A digital industrial solid waste reuse platform for the Balkan region

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Abstract

The "SWAN-a digital Solid Waste reuse plAtform for BalkaN" project is the creation of an innovative reuse ecosystem that will develop locally and manage transnationally value chains for industrial solid waste in Balkan Region and is co-financed by the European Regional Development Fund (ERDF) under the umbrella of the European Union programme INTERREG BalkanMed 2014-2020. The SWAN project aims to reduce the total quantity of industrial solid waste disposed or landfilled and to improve the overall resource efficiency of the studied regions. This will be achieved by the design and development of a digital platform that will a) map solid waste sources and potential receivers of waste streams; b) propose national and transnational viable waste reuse pathways, through matching supply and demand; c) establish a collaborative network of relevant stakeholders in the region. The project is closely related to the EU Circular Economy Strategy (2018), which aims to stimulate Europe's transition towards a circular economy and industrial symbiosis for reducing the total amount of waste, boost global competitiveness, foster sustainable economic growth and generate new jobs. Furthermore new environmental policies and strategies for advanced solid waste management will be proposed and a pilot value chain in the region of Attica will be implemented.

Keywords: *Industrial Solid Waste, Circular Economy, Digital Platform, Interreg V Balkan Med, SWAN, Industrial Symbiosis*

1. Introduction

The EU economy currently loses a significant amount of potential secondary raw materials which are found in waste streams. In 2013, total waste generation in the EU amounted to approximately 2.5 billion tons of which 1.6 billion tons were streams that could be potentially reused or recycled. In 2016, only a limited share (43%) of the municipal waste generated in the Union as a whole was recycled, with the rest being landfilled (24%) or incinerated. In 2016 ten Member States still landfilled over 50% of their household waste and six of them incinerated 40% or more [1,2]. Towards that end on 22 May 2018, the EU Member States approved a set of ambitious measures to make EU waste legislation fit for the future, as part of the EU's wider Circular Economy Policy. According to these rules: a) increase the recycling rates for packaging waste to 65% by 2025 and 70% until 2030; b) increase recycling of municipal waste to at least 60% by 2030; and c) eliminate landfill to 10% or less of the total amount of municipal waste generated by 2035. The new legislation foresees more use of effective economic instruments and other measures in support of waste hierarchy. Producers are given an important role in this transition by making them responsible for their products when they become waste. New requirements for extended producer responsibility schemes will lead to improving their performance and governance. In addition, mandatory extended producer responsibility schemes have to be established for all packaging by 2024 [2].Thus, turning waste into a resource is an essential part of increasing resource efficiency and closing the loop in a circular economy.

Material management is recognized by European policy makers as a necessity not only to decrease impact of waste but also to reduce raw material depletion [3]. Many recycling initiatives reached a plateau of using existing product cycles and recovery technology. Still, there are key waste streams and materials that need to be further addressed due to the difficulty (cost and complexity) of recycling them, their large volume and their carbon footprint.

This challenge is stressed in the Balkan Mediterranean region, where the economic crisis is still present, controlling costs is a key target, and new growth options for the regional economies and societies are sought after. It is known that the added value from efficient waste management in the region, with material and energy cost savings, is currently not always realized because stakeholders do not possess a clear view of opportunities (e.g. industrial symbiosis schemes) and indirect gains (e.g. climate change mitigation potential). Additionally in

the Balkan region, is the added challenge of a lack of national or regional strategies for effective management of solid waste which the annual generation of municipal waste, mainly from households but including similar wastes from such sources as commerce, offices and public institutions has largest increases [4].

2. SWAN Project

The project is entitled “a digital Solid Waste reuse plAtform for BalkaN” with short title “SWAN”. SWAN (MIS 5010973) is a project co-funded by the European Union Cooperation Programme “Interreg V –B Balkan-Mediterranean 2014-2020”and National Funds of the participating countries. The project will cover four countries, namely Greece, Albania, Cyprus and Bulgaria, started on 15.09.2017, has a total duration of 24 months and total budget of €968.000 (€822.800 ERDF)

2.1. Beneficiaries

The consortium is formed by seven Partners representatives of four Balkan Mediterranean countries (Greece, Albania, Bulgaria and Cyprus):

- **Association of Municipalities in the Attica Region (E.D.S.N.A.),** EDSNA is the Solid Waste Management Authority for all municipalities in the Attica Region: Lead Beneficiary (LP) of the project
- **Greek Ministry of Environment and Energy,** The Greek Ministry of Environment belongs to the main public body of Greek Government and works to achieve the protection of the natural environment and resources, the improvement of quality of life.
- **University of the Aegean / Research Unit / Department of Business Administration**, University of the Aegean (U AEGEAN)/GR embodies the concept of a university network with 16 Departments /26 Postgraduate Programmes in 6 Aegean islands and one of the largest academic e-libraries.
- **Albanian Ministry of Environment, Forestry and Water Administration**, Albania Ministry of Environment is a public institution responsible for the formulation and implementation of environmental policies. Participation in this project will help and support ministry to improve the waste management plan of Albania.
- **ILIRIA – Protection and Social & Environmental Development Association NGO**, Is a NGO registered by the District Court of Tirana. By participation in the project, the NGO will be informed about general waste issues and will contribute to a better waste management in Albania.
- **Bulgarian Industrial Association – Union of the Bulgarian Business, BIA**, The BIA – Union of the Bulgarian Business is a non-governmental organization of the Bulgarian industry.Participating in the project will provide BIA with a strong tool for supporting industry in its efforts to implement the circular economy approach and become driving force for better environmental performance of the country and region.
- **Cyprus University of Technology-Department of Environmental Science and Technology,** The University (6 faculties and 12 Departments) is based at Limassol. The Dpt. of Env. Science and Technology is involved in a large number of research projects dealing with environmental monitoring, risk and impact assessment.

