cleaner and greener Mahdia.

The plan includes a component focused on professionalization and capacity building to enhance knowledge and skills in waste management. This involves developing information systems, establishing regional networks for

Sestri Levante, Italy

The integrated waste management plan in Sestri Levante encompasses various key components addressing waste reduction, recycling, composting, and other waste management strategies. Each component plays a crucial role in achieving the municipality's waste management goals and ensuring a sustainable future.

efforts are made to raise awareness and promote responsible consumption habits among citizens. Through awareness campaigns and educational initiatives, stakeholders are encouraged to adopt sustainable practices that minimize waste generation. Businesses are also encouraged to offer eco-friendly products, further contributing to waste reduction efforts.

Recycling is another significant component emphasized in the plan. The municipality aims to expand the infrastructure for separate collection of recyclable materials, making it easier for citizens to participate in recycling programs. Awareness campaigns provide clear guidelines on sorting and collection procedures, ensuring that stakeholders have the necessary knowledge to engage in proper recycling practices.

Composting is highlighted as a solution for organic waste. The plan promotes both home composting for residents and community-wide composting programs for green waste. By providing guidance on composting techniques,

distributing composting bins, and offering educational materials, stakeholders are empowered to participate in composting and understand its environmental benefits.

The plan also focuses on optimizing waste collection and management systems. One strategy involves implementing a "Pay-As-You-Throw" system, where individuals pay based on the amount of non-recyclable waste they generate. This approach incentivizes waste reduction, encouraging citizens to be more conscious of their waste production and actively participate in recycling and composting initiatives.

A NEW SERVICE AS A STRATEGIC CHOICE: THE PAY AS YOU THROW SCHEME

Environmental Sustainability

Economic incentives that promote greater awareness among citizens towards virtuous behaviors.

- Progressive reduction of non-recyclable waste production for disposal.
- Natural increase in the percentage of waste sorting and material recovery.

Economic Sustainability:

- Alignment between revenues, actual service costs, and investment expenses coverage.
- Greater contribution equity for citizens and non-domestic users.
- Stimulates greater management and operational efficiency for the service provider, citizens, and businesses.

Transparency and Simplification

Pay as You Throw Scheme facilitates the introduction of a more easily understandable "bill" for everyone.

Consistency with Current Regulations

The implementation of the Pay as You Throw Scheme is fully compliant with the current European, national, and regional regulations in this field.

Tools for Measuring Waste Quantity

- Each container is equipped with a unique identification code assigned to a household (all residents in a specific street number) or non-domestic user.
- An electromagnetic passive transponder is applied to all non-recyclable waste containers, enabling automatic measurement through dedicated instrumentation installed on collection vehicles.

PAYT (Pay as You Throw):

- "The polluter pays" principle (Directive 2004/35/CE).
- Payment based on the actual waste produced (PAYT).
- Waste estimation based on container volumes and the number of non-recyclable waste container emptying cycles.

Tariff with Measurement

- The tariff with measurement remains a consideration and is collected by the entity entrusted with urban waste management (paragraph 31).
- The tariff with measurement is subject to VAT, which is deducted from the tax paid to suppliers and therefore does not constitute a cost in the Environmental Economic Profile (as stated in the ministerial guidelines).

What is the "Pay as You Throw Scheme"?

The Pay as You Throw Scheme is the fairest way to charge citizens for waste collection and disposal services. In addition to a fixed portion, each user pays based on the actual amount of non-recyclable waste generated and delivered to the waste collection company.

Why switch to the Pay as You Throw Scheme?

Globally, it is well-established that the Pay as You Throw Scheme is the most effective strategy to achieve optimal results and create positive synergies between waste prevention and recycling.

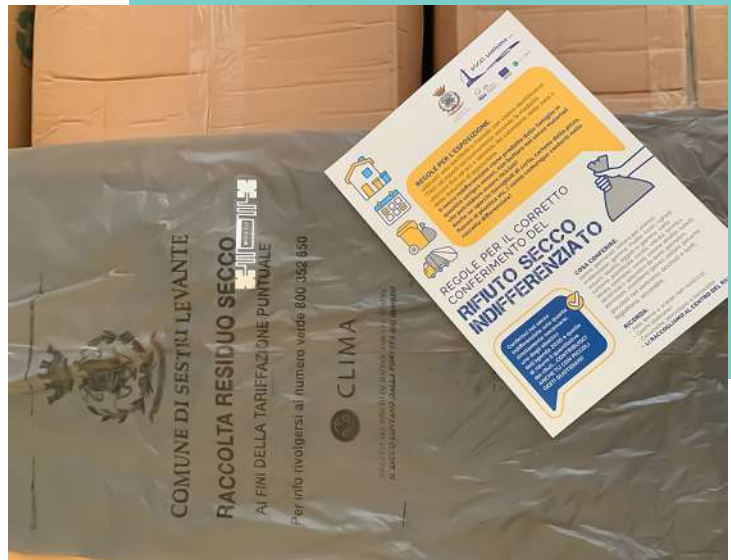
Additionally, it offers greater contribution equity, allowing payment based on the actual services provided rather than square meters or the size of the household.

