"CircE - European regions toward Circular Economy"
INTERREG Europe Project

Priority Opportunities
Project Partner 7 - Sofia Municipality

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1. EXECUTIVE SUMMARY

The *Analytic Hierarchy Process* (AHP), introduced by Thomas Saaty (1980), is an effective tool for dealing with complex decision-making, and may aid the decision maker to set priorities and make the best decision. By reducing complex decisions to a series of pairwise comparisons, and then synthesizing the results, the AHP helps to capture both subjective and objective aspects of a decision. In addition, the AHP incorporates a useful technique for checking the consistency of the decision maker's evaluations, thus reducing the bias in the decision making process. The AHP has a special concern with departure from consistency, its measurement and on dependence within and between the groups of elements of its structure. It has found its widest applications in multicriteria decision making, planning and resource allocation and in conflict resolution. In its general form the AHP is a nonlinear framework for carrying out both deductive and inductive thinking without use of the syllogism by taking several factors into consideration simultaneously and allowing for dependence and for feedback, and making numerical tradeoffs to arrive at a synthesis or conclusion. T. L. Saaty developed the AHP in 1971- 1975 while at the Wharton School (University of Pennsylvania, Philadelphia, Pa).

2. PRIORITIZATION

How we used the Criteria tree

We used the Criteria tree as method defining our prioritization criteria. The final priority opportunities were defined based on the results of the AHP evaluation in key to the identified risks by the project. Each of the identified opportunities has its own specific contribution to the practical implementation of the circular economy on the territory of Sofia municipality. Because of that, their clear prioritization without the application of the AHP method was not possible. For that purpose, as a first step, we identified the challenges to each opportunity and the goals that will be reached with its realization. After a preliminary priority evaluation by the project team members, the results obtained for the different options differed with a long range. Each expert had done the prioritization based on his / her own knowledge, views and expertise. The prioritizations made were correct from an individual point of view but hardly comparable and justified as part of a holistic approach.

Due to the above, we decide to use the possibilities of the AHP method to reach a fully reasoned, prioritized and easily explainable evaluation approach.

We use AHP to measure both physical and psychological values of selected criteria. The evaluation process was separate in to the three main steps.

2.1. How we defined the weights

Within which the AHP method has investigated. In order to understand the process, the project team searched for additional public information and data describing in details the method. Short online library with articles, examples and video lesson was prepared and distributed among the team. Project team experts enrich their knowledge on AHP method using the lead partner presentation and collected additional information. Team up discussion was health to support the knowledge exchange, lesson learned, presenting opinions and shape the evaluation process by AHP method. The AHP method has implemented on practice for the selected criteria. The

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project team discussed the achieved result, which have verbally explained and motivated. We summarized the achieved results and they were send by emails to the project stakeholders.

2.2. Group Evaluation

In order to participate identified project stakeholders to the decision making process we engaged them in to the AHP evaluation as well. Their judgments on the values of criteria has administered online, through emails. To provide a common ground for sharing information, the stakeholders received an overview of the AHP method, summarized prioritization results performed by project team during implementation of step one and opportunity prioritization. The stakeholders were encourage to provide individual evaluation using AHP method.

2.3. How we got the final priority ranking

We agreed that the best way to achieve the final results from EHP evaluation is by organizing stakeholder meeting. The meeting was held on 28 September on which the project team act as facilitator in order to explain the achieved results and facilitate the meeting discussions. Each stakeholder has a chance to participate to the discussion and to motivate and present the evaluations values. During the meeting, some of the stakeholders recognize the AHP as method that can be implement in their sectors and support them taking the motivate decisions. Aggregation of individual judgments take place as well. During the current evaluation stage, differences in judgments on the pairwise comparisons was reduced by discussing previously unshared information about the properties of the criteria or alternatives that were inconsistently compared.