2.2 Aim

The aim of the SWAN project is to reduce the environmental polluting load by diverting the volume of solid industrial waste from being landfilled, reduce the amount of imports of raw materials and cut down the respective national greenhouse gases (GHG). This will be achieved with the creation of an innovative Balkan Med ecosystem (SWAN ecosystem) that will develop locally and manage transnationally value chains for solid waste.
It will be comprised of two parts, which sum up the project’s main outputs:

a) A digital ecosystem which will separately map and collectively match solid waste sources and flows in the region. A set of new algorithms will provide core intelligence for technical and financial matching of supply and demand, incorporating viable business models;
b) An industrial ecosystem of industries in the Balkans that produce and use solid waste. They will use the SWAN digital ecosystem for exploiting new recycling opportunities that may not be economically viable locally but make financial and social sense transnationally.

Specifically, the proposed waste reuse value chains will aim at a positive impact on the project partners' regional and national economies and foresees in a wide range of beneficiaries:

a) Resource policy makers will develop relevant strategies, quality specifications and standards and policy instruments for savings and profit opportunities;
b) Waste producers and collectors will identify ways to recover value;
c) Industrial firms will discover material opportunities to source suitable substitutes and to achieve positive GHG abatement;
d) The wider society may see job creation, ranging from IT support for the four IT platforms, to new SMEs that will enter the resulting waste management value chains.
e) The development of environmental policies and strategies for improved solid waste management.

The end goal is tangible and pragmatic improvements in social, environmental and financial conditions in the region, thus paving the way towards green growth in the region that is fully aligned with EU aspirations for environment and growth.

2.3 Methodology / Work Packages (WP)

A three-step approach is adopted: a) map & tag potential sources and sinks of solid waste in the partners' countries; b) match them based on technical and financial criteria; c) propose relevant business models for opportunity exploitation, especially at transnational level. This paper deals with these steps six work packages that unfold in:

2.3.1 WP1–PROJECT MANAGEMENT & COORDINATION. ***Provides an efficient transnational Project Management, ensures successful partnership, and monitors timely implementation.***

2.3.2 WP2–PROJECT COMMUNICATION & DISSEMINATION. ***The SWAN team uses environmentally-friendly tools to reach the public and private sectors, SMEs, and the citizens of the regions participating in the project.***

Communication and dissemination are activities relating to the project's appearance to the "outside world". The communication and dissemination effort of SWAN aims to accomplish the following goals (qualitative and quantitative):

• Publish and disseminate the results of the project within the local authority administration and to local relevant stakeholders as well as to the wider community of European urban policy-makers and practitioners
• Attract the local authority and local relevant stakeholders to events and activities organised by the partnership

The stakeholders should become aware of the project's scope and agenda and how these are connected to their own needs and priorities.

For that reason a SWAN communication plan has been conducted, which structures and organises the communication and dissemination effort of the project SWAN. The plan includes a detailed analysis of the communication strategy and the communication and dissemination infrastructure, target groups and the society in general on the objectives, activities and results of the project.

Fig. 1 The SWAN project logo

2.3.3 WP3–DIGITAL ECOSYSTEM. ***Develops the SWAN Digital Ecosystem of four IT platforms on which development of solid waste reuse value chains will be based.***

This will be a collaborative network of four IT platforms, one for each country of the consortium. Each IT platform will act as a digital observatory for cataloguing the corresponding partner region's solid waste sources and flows. A common architecture will enable them to exchange information, leading to the creation of the SWAN Balkan Solid Waste Map–a unique dashboard of solid waste flows and stakeholders in the region, and a significant step in developing pragmatic solutions to the aforementioned EU challenges.
These freely accessible platforms will act as repositories of best-practice business models for solid waste management.

2.3.4
WP4–SINK/SOURCE MAPPING. ***Develops the SWAN Balkan Solid Waste Map-a unique dashboard of solid waste flows and stakeholders in the region.***
WP5–SINK/SOURCE MATCHING. ***Develops the algorithms that process the SWAN Balkan Solid Waste Map and provide different options for solid waste reuse value chains and related business models.***

The core of the SWAN project is the development of the SWAN mapping and matching tool. Its objective will be to (a -WP4) map all the existing sources of solid waste and their characteristics in a given region as well

as the potential users/sinks of these waste streams and (b -WP5) to implement an algorithm that can match the sources and sinks based on geographical (proximity between source and sink), technical (suitability of waste type) and financial (viable investment for all parties involved) criteria.