Communication and education are essential components of the plan. A well-defined communication plan ensures that stakeholders are informed about waste management practices, local initiatives, and the benefits of sustainable strategies. Public awareness campaigns, informational materials, and community events play a vital role in educating and engaging citizens.

Green public procurement is integrated into the plan, promoting environmentally friendly criteria in the procurement processes of the local administration. By purchasing products and services with reduced environmental impacts, such as energy-efficient equipment and eco-friendly materials, the municipality sets an example and encourages sustainable practices throughout the community.

Additionally, the plan addresses paper waste reduction by promoting the minimal consumption of paper in both public and private offices. Practices such as electronic communication and documentation are encouraged, while suggestions

like double-sided printing, paper reuse, and the use of recycled paper are provided for necessary paper usage. By implementing these key components and actively involving stakeholders, Sestri Levante strives to develop an integrated waste management plan effectively addressing waste reduction, recycling, composting, and other waste management practices. This holistic approach ensures a sustainable and environmentally conscious future for the municipality.



Bickfaya, Lebanon

The Integrated Waste Management Plan for the Municipality of Bickfaya holds a unique position compared to the other two municipalities engaged in the project. Unlike the other partners, the Municipality of Bickfaya has been drafting its first-ever Municipal Waste Plan. While there were already several commendable waste management practices in place, the municipality recognized the need for a comprehensive and structured plan to further enhance their efforts.

Previously, the Municipality of Bickfaya had implemented various good practices related to waste management. These practices included initiatives carried out by NGOs, associations, and institutions within the community, as well as the proactive involvement of the municipality itself. However, these efforts were not formalized under a dedicated waste management plan.

The Integrated Waste Management Plan for the Municipality of Bickfaya begins with an introduction, outlining the objectives and importance of sustainable waste management practices. It emphasizes the transition towards a zero waste approach to minimize environmental impact and promote a healthier community.

The plan fully recognizes the managerial aspects of solid waste management, including the legal and regulatory framework outlined in LAW Number 80 - Integrated Solid Waste Management, Section II, Lebanon. It also acknowledges the significant role of NGOs, associations, and institutions within the Bickfaya community, playing vital roles in providing technical support, education, and raising awareness on environmental activities, such as street cleaning and waste sorting.

The Municipality of Bickfaya is introduced, highlighting its location in the Matn district region of Lebanon. The municipality, headed by Mayor Nicole Gemayel, is responsible for waste management in the town. It oversees waste collection, treatment, and overall cleanliness. The municipality's role in waste management is further reinforced by its pioneering efforts in establishing the waste management plant "Bi Clean" without relying on private contractors.

The plan provides an overview of the population residing in Bickfaya. It mentions the permanent residents as well as the seasonal variations, particularly during the summer season when the town becomes a popular destination

for tourists. The presence of hotels, restaurants, and ecological attractions contribute to the increase in population during this time.

In terms of solid waste management, the plan identifies the various waste streams, including municipal solid waste, industrial waste, construction and demolition waste, combustible waste, slaughterhouse waste, and infectious waste. It presents the daily production rates of municipal solid waste during winter and summer seasons, with a focus on the dominant fraction, which is organic waste. Food waste constitutes a significant portion of the organic waste, originating from households, commercial establishments, and restaurants.

The plan acknowledges the additional waste quantities managed by the Bi Clean facility, which come from the neighboring municipality of Ain el Kharroube. This includes recyclable and organic waste, which is delivered directly to the facility without incurring additional transportation costs.

Regarding solid waste treatment, the plan highlights the importance of the Bi Clean waste management facility. It outlines the municipality's efforts in establishing the facility independently to address the waste crisis. The facility plays a crucial role in treating all waste collected from the Municipality of Bickfaya and receiving additional waste from Ain el Kharroube.

The plan treats into details the collection and transportation system employed by the municipality. It mentions the use of two trucks, one dedicated to recyclable waste collection and the other for non-recyclable waste. The collection is carried out through a door-to-door system, ensuring accountability and maintaining sorting quality. Specific collection areas and frequencies are established for different parts of Bickfaya.

To raise awareness about waste management, the plan highlights various methodologies employed by the municipality. This includes door-to-door campaigns, social media outreach, training sessions, environmental booths, clean-up days, and collaborations with schools, hotels, restaurants, and markets. Materials such as flyers, billboards, social media posts, webinars, and printed resources are utilized to educate and engage the community.

As part of the plan, the municipality has established a compost site within the CLIMA project, which aims to promote sustainable waste management practices.

The full operationalization of the compost site plays a crucial role in managing organic waste effectively. The site provides a designated area for the controlled decomposition of organic waste, allowing it to be transformed into nutrient-rich compost. By diverting organic waste from landfills, the municipality reduces the environmental impact associated with landfilling and promotes the sustainable use of resources.

The Integrated Waste Management Plan for the Municipality of Bickfaya encompasses multiple components aimed at achieving sustainable waste management practices. It recognizes the legal framework, the roles of various stakeholders.