These steps were initiated in respect to the AHP stages in the decision-making process: Structuring the decision problem to solve; Evaluating the decision criteria and the decision alternatives, and Categorizing, rankordering, or prioritizing the decision alternatives.
Because the weights of the criteria may be dependent on how well the set of alternatives fulfill these criteria, we used a bottom-up approach of conducting the pairwise comparisons. This means that the relative priorities of the alternatives on the criteria were evaluated first, after which the weights for the criteria were judged. Conversely, in a top-down approach, first the weights for the criteria are evaluated, and subsequently the priorities of the alternatives.
The results of determine relative importance of criteria through judgments are presented bellow, as follow

Circular economy impact

		Circular Economy Impact			
	Level 1	Strategic	Economic	Social	Environmental
Circular Economy Impact	Strategic	1	5,0000	1/3	1/5
	Economic	0,2000	1	1/3	1/9
	Social	3,0000	3,0000	1	1/7
	Environmental	5,0000	9,0000	7,0000	1
	Please add a number between 1 and 9 in the green slots (9 being the highest value)				

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Strategic Impact

		Strategic Impact				
	Level 2	Replicability	Time-scale	Coherence with RIS3	Contribution to the Local Eco-System Development	Contribution to the legislation targets
Strategic Impact	Replicability	1	5,0000	3,0000	1/6	1/7
	Time-scale	0,2000	1	5,0000	1/5	1/3
	Coherence with RIS3	0,3333	0,2000	1	1/3	1/5
	Contribution to the Local Eco-System Development	6,0000	5,0000	3,0000	1	1/5
	Contribution to the legislation targets	7,0000	3,0000	5,0000	5,0000	1
	Please add a number between 1 and 9 in the green slots (9 being the highest value)					

Economic Impact

		Economic Impact	
	Level 2	Profit	Payback Time
Economic Impact	Profit	1	1/7
	Payback Time	7,0000	1
	Please add a number between 1 and 9 in the green slots (9 being the highest value)		

Social impact

		Social Impact			
	Level 2	New Skills	Public awareness	Social Inclusion	Job Creation
Social Impact	New Skills	1	1/3	1/7	1/5
	Public awareness	3,0000	1	5,0000	7,0000
	Social Inclusion	7,0000	0,2000	1	5,0000
	Job Creation	5,0000	0,1429	0,2000	1
	Please add a number between 1 and 9 in the green slots (9 being the highest value)				

Environment impact

		Environmental Impact		
	Level 2	Emissions Saved	Energy Efficiency	Resource Efficiency
Environmental Impact	Emissions Saved	1	5,0000	1/7
	Energy Efficiency	0,2000	1	1/9
	Resource Efficiency	7,0000	9,0000	1
	Please add a number between 1 and 9 in the green slots (9 being the highest value)			

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Resource efficiency

		Resource Efficiency	
	Level 3	Total Resource Volume Saved	Strategic Resources Saved
Resource Efficiency	Total Resource Volume Saved	1	1/7
	Strategic Resources Saved	7,0000	1
	Please add a number between 1 and 9 in the green slots (9 being the highest value)		

The calculation of the weights we have got from the lead partner.

Level 1	Local weight	Global weights
Strategic	0,146	0,146
Economic	0,047	0,047
Social	0,1395	0,1395
Environmental	0,6675	0,6675
Level 2	Local weight	Global weights
Replicability	0,0971	0,0141766
Time-scale	0,0914	0,0133444
Coherence with RIS3	0,0606	0,0088476
Contribution to the Local Eco-System Development	0,3259	0,0475814
Contribution to the legislation targets	0,425	0,06205

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Level 2	Local weight	Global weights
Profit	0,125	0,005875
Payback Time	0,875	0,041125
Level 2	**Local weight**	**Global weights**
New Skills	0,0263	0,00366885
Public awareness	0,6661	0,09292095
Social Inclusion	0,2245	0,03131775
Job Creation	0,0832	0,0116064
Level 2	**Local weight**	**Global weights**
Emissions Saved	0,2192	0,146316
Energy Efficiency	0,0593	0,03958275
Resource Efficiency	0,7215	0,48160125
Level 3	**Local weight**	**Global weights**
Total Resource Volume Saved	0,125	0,060200156
Strategic Resources Saved	0,875	0,421401094