The algorithm will be implemented in selected regions of the countries involved in the project consortium. For each waste source and sink, its geographical coordinates as well as all the major qualitative and quantitative parameters, relevant to the solid waste streams, will be collected using questionnaires. The qualitative parameters include the type of the waste, the seasonal availability as well as the current management method, whereas the qualitative parameters include the quantity of each waste flow and any monetary values related to the existing management method.

At the same time, a database of existing solid waste management schemes based on industrial symbiosis will be designed, developed and populated. The information will be drawn from previously published literature sources as well as input from the questionnaires. This database will be a critical component in the development of the matching algorithm.

2.3.5 WP6–INTEGRATION. ***Ensures knowledge management and synthesis of results for establishing a sustainable and viable infrastructure post-project completion.***

INDUSTRIAL ECOSYSTEM, i.e. a network of industries in the region that produce and use solid waste. These are the direct users of the SWAN Digital Ecosystem, and thus its immediate beneficiaries. Their collaboration will aim at the development and promotion of local/regional/national and transnational solid waste reuse value chains. This is a significant characteristic of our approach as it will enable exploitation of recycling opportunities that may be prohibitively costly at local level but cost-efficient through a transnational value chain. In addition, the industrial ecosystem will have direct access to the two Ministries of Environment (Gr, Al) of our project team, thus enabling the development of a wider network of stakeholders/decision-makers, for investigating together common approaches, local adaptations through policy making, and transnational economies of scale through smart cooperation at all levels (technical, project, stakeholder). Finally, the LP will contribute a unique waste management facility that may be used as testbed by this ecosystem.

2.4 Location of Activities

The project will cover four countries, namely Greece, Albania, Cyprus and Bulgaria. In Greece, the application area will be the Attica Region, where LP operates as the regional public body responsible for solid waste management. Attica region encompasses the entire metropolitan area of Athens, the capital of Greece. Circa 3,750,000 people live in the region (approximately 40% of the total Greek Population), generating nearly 45% of the country's total waste balance.

A full inventory and mapping of all possible and potential sources of solid waste, including small, medium and large enterprises, with quantitative and qualitative characteristics (including spatial characteristics, categorization-metals/plastics/organic waste/etc., requirements for treatment before reuse) will be performed.

At the same time, a unique waste management and storage unit for solid waste, located in Attica and controlled by the LP, will be capitalized as a testbed for the purposes of SWAN, in order to test implementation of selected business models, and contributing to the viability aspects of the project.

In the remaining partner countries, project activities will be carried out at national level. All medium and large industries will be recorded, along with the characteristics of the available solid waste flows. The parallel objective will be to identify regions which could act as the basis for the development of industrial symbiosis clusters based on solid waste.

In addition, project partners in Albania, Cyprus and Bulgaria will get in contact with selected stakeholders in the identified regions, in order to validate the proposed business models and plan for further funding to implement them, thus ensuring the continuation of the SWAN legacy.

2.5 Transnational Cooperation

A critical parameter that affects the viability of solid waste reuse value chains is the cost of transportation. Due to their nature, solid waste cannot be easily compressed in order to reduce their volume, thus making their handling difficult and expensive. In Balkan countries, with many small towns with industrial activity near the borders, the best solution for reusing the waste flow may be found on the other side of the border. Thus, our overall project design and implementation approaches are inherently transnational. Our vision is to identify viable transnational business models and to gradually create a Balkan cluster based on solid waste reuse, which will strengthen local economies while tightening the bonds among the countries represented in the project consortium.

2.6 Expected results

The results viability plan consists of 4 impact categories that further highlight the innovations of SWAN:

- RESEARCH: a)Provide assistance to waste management agents towards identifying joint business opportunities and promote academia-industry cooperation, through the application of the two algorithms for solid waste supply and demand matching;(b)Develop the SWAN Balkan Solid Waste Map, link national and transnational stakeholders and develop innovative approaches towards achieving circular economy benefits through the formulation of 8 survey reports.
- KNOWLEDGE TRANSFER: Project beneficiaries and the wider public will learn about circular economy and industrial symbiosis and familiarize themselves with the concept of waste reuse value chains through workshops, project website, newsletters, press releases, articles and press coverage. They will be encouraged to learn and use the SWAN Digital Ecosystem (using the operational and training manuals and by attending the training sessions) and work towards achieving wider EU targets on waste reuse. Moreover, targeted policy making at national and transnational levels will be enabled through our policy recommendation reports.
- PRODUCT DEVELOPMENT: Project beneficiaries will be able to jointly identify opportunities (using the platforms and databases) and develop new models for exploiting transnational waste reuse value chains, through the national business model reports and transnational business models. Moreover, all interested SMEs will be encouraged to introduce innovations (products, processes) in these newly developed value chains.
- SUSTAINABLE NETWORKS: The SWAN Industrial Ecosystem will remain free access & active after the completion of the project and, will help to sustain the ecosystem links, contribute to its expansion to all Balkan countries by including additional actors (research institutes, enterprises, NGOs, SMEs)

3. References

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