"CircE - European regions toward Circular Economy"

INTERREG Europe Project

Priority Opportunities

Project Partner 3

Lower Silesia

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1. Executive summary

The main output of CircE Project is to increase the capability of PP Policy instruments to steer economy towards a circular model. To achieve this objective Lower Silesia region collected the information needed to identify circular economy opportunities thanks to meeting and dialogue with regional Stakeholders and Marshal's Office. Very important aspect was to collaborate with other PP in exchanging experience and awareness in this subject. Regions further developed in CE concept gave many useful tips and examples of implemented and working actions. All found opportunities in the region was reported in Opportunities Report done in semester 2. The opportunities previously reported have been found in publications such as: Diagnosis and development trends for S3 Natural Resources And Recyclable Materials, Strategic Framework for Smart Specialisations of Lower Silesia, Road map of transformation towards a circular economy and others. Another step was to confront all opportunities with barriers occurring in the region such as economic, market failures, regulatory failure and social factors. After this procedure opportunities were put in order to create a list of most favorable for CE implementation. The ranking will be useful in later on actions concerning increasing the capability of Policy Instrument to transfer from linear economy into circular economy model. This report shows the procedure concerning prioritization, how it was conducted by Lower Silesia and what were the results.

2. Prioritization

First step of prioritization was to find a common methodology for all PP. One of the most commonly used approach for analysis of various data that fits CircE Project objectives is Analytic Hierarchy Process (AHP). It is exploited for multi-criteria decision making problems. First step was to develop a decision hierarchy in the form of criteria tree. PP discussed the main criteria which should be considered in prioritizing the opportunities. After PP meetings in Lille (April 2018) and Arnhem (June 2018) and additional suggestions were send via mail.

To choose which criteria is more significant than the other each PP defined weights of the criteria. The regions may perceive different importance levels of the criteria, so for better accuracy, as the regions differ in prosperity and development, weights were evaluated independently. As it is shown on the criteria tree figure below, there are three levels of impacts. In all of these three levels pairwise comparison of criteria was conducted. Final criteria tree consist of 4 circular economy impacts – Strategic, Economic, Social, Environmental, which further divide into second level criteria, such as Replicability, Time-scale, Coherence with RIS3, Contribution to the Local Eco-System Development, Contribution to the legislation targets, Profit, Payback Time, New Skills, Public awareness, Social Inclusion, Job Creation, Emissions Saved, Energy Efficiency and finally third level criteria, such as Total Resource Volume Saved and Strategic Resources Saved. The importance was judged by all Lower Silesia members in CircE project and averaged to give final result. Lower Silesia did not include SH to make any contribution at this stage.

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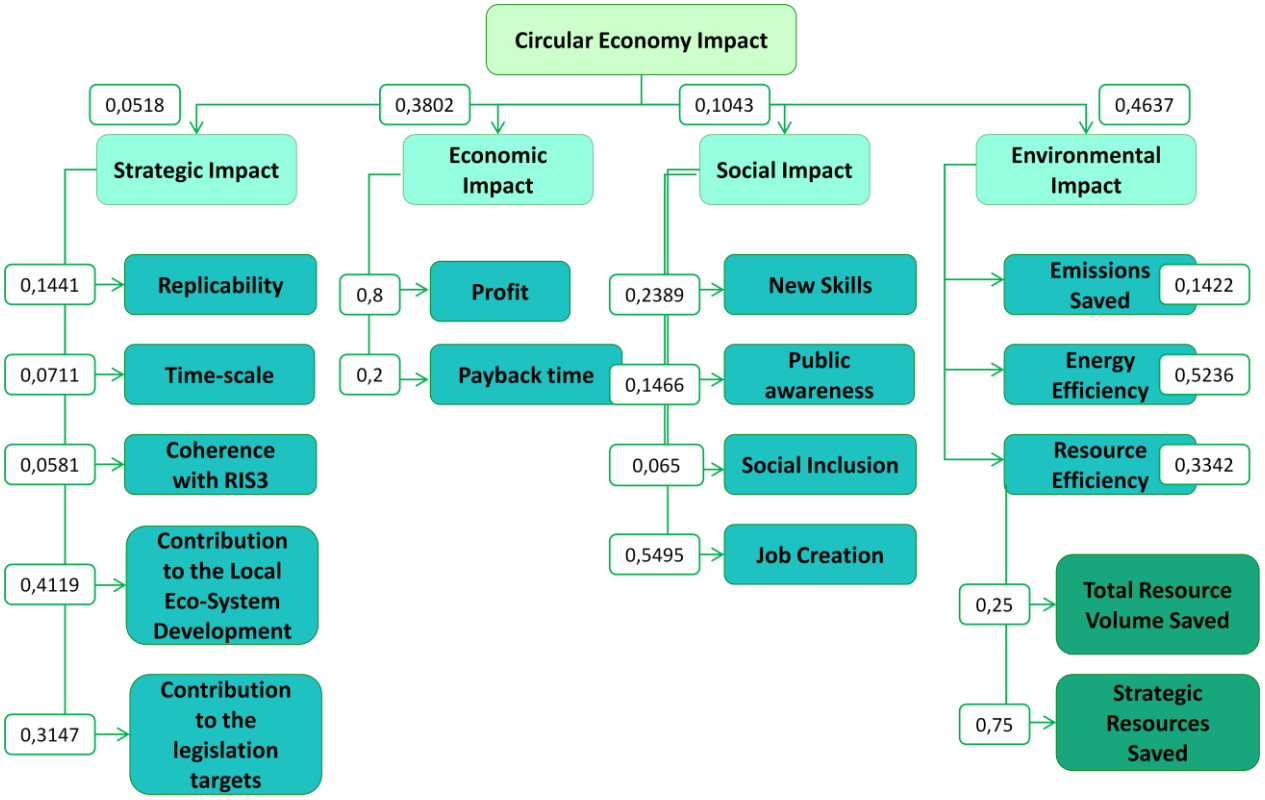