Following the achieved results, the AHP methods allow us to draw up the conclusions that for PP07 the highest global weights are for Environmental criteria, followed by Resource Efficiency, Strategic Resources Saved, Emissions Saved, Strategic, Social, Public awareness, Contribution to the legislation targets, Total Resource Volume Saved, Contribution to the Local Eco-System Development, Economic, Payback Time, Energy Efficiency, Social Inclusion, Replicability, Time-scale, Job Creation, Coherence with RIS3, Profit and New Skills.

3. OPPORTUNITIES RANKING

Similar approach was used for evaluation of identified project opportunities. The relative importance/preference/likelihood was achieved for every first criterion in respect to the second one for each opportunity. Following the lead partner instructions the ratio scale adopted ranges from 1 (criteria are perceived as equal) to 9 (the first criterion is considered extremely more important than the second one).

3.1. PP07-S5-001 Training center

Establishment of a center within the Municipal enterprise for waste treatment - Sofia for training of staff for the operation of composting plants, seeking an adequate response to the growing need of such specialists in the country, with target Food waste. The identified barriers are Economics - Not profitable for businesses even if other barriers are overcome - Lack of a comprehensive understanding that the practical application.

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3.2. PP07-S5-002 Sectoral separate collection

Start meetings and talks with the hotel industry and municipal hospitals for separate collection of biodegradable waste, with target Food waste. The identified barriers are Economics - Capital intensive and/or uncertain payback times - Complex approach based on interdependent and consistency.

3.3. PP07-S5-003 Sustainable ecotourism

Promoting the possibilities of maintaining composts in guest houses as part of the sustainable ecotourism, with target Food waste. The identified barriers are Economics - Capital intensive and/or uncertain payback times - Complex approach based on interdependent and consistency.

3.4. PP07-S5-004 Cycling

Promoting bicycles as an opportunity to move to a central city area, with target Environment transport. The identified barriers are Economics - Not profitable for businesses even if other barriers are overcome - Lack of public interest.

3.5. PP07-S5-005 Industrial symbiosis

Preparing business models to promote cross-sectoral links, by creating secondary raw materials markets or promoting so-called "Industrial symbiosis", with target Raw materials. The identified barriers are Market failures - Externalities (true costs) not fully reflected in market prices - High production costs and not enough developed national market for secondary raw materials and recycled materials.

3.6. PP07-S5-006 Guidelines preparation

Preparation of guidelines containing sequence actions taken in case of destruction of buildings and the subsequent treatment of generated waste, with target Built. The identified barriers are Social factors - Custom and habit: ingrained patterns of behavior by consumers and businesses - Lack of a comprehensive understanding that the practical application.

3.7. PP07-S5-007 Pellet plant

Construction of a pellet plant for utilization of wood waste generate from Municipal enterprise for waste treatment – Sofia and feeding the administrative buildings of Sofia Municipality, with target Biodegradable waste. The identified barriers are Social factors - Custom and habit: ingrained patterns of behaviour by consumers and businesses - Lack of a comprehensive understanding that the practical application.

3.8. PP07-S5-008 ECO-INDUSTRIAL PARK

Building an ECO-INDUSTRIAL PARK, representing a multifunctional complex, illustrating the idea of resource efficiency and circular economy. The park will essentially be a preparation center for re-use and recycling, but at the same time it will be designed as a visitor center for social and cultural events, recreation areas to attract the attention of visitors and to increase their awareness and ecological issues, with target Resource efficiency and circular economy. The identified barriers are Social factors - Capabilities and skills lacking either in-house or in the market at reasonable cost - Insufficient comprehensive and detailed basic information.