IV

IMPLEMENTATION PROCESS

Description of the implementation process of the integrated waste management plan in each municipality

This chapter describes the implementation processes of an integrated waste management plan in three target municipalities: Mahdia in Tunisia, Sestri Levante in Italy, and Bickfaya in Lebanon. The implementation processes varied significantly due to the different starting situations in each municipality. In Mahdia, where a waste management plan already existed, the focus was on implementing pilot projects for separate collection of organic waste, plastics, and aluminum. The chosen pilot neighborhood showed positive engagement from the residents, leading to further implementation. In Sestri Levante, the municipality aimed to increase the already high rate of differentiated waste collection through the introduction of a “Pay as You Throw” tariff system. Extensive communication and feedback gathering were conducted before distributing kits for the experimental phase. Bickfaya, in Lebanon, focused on refining and expanding its existing waste separation practices, including the establishment of a composting site and involving commercial and tourist activities in waste management.

Mahdia, Tunisia

In Mahdia, the implementation process within the CLIMA project focused on the pilot neighborhood selected by the municipality in collaboration with consultants. The pilot neighborhood was chosen based on specific criteria, and an investigation was conducted to ensure the residents' positive response. The community showed strong support through positive feedback on questionnaires, leading to the decision to proceed with implementation in that area.

To prepare the residents, the project partners organized various activities over the course of approximately one year, starting from the spring of 2022. These activities included open days, training sessions, and gathering feedback from the citizens. The municipality aimed to create awareness and educate the community about the importance and benefits of waste separation and recycling.

“
To implement this MWMP, we concentrated our efforts on training, communication activities, raising awareness of the whole of society and encouraging families to practice individual compost,
Lamia Sayahi.

In March 2023, after the completion of the municipal composting site, the implementation process entered a new phase. The municipality initiated door-to-door collection of organic waste, emphasizing the separation of organic waste from other types of waste. Additionally, efforts were made to involve informal waste collectors in recovering recyclable solid waste, particularly glass and plastic. The aim was to establish a comprehensive waste management system that includes both formal and informal waste collection channels.

Sestri Levante, Italy

In Sestri Levante, the implementation process within the CLIMA project focused on enhancing the existing waste management system, which already had a 70% rate of differentiated waste collection. The municipality aimed to increase the percentage of differentiated waste further, and for this purpose, a waste management plan was developed.

“ We started with an analysis of the current state, proposed the experimentation path to the city council, initiated awareness campaigns, and then began the actual piloting phase. We conducted ongoing monitoring and implemented a series of adjustments, leading us to the end of the experimentation process and conducting a final evaluation,

_____ said Annalisa Fresia.

The municipality conducted a series of meetings with the citizens, starting from March 2022, to gather their opinions and inform them about the upcoming experimental phase of the new waste tariff system known as “Pay as You Throw.

“ Through communication and awareness efforts, the community has been able to reduce the production of non-recyclable waste not only in the household waste management phase but also upstream during the

purchasing phase,

_____ said Rossana Gotelli (environmental officer at Sestri Levante Municipalirt).

These meetings aimed to create awareness and obtain feedback from various stakeholders, including condominium administrators, traders, and tourism sector operators such as hotels, restaurants, and campsites.

“ We involved various stakeholders, starting from the municipal council to the citizens and businesses, in an effort to bring the focus back to the importance of recycling,

_____ said Annalisa Fresia.

After the initial preparation phase, kits were distributed to citizens and other users in late April or early May 2022 to initiate the experimental phase of the “Pay as You Throw” system. The municipality ensured widespread communication to engage the entire population of Sestri Levante. The experimental phase allowed for data collection and evaluation, which would inform the final implementation of the new waste tariff system. This approach aligned with Sestri Levante’s long-standing commitment to zero waste, making the localized tariff system a strategic step towards replacing the old collection method.

Bickfaya, Lebanon

In Bickfaya, the waste management plan aimed to further define and enhance the existing waste separation practices that the municipality had already initiated in response to the waste crisis in 2015. The implementation phase of the plan within the CLIMA project primarily focused on two aspects: establishing a municipal composting site and expanding the participation of commercial and tourist activities in waste separation and organic waste collection.

The municipality aimed to better structure the waste management system that was already in place and extend its coverage to a wider user base. The focus

was on increasing the separation and collection of organic waste, not limited to private households but also including businesses and other municipalities adjacent to Bickfaya.

By establishing a municipal composting site, the municipality aimed to efficiently manage organic waste and promote its conversion into valuable compost. Additionally, involving commercial and tourist activities in waste separation and collection aimed to expand the impact of waste management practices beyond residential areas and involve a broader range of stakeholders.

Strategies and the actions taken to implement the plan, including policy changes, infrastructure development, awareness campaigns, and community engagement

In the three countries, different strategies were implemented to carry out the waste management plan, considering the distinct starting contexts, as mentioned previously. The development and ideation of the waste management plan involved the participation of various stakeholders. An international forum was organized at the beginning of the project, where Lebanon, Italy, and Tunisia engaged in dialogue and shared their waste management situations. This forum aimed to analyze the initial conditions in each country and involve key actors in the three territories. The project also engaged with the private profit sector, seeking additional actors and allies who could contribute to the creation and implementation of the waste management plans.