Figure 1. CircE Criteria Tree with Lower Silesia local weights

The most significant Circular Economy Impact for Lower Silesia region is Environmental Impact. The region is greatly concerned with negative environmental consequences related to the linear model of economy. Excessive consumption and a huge number of objects produced in accordance with the linear economy also affect climate change and wasteful management of natural resources. Problems concern air quality, such as exceeded PM10, PM2,5 or BaP (Benzo(a) pyrene) indicators. Poland is implementing Air Protection Programs (POPs), investment, organizational and legal activities undertaken in communes as part of Low Emission Reduction Programs (PONE) and also Low Emission Economy Plans (PGN). Water condition in the Region is not on satisfying level. The factors contributing to low quality of water are biological parameters, presence of biogenic compounds (especially phosphates) and exceeded values of two compounds from the group of polycyclic aromatic hydrocarbons (PAHs). Small improvement in recent years is caused by modernization of municipal and industrial wastewater treatment technology, expansion of wastewater networks and production restrictions of many industries. High importance of environmental protection describe the fact that the forth strategic objective of Regional Strategy for Lower Silesia 2030 is 'Responsible Use Of Resources And Protection Of Environmental Values And Cultural Heritage', where operational objective is among others 'Circular Economy Development'. Soil condition in the region is weakened by agricultural activity, erosion and contamination by heavy metals. There is also increasing need for reclamation in some post-industrial areas. Waste management belongs to the areas of environmental protection, where many problems still arise. Waste is a potential resource if it is prepared for re-use, recycle or otherwise recover. The neutralized waste can be treated as the loss of resources and the sign of inefficiencies in the economy. Reprocessing of waste is part of the concept of bioeconomy, according to which waste can be transformed into products, such as, for example, wastes, biomaterials, bio-based

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products and bioenergy. In Poland main source of waste in 2017 were, as in previous years: mining and quarrying (about 56.5% of the total waste generated), industrial processing (23.8%) and generation and supply of electricity (15.4%). Out of the total amount of waste generated in 2017, 49% of waste was recovered, 42% was disposed of via storage, and 4% were otherwise disposed of. In 2017, 11 969 thousand tonnes of municipal waste were created with an increase in production by 2.7% compared to the previous year.

Among Environmental Impact, the most important is Energy Efficiency.

The second most significant CE Impact is Economic Impact. Circular Economy as a new model requires innovative approach to business. Moving away from the traditional take-make-consume-dispose scheme, there are innovators who propose completely new solutions that meet the needs and expectations of new consumers, generate more value, without the need to use so many resources. Circular economy leads to significant savings, for example in the case of some consumer goods - food, beverages, textiles and packaging - global savings potential of 700 billion USD per year is estimated, or approximately 20% of material costs in these sectors.

The third CE Impact is Social Impact. All new business model proposals related to the economy of sharing, eco-design, reuse or recycling drive a new, responsible way of consumption. But with the development of circular economy, new jobs can be created. It is estimated that along with the implementation by European Commission of legislative changes regarding waste and the promotion of recycling, by 2030, there may be almost 18 000 new jobs. A much greater potential is anticipated for circular value chains. In Britain alone, there is an estimated need for around 500,000 new jobs. With the development of services at the expense of products, there is expected a demand for employees in the services sector. On the Polish market, according to the authors of the Green Alliance report, 180 