3.9. PP07-S5-009 RRR centers

Design of centers for reuse, repair and preparation of waste to reuse, including provision of facilities and equipment on the territory of Sofia Municipality - Municipal - Eco Parks, through which to seek a point of intersection between the interest of the business, the municipality and

the inhabitants, with target Eco Parks. The identified barriers are Social factors - Capabilities and skills lacking either in-house or in the market at reasonable cost - Insufficient comprehensive and detailed basic information.

3.10. PP07-S5-010 Clean technologies for sustainable environment

Innovative and applied potential of a competence center "Clean technologies for sustainable environment - water, energy, waste for the circular economy - Clean & Circle" - The idea of the center is the development of specific technologies and innovations for the different types of waste to become resources, with target Sustainable environment. The identified barriers either are Social factors - Capabilities and skills lacking in-house or in the market at reasonable cost - Lack of a comprehensive understanding that the practical application.

3.11. PP07-S5-011 Public campaigns

Conduct of campaigns, meetings, seminars and public discussions on raising awareness of the transition to circular economy opportunities, with target Public awareness. The identified barriers are Social factors - Capabilities and skills lacking either in-house or in the market at reasonable cost - Lack of a comprehensive understanding.

3.12. PP07-S5-012 Partnership

Preparation and signing a partnership and mutual assistance agreement in the field of environment and the circular economy with specialized in these sectors universities (for example, University of Chemical Technology and Metallurgy, University of Forestry and etc.), with target Public awareness. The identified barriers are Social factors - Capabilities and skills lacking either in-house or in the market at reasonable cost - Lack of a comprehensive understanding that the practical application of a circular economy is rather a complex approach based on interdependent and consistent policies rather than the application of individual measures and guidelines.

3.13. PP07-S5-013 Legislation development

Initiate steps to modify waste management programs with the inclusion of a circular economy section, with target Legislation. The identified barriers are Social factors - Capabilities and skills lacking either in-house or in the market at reasonable cost - Lack of a comprehensive understanding that the practical application of a circular economy is rather a complex approach based on interdependent and consistent policies rather than the application of individual measures and guidelines.

3.14. PP07-S5-014 Energy recovery

The third phase of a project for the construction of a cogeneration plant in Sofia municipality with the utilization of RDF fuel on the territory of "Toplofikacia Sofia" with funding from OP "Environment 2014-2020" is in the process of preparation. The capacity of the plant is to recover 180,000 tons of RDF per year and will produce 135,000 MWh of electricity sufficient to meet the needs of 25,000-30,000 households; 390,000 MWh of heat sufficient to meet the needs of 30,000-40,000 households; 65 million Nm3 will reduce Natural gas consumption. The total energy efficiency of the plant is over 90%, with target Sustainable environment. The identified barriers are Social factors - Custom and habit: ingrained patterns of behavior by consumers and businesses - Sensitive social topic, related to Not in My Backyard Phenomenon

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and forthcoming actualization of tax rates. Technical time needed for project preparation and approval.

3.15. PP07-S5-015 Public awareness

Civil participation in the recycling process provides for identifying at least 300 households to participate in a pilot initiative for a comprehensive organization of separate collection of packaging waste - plastics, paper, metal and glass and food waste. During the project implementation, Sofia Municipality will provide separate households for separate collection to households willing to participate free of charge, with target Public awareness. The identified barriers are Social factors - Capabilities and skills lacking either in-house or in the market at reasonable cost - Lack of a comprehensive understanding.

3.16. PP07-S5-016 Mobile separate collection

Implementing separate collection in vehicles owned by Sofia Municipality Bus Park, by positioning a mobile separate collection bins and guidelines for their purpose. That will create an opportunity for Sofia municipality gest to use a separate collection of WEEE, during their travels, with target WEEE. The identified barriers are Economics - Capital intensive and/or uncertain payback times - Complex approach based on interdependent and consistency.