The overarching paradigm for the project was the zero waste approach, although the specific ambitions of each country's plan varied. Nonetheless, in all three contexts, the plans represented an innovation and an upgrade compared to the existing waste management practices.

In Mahdia, Tunisia, one of the most innovative and experimental actions proposed was the launch of a pilot project for organic waste collection in the Jbal Dar Waja neighborhood.

Additionally, the construction and utilization of a composting and vermicomposting station managed by the municipality were initiated. The Mahdia composting site has a daily capacity of 5 tons, and the municipality acquired a dedicated truck for organic waste collection. The infrastructure investment for the composting site amounted to over €220,000, while the truck cost approximately €50,000. The equipment necessary for the site's functioning, currently provided by the municipality, has a value of around €30,000. These investments, supported by the European Union, were significant for Mahdia, enabling the expansion of areas in the city that can benefit from separate waste collection services in the

coming years.

Extensive communication and coordination efforts were undertaken with numerous stakeholders. This included engaging with the local community, particularly the residents of the pilot neighborhood, as well as national waste management institutions, the private sector, civil society representatives, municipal personnel, and political representatives. A monitoring and evaluation committee was established within Mahdia municipality to oversee the implementation of the municipal waste management plan, comprising representatives from the local community, municipal technicians, and civil society members.

“ I believe that in order to further improve the Waste Management Plan of Mahdia we need to further develop a culture promoting the culture of the 5R, and further invest in the cooperation with the actors of the civil society, Mohammed Boussofara.”

In Sestri Levante, Italy, as previously mentioned, the municipality had already adopted the zero waste strategy. The analysis and experimentation aimed to solidify the implementation of the “pay as you throw” tariff system as the primary waste management model in the city.

“ In addition to equipping ourselves from a technological standpoint for the PAYT tariff experiment, the process of raising awareness and communicating with the citizens has been crucial

_____ said Rossana Gotelli.

The main investment in Sestri Levante was the distribution of kits for precise billing, which included tags similar to anti-theft tags found in retail stores, to be given to citizens. The collected bags from the waste management company contained automated information, allowing the attribution of the weight

of non-recyclable waste to the corresponding user. The technological investment for the pay as you throw experiment amounted to approximately €80,000 and enabled the integration of door-to-door waste collection with the pay as you throw system, eliminating the need for dedicated bins for non-recyclable waste.

Furthermore, the Municipality of Sestri Levante played a leading role in a heated discussion between the municipalities in the Tigullio area and the Metropolitan City of Genoa (formerly the Province of Genoa). Towards the end of 2020, the Metropolitan City of Genoa proposed the adoption of a single waste management operator for the entire province, potentially jeopardizing the specific needs and characteristics of each municipality. In response, the municipalities in the Tigullio area, led by the Mayor of Sestri Levante, strongly advocated for the tender process to respect the diverse needs of each municipality within the province. The CLIMA project played a crucial role in facilitating the coordination and unified presentation of the concerns and requests of the Tigullio municipalities.

In Bickfaya, Lebanon, a significant investment was made to establish a municipal composting site.

Challenges faced during implementation and how they were addressed

The implementation of waste management plans in each municipality within the context of an international cooperation project posed significant challenges that required careful consideration and strategic solutions. Developing and executing a waste management plan is an ambitious undertaking, not devoid of complexities and risks, as discussed from the outset. Two of the project's target municipalities already had existing waste management plans in place, while the municipality of Bickfaya lacked one entirely. However, the process of creating a waste management plan extends far beyond a mere technical or academic exercise; it necessitates extensive preparation, stakeholder involvement, and the formulation of a realistic implementation plan that goes beyond a mere theoretical exercise.

In the case of Mahdia, Tunisia, several operational difficulties were encountered, resulting in delays in initiating the tender process for the construction of the composting site. Furthermore, the fluctuating global markets introduced instability in construction material prices, rendering the initially budgeted amount insufficient to complete the project. As a consequence, the tender for the construction of the site had to be reissued four times, with the final offer surpassing the budget by approximately 30%. To surmount these challenges,

The site implemented innovative technology, equipping the municipality with a three-layer membrane that covers three tunnels where organic material is cyclically composted. This process allows for the production of compost within just nine weeks while preventing rainwater infiltration and odor emissions. The membrane, purchased through an international tender from an Austrian specialized company, was installed in Lebanon in May 2022. Due to electricity supply issues in the country, adjustments were made to ensure the membrane's power requirements could be met. To achieve complete energy autonomy for the composting facility, a solar panel station was installed. The total investment exceeded €300,000 but ensured the expansion of Bickfaya Municipality's waste sorting center (BiClean) and the implementation of a composting system capable of processing 5 tons of organic waste per day.

It is essential to note that before the start of the CLIMA project, although Bickfaya Municipality had good waste management practices, there was no pre-existing municipal waste management plan. Therefore, the project's investment facilitated the creation of the municipality's first-ever waste management plan.

adjustments were made to the budget, and resources were reallocated towards the construction of the composting site. Additionally, the Municipality of Mahdia contributed around €30,000 to the project, facilitating the completion of the site. However, since the site has only been operational for a few months at the time of writing, it is currently facing predictable initial challenges associated with piloting a systematic waste separation initiative. Although the project was intended to support the pilot project for approximately two years, the Municipality of Mahdia is actively exploring avenues to secure funding that would ensure the sustainability and further development of this pilot initiative.

Sestri Levante, Italy, encountered its own set of challenges during the implementation of the waste management plan. One of the primary obstacles was the need for citizens to adapt to the changes in waste management practices.

"We encountered a challenge regarding the limited usage of the provided equipment, as not all citizens used the tagged bags for non-recyclable waste. This resulted in a decrease in the reliability of the collected data," said Annalisa Fresia.

Moreover, the institutional and political situation, with the

municipal government nearing the end of its term, did not facilitate the municipality in making sufficiently bold decisions. In fact, to avoid causing discontent among the population, it was decided not to reduce the collection frequency or impose penalties during the piloting phase.

However, the municipality, with the support of the CLIMA project, made substantial investments in extensive communication and engagement strategies aimed at transforming citizens from passive users into active participants in the waste management process. By fostering a sense of ownership and shared responsibility among residents, the municipality aimed to empower the community and promote its zero-waste paradigm. The strategic approach of involving citizens as significant stakeholders sought to create a collective commitment to the success of waste management initiatives, enabling the city of Sestri Levante to make significant strides towards its waste reduction goals.

“The piloting was important as it allowed us to reconnect with over 8,000 households. Furthermore, the waste management company provided us with an opportunity to conduct a survey on the available equipment for approximately 1,000 commercial users”, said Rossana Gotelli.

The municipality of Bickfaya, Lebanon, confronted a distinct set of challenges due to the country's crisis that emerged in 2019. This multifaceted crisis, encompassing social, economic, and financial dimensions, led to an unprecedented devaluation of the Lebanese pound and a subsequent decline in the purchasing power of a substantial portion of the population. Consequently, the crisis significantly affected the implementation of the waste management plan, particularly due to the ensuing energy crisis. The devaluation of the Lebanese pounds severely eroded the municipality's financial independence, making it arduous to provide dignified salaries to employees and allocate adequate resources for effective city management.



The fluctuations in the fuel prices to operate the facility were mainly the biggest challenges. This was due to the exchange rate that was officially 1500 LBP for each 1 USD, and suddenly increased to reach 100,000 LBP and more,

Lama Nehme.

Additionally, the composting site faced energy shortages, hindering its operational capacity. To address this challenge, the municipality, in collaboration with the CLIMA project, opted to install

a small solar panel station. This innovative solution aimed to render the composting site energy-autonomous, mitigating its reliance on the unstable energy infrastructure and minimizing its environmental impact. By leveraging renewable energy sources, the municipality of Bickfaya aimed to overcome the energy crisis and maintain the functionality of the composting site, thereby advancing its waste management objectives.

Despite the numerous challenges encountered during the implementation of waste management plans, the municipalities displayed resilience and determination in finding suitable solutions with the support of the CLIMA project. Overcoming bureaucratic hurdles, adapting to unforeseen circumstances, and actively engaging the community emerged as vital aspects of the implementation process. By addressing these challenges head-on, the municipalities aspired to achieve their waste management objectives, fostering sustainable and environmentally responsible practices in their respective regions.

Moreover, it is essential to recognize the broader context within which these municipalities operate. The political and institutional landscape plays a significant role in shaping the implementation and management of waste management plans. Changes in political leadership, reshuffling of governing bodies, and deeper institutional transformations can jeopardize the efforts made by technical experts, as the support of political representatives remains crucial for the success of waste management initiatives. The municipalities must closely monitor and adapt to any shifts in the political and institutional landscape to ensure the continuity and effectiveness of their waste management efforts.

In conclusion, the implementation of waste management plans within the framework of international cooperation projects presented formidable challenges for each municipality involved. From operational difficulties to budget constraints and socio-economic crises, the road to effective waste management proved arduous.

However, through resilience, strategic planning, and the support of initiatives like the CLIMA project, the municipalities managed to overcome these challenges. By engaging stakeholders, leveraging renewable energy sources, and fostering a sense of ownership among citizens, these municipalities are paving the way for sustainable waste management practices. As they continue to navigate the complexities of waste management, the municipalities are not only addressing local waste issues but also contributing to broader environmental goals and the well-being of their communities.



CROSS-COUNTRY COMPARISON

Making a Comparative Analysis of the Experiences of the Three Municipalities in Italy, Tunisia, and Lebanon:

The implementation processes of the integrated waste management plans in Mahdia, Tunisia, Sestri Levante, Italy, and Bickfaya, Lebanon, showcased both similarities and differences. Each municipality had its unique starting situation and challenges, leading to distinct strategies and actions taken to implement their waste management plans.

In Mahdia, Tunisia, the implementation process focused on the pilot neighborhood selected by the municipality in collaboration with consultants. The community's positive response and strong support were crucial in driving the implementation forward. The municipality organized various activities, such as open days and training sessions, to prepare the residents and create awareness about waste separation and recycling. The establishment of a composting site and involving informal waste collectors were key aspects of the plan implementation. The municipality aimed to create a comprehensive waste management system that integrated both formal and informal waste collection channels.

Sestri Levante, Italy, already had a high rate of differentiated waste collection, and the focus was on enhancing the existing waste management system. The municipality introduced a "Pay as You Throw" tariff system to further increase waste separation. Extensive

communication and feedback gathering were conducted, and kits were distributed to citizens to initiate the experimental phase of the new waste tariff system. Sestri Levante's long-standing commitment to zero waste made the localized tariff system a strategic step in replacing the old collection method.

Bickfaya, Lebanon, aimed to refine and enhance its existing waste separation practices. The plan focused on establishing a municipal composting site and involving commercial and tourist activities in waste management. By expanding the participation of different stakeholders, including businesses and neighboring municipalities, Bickfaya aimed to improve waste separation and collection beyond residential areas. The investment in a composting site and the engagement of commercial and tourist activities were critical steps towards achieving effective waste management.

While the municipalities had similar goals of improving waste management, the strategies employed and actions taken varied. Mahdia emphasized pilot projects and community engagement, Sestri Levante focused on a localized tariff system and citizen involvement, and Bickfaya aimed to enhance waste separation practices and involve a broader range of stakeholders.

Similarities and differences in the adoption of integrated waste management plan and zero waste approach

The adoption of integrated waste management plans and zero waste approaches shared common elements across the three municipalities, but also exhibited some differences based on their specific contexts. All three municipalities aimed to improve waste management practices, promote recycling, and reduce the amount of waste sent to landfills. However, the strategies employed and the scale of implementation varied.

In terms of similarities, community engagement played a crucial role in all three municipalities. Mahdia, Sestri Levante, and Bickfaya recognized the importance

of educating and involving residents in waste separation and recycling initiatives. They organized various activities such as training sessions, open days, and feedback gathering to raise awareness and foster a sense of ownership among the community members.

Infrastructure development was another common aspect. Mahdia established a composting site, Sestri Levante distributed kits for the PAYT scheme implementation, and Bickfaya invested in a municipal composting site with innovative technology. These technologies and infrastructure investments aimed to support waste

separation, collection, and treatment processes, contributing to the overall objective of reducing waste and promoting recycling.

Policy changes were also integral to the adoption of integrated waste management plans and zero waste approaches. In Sestri Levante, the introduction of the “Pay as You Throw” tariff system required policy adjustments and coordination with stakeholders. Mahdia implemented policies emphasizing the importance of integrating both public and private waste collection channels. Bickfaya focused on expanding waste separation practices to commercial and tourist activities, necessitating policy changes to engage these sectors effectively. Despite these similarities, there were also notable

differences in the adoption of integrated waste management plans and zero waste approaches. The starting situations in each municipality influenced the specific strategies employed. Mahdia built upon an existing waste management plan and focused on implementing pilot projects for separate waste collection, emphasizing community engagement and the involvement of different stakeholders. Sestri Levante aimed to enhance its already high rate of differentiated waste collection through the “Pay as You Throw” tariff system, relying on extensive communication and citizen participation. Bickfaya sought to refine and expand existing waste separation practices, primarily targeting organic waste collection and involving commercial and tourist activities.

Key lessons learned and best practices that can be shared among the municipalities

Developing and implementing integrated waste management plans is a complex process that requires careful consideration of stakeholder engagement, thorough research, data collection, infrastructure investments, and addressing specific challenges. Based on the experiences and best practices from Mahdia, Sestri Levante, and Bickfaya, several key lessons can be learned and shared among municipalities aiming to improve their waste management strategies.

1. Prioritize Stakeholder Engagement:

Stakeholder engagement is crucial throughout the planning and implementation phases. In Mahdia, Sestri Levante, and Bickfaya, involving a wide range of stakeholders, including citizens, businesses, local organizations, and waste management institutions, led to more comprehensive and effective waste management plans. Public consultations, meetings, workshops, and awareness campaigns were conducted to gather input, educate the community, and foster a sense of ownership and responsibility.

2. Conduct Thorough Research and Data Collection:

Thorough research and data collection are essential in developing waste management plans. Diagnostic reports, interviews, fieldwork, and data-driven analysis provided valuable insights into existing waste management practices, identified areas for improvement, and informed the formulation of strategic and operational plans. It is crucial to gather accurate and up-to-date data to make informed decisions and set realistic goals.

3. Establish Monitoring Committees:

Creating monitoring committees or dedicated bodies to oversee plan implementation is crucial. In Mahdia, the establishment of a monitoring committee ensured effective implementation, regular assessment, and adjustments when necessary. These committees can monitor progress, evaluate the plan's performance, and ensure that proposed measures are executed effectively, leading to better waste management outcomes.

4. Foster Public-Private Partnerships:

Engaging the private sector and establishing partnerships with businesses and waste management companies can bring expertise, resources, and innovation to waste management plans. In Mahdia and Bickfaya, agreements with private entities were established to improve waste collection services, optimize routes, and leverage technological advancements. Public-private partnerships can lead to more efficient waste management operations and create opportunities for sustainable financing.

5. Address Challenges in Financing:

Securing adequate funding for waste management plans is often a challenge. Fluctuating exchange rates, as experienced in Bickfaya, can pose financial difficulties. It is important to develop financial models that account for such challenges and explore additional sources of financing. Collaboration with international cooperation projects and seeking support from government agencies and organizations can assist in overcoming financial barriers.

6. Align with Provincial or Regional Plans:

Aligning local waste management plans with provincial or regional strategies is essential to ensure coherence and cooperation among neighboring municipalities. In Sestri Levante, aligning with provincial waste management plans was necessary to address waste management challenges collectively, and also to jointly advocate for changes, when necessary. By coordinating efforts and presenting unified concerns, municipalities can protect their interests and contribute to a more comprehensive waste management dynamic at a larger scale.

7. Adapt Plans to Local Context:

Waste management plans should be tailored to the specific needs and characteristics of each municipality. It is important to consider the local context, including demographic factors, waste generation patterns, available infrastructure, and cultural practices. Customizing the plan ensures its feasibility and relevance, leading to better community engagement and support.

8. Embrace Innovation and Technological Advancements:

Incorporating innovative technologies and practices can enhance waste management systems. Composting stations, advanced waste collection methods, and dynamic information systems, as implemented in Sestri Levante, contribute to more efficient waste management operations. Exploring new technologies and best practices from other municipalities or countries can lead to continuous improvement and greater sustainability.

9. Overcome Leadership Changes and Institutional Challenges:

Changes in municipal leadership and institutional challenges can disrupt the implementation process. Building institutional capacity, ensuring continuity in waste management efforts despite leadership changes, and establishing clear communication and sharing of responsibilities within the plan team can mitigate the impact of such challenges. It is important to develop strategies that foster institutional stability and ensure that waste management plans are institutionalized beyond individual political terms.

10. Share Knowledge and Collaboration:

International cooperation projects, like the CLIMA project, played a vital role in facilitating knowledge sharing, collaboration, and coordination among municipalities. Participating in international forums and engaging with other municipalities or organizations facing similar waste management challenges can provide valuable insights, lessons, and potential solutions. Sharing knowledge and best practices can accelerate progress and foster innovation in waste management.

In conclusion, developing and implementing integrated waste management plans requires a holistic approach that encompasses stakeholder engagement, thorough research, data collection, infrastructure investments, and addressing specific challenges. The experiences and best practices from Mahdia, Sestri Levante, and Bickfaya demonstrate the importance of involving stakeholders, conducting research, establishing monitoring committees, fostering partnerships, addressing financial barriers, and adapting plans to the local context. By learning from these experiences, municipalities can improve their waste management strategies, enhance sustainability, and contribute to a cleaner and healthier environment for their communities.

Importance of Adopting an Integrated Waste Management Plan and Zero Waste Approach

The adoption of an integrated waste management plan and the zero waste approach holds immense importance for municipalities as they strive towards a sustainable future. Waste management is a pressing issue that affects communities, economies, and the environment on a global scale. Municipalities play a crucial role in designing and implementing strategies to address waste challenges within their jurisdictions, and adopting an integrated approach is key to achieving effective and efficient waste management systems.

By embracing the zero waste paradigm, municipalities can revolutionize their waste management practices. The zero waste approach entails a shift in mindset and practices, aiming to minimize waste generation and maximize resource recovery through recycling, composting, and innovative waste treatment technologies. It goes beyond the traditional linear “take-make-dispose” model and fosters a circular economy, where materials are kept in use for as long as possible, creating a sustainable and regenerative system.



The benefits of adopting an integrated waste management plan and zero waste approach are manifold. Firstly, it significantly reduces the amount of waste sent to landfills, mitigating the environmental impact associated with landfilling, such as greenhouse gas emissions and soil and water pollution. By diverting waste from landfills, municipalities can contribute to preserving natural resources, conserving energy, and

reducing carbon emissions.

Secondly, embracing the zero waste approach promotes resource conservation and recovery. Waste is seen as a valuable resource that can be recycled, reused, or repurposed. Through comprehensive recycling programs, municipalities can recover valuable materials, reducing the need for raw material extraction and decreasing

the strain on natural resources. This not only contributes to environmental sustainability but also fosters economic opportunities, such as job creation in the recycling industry and the development of a circular economy.

Thirdly, integrated waste management plans and zero waste approaches prioritize citizen participation and community engagement. By involving residents in waste reduction and recycling initiatives, municipalities can foster a sense of ownership and responsibility among the community members. Education and awareness campaigns play a crucial role in informing citizens about proper waste separation, recycling practices, and the importance of waste reduction. Engaged and informed communities are more likely to actively participate in waste management efforts, leading to higher recycling rates and better overall waste management outcomes.

Furthermore, adopting an integrated waste management plan and zero waste approach encourages innovation and technological advancements. Municipalities are compelled to explore and implement cutting-edge

technologies, such as advanced waste collection systems, smart sorting and recycling processes, and renewable energy solutions. New technologies on the Zero Waste Approach are not always synonymous of expensive or high technologies, but quite often demand low investments, and the re-discovery of previous positive attitudes, such as the Mreparation and re-use circuits. These innovations improve waste management efficiency and contribute to a greener and more sustainable future.

Adopting an integrated waste management plan and embracing the zero waste approach is of utmost importance for municipalities. It offers a pathway to address waste management challenges, reduce reliance on landfills, conserve resources, promote citizen engagement, and foster economic and environmental sustainability. By prioritizing the principles of the zero waste paradigm, municipalities can pave the way towards a cleaner, healthier, and more sustainable future for their communities and contribute to global efforts in waste reduction and resource conservation.

Future Directions for Waste Management and the Zero Waste Approach

As municipalities continue their journey towards sustainable waste management, there are several key directions that can shape their future efforts.

Firstly, continuous stakeholder engagement remains crucial. By involving citizens, businesses, local organizations, and waste management institutions, municipalities can create more comprehensive and effective waste management plans. Public consultations, workshops, and awareness campaigns are essential tools to educate the community, foster a sense of ownership, and encourage responsible waste management practices.

Secondly, the importance of thorough research and data collection cannot be overstated. Diagnostic reports, interviews, and data-driven analysis provide valuable insights into existing waste management practices, identify areas for improvement, and inform the formulation of strategic and operational plans. Accurate and up-to-date data enable municipalities to make informed decisions, set realistic goals, and monitor progress effectively.

Thirdly, the establishment of monitoring committees or dedicated bodies is essential for successful plan implementation. These committees can oversee progress, evaluate performance, and ensure that proposed

measures are executed effectively. Regular assessment and adjustments are necessary to address challenges, improve waste management practices, and achieve desired outcomes.

Fourthly, fostering public-private partnerships can bring expertise, resources, and innovation to waste management plans. Engaging the private sector, collaborating with businesses, and waste management companies can lead to more efficient waste collection, optimized routes, and opportunities for sustainable financing. Municipalities should explore these partnerships to enhance waste management operations and ensure long-term sustainability.

Fifthly, addressing financing challenges is vital for the success of waste management plans. Securing adequate funding can be difficult, especially considering fluctuating exchange rates and economic uncertainties. Municipalities should develop financial models that account for such challenges and explore additional sources of financing. Collaboration with international cooperation projects, seeking support from government agencies, and organizations can provide assistance in overcoming financial barriers.

Sixthly, aligning local waste management plans with provincial or regional strategies is essential. By

coordinating efforts and presenting unified concerns, municipalities can contribute to a more comprehensive waste management approach at a larger scale. Cooperation among neighboring municipalities ensures coherence and efficiency, leading to better waste management outcomes

Seventhly, plans should be tailored to the specific needs and characteristics of each municipality. Demographic factors, waste generation patterns, available infrastructure, and cultural practices should be considered when developing waste management strategies. Customizing plans, with a transformative perspective grounded on the

reality of each territory, ensures their feasibility, relevance, and larger community engagement and support. Eighthly, municipalities should embrace innovation and technological advancements. Incorporating new technologies, such as composting stations, advanced waste collection methods, and dynamic information systems, can enhance waste management systems' efficiency and sustainability. Exploring best practices from other municipalities or countries can lead to continuous improvement and innovative waste management solutions..



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Ninthly, overcoming leadership changes and institutional challenges is essential for the continuity of waste management efforts. Building institutional capacity, ensuring effective communication, and sharing of responsibilities within the plan team can mitigate the impact of leadership changes. Municipalities should develop strategies that foster institutional stability and ensure the institutionalization of waste management plans beyond individual political terms.

Lastly, knowledge sharing and collaboration are key to advancing waste management practices. Participating in international forums, engaging with other municipalities or organizations facing similar waste management challenges, and sharing knowledge and best practices can accelerate progress and foster innovation in waste management. Collaboration and cooperation among mu-

nicipalities can lead to collective learning and the development of sustainable waste management solutions.

In conclusion, this publication provided valuable insights and concrete guidance for Mediterranean municipalities aspiring to improve their waste management practices and embrace the zero waste approach. By adopting integrated waste management plans, municipalities can significantly contribute to a cleaner and healthier environment for their communities. Through stakeholder engagement, research, infrastructure investments, and addressing challenges, municipalities can pave the way towards sustainable waste management systems and a circular economy. By learning from the experiences and best practices of Mahdia, Sestri Levante, and Bickfaya, municipalities can enhance their waste management strategies and contribute to a more sustainable future.

CLIMA

CLEANING INNOVATIVE MEDITERRANEAN ACTION

FINANCIAL DATA

2.8	million € Total Budget
2.5	million € EU contribution
10%	Partners' cofinancing

PROJECT DURATION



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