3.17. PP07-S5-017 Centers for reuse and repair

Eco Parks. It is foreseen the citizens to bring on site their old furniture and other waste. If something could be repair will be sell it in the center shop, with target WEEE. The identified barriers are Economics - Not profitable for businesses (1) even if other barriers are overcome - Strongly related to market habits. Long rate or investment return and lack of consumers' interest.

The evaluation AHP results for each identify opportunity are present below.

Opportunity		Global ranking value	Clarification
PP07-S5-001	Training center	4,71412047	Generation of trained specialists will satisfy the expected demand for expertize, not only on the territory of the municipality but also on the country. The need for professionally trained staff increases annually with the construction of the pre-treatment, composting facilities (mainly financed by the OP "Environment"), etc. installations for treatment of MWs.
PP07-S5-002	Sectoral separate collection	6,04659109	Separate collection is the second most important step after the prevention, through better quality for reuse, recycle and recovery operations.
PP07-S5-003	Sustainable ecotourism	3,9168542	The introduction of sustainable tourism as an integral part of the sector will enhance both the public culture of tourists, waste management processes and the introduction of pilot models for separate collection and composting.
PP07-S5-004	Cycling	5,39973684	Despite the good potential for development, a substantial infrastructure is needed to create safe conditions for practical realization in bigger scale.

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PP07-S5-005	Industrial symbiosis	5,2930578	A clean business to business model combining the challenges of some companies with the capabilities of others to achieve circular economy models.
PP07-S5-006	Guidelines preparation	5,118524	The understanding of the legislative framework, objectives, requirements and guidelines for development as well as the principles, good practices and opportunities in the sector can be ensured through the realization of this opportunity.
PP07-S5-007	Pellet plant	5,50248035	The construction of pelet installation will ensure part of the biodegradable waste to recovery for which additional technological, time and financial resources are needed.
PP07-S5-008	ECO-INDUSTRIAL PARK	4,4490584	Understanding and realizing the processes is easier settle by providing the opportunity for their practical visualization on the ground.
PP07-S5-009	RRR centers	5,0053237	Creating places that serve as a cross-section between business, population and municipal is expected to bring about the practical realization of more business ideas in the field of circular economics.
PP07-S5-010	Clean technologies for sustainable environment	5,95504751	Create and support the development of a community united around the need to improve technological processes and reduce their pressure on environmental components.
PP07-S5-011	Public campaigns	5,6171774	High awareness provides a high level of understanding of processes related to the circular economy and the thinking towards the initiatives taken in this direction.
PP07-S5-012	Partnership	5,99304779	The unification of different communities (scientific, local, business, population, etc.) in one cause ensures the achievement of quality results.
PP07-S5-013	Legislation development	6,33363055	Proposals to optimize national and local regulations to facilitate the realization of circular economy models.
PP07-S5-014	Energy recovery	6,60178224	Main priority of Sofia Municipality during the current programming period and a leading scenario of a municipal waste management system.
PP07-S5-015	Public awareness	4,65828845	Integrating society into waste management processes by delivering visible results achieved through their efforts.
PP07-S5-016	Mobile separate collection	5,13809505	Providing an opportunity for the selective separation of waste as close as possible to the generation place will provide both cleaner flows and built habits for local participation in the process.

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PP07-S5-017	Centers for reuse and repair	5,47473665	In line with national policy, the current programming period will provide an opportunity for the direct involvement of local craftsman communities in the processes of circular economy.

The rankings results using AHP was fully approved by the stakeholder without any differences. The achieved results will be further analyzed and will incorporate in to the Sofia municipality Waste management program action plan.

4. THE STAKEHOLDERS

The summarized result were presented to the stakeholders on meeting on 28 September. Only general remarks were made by the stakeholders, related to the flexibility and opportunities of implementing the AHP methods in their working process.

The main conclusion of the prioritization, using AHP was that the method provide a practical working opportunity to clear and understandable evaluation and prioritization of criteria, and a set of alternative options among which the best decision is to be made.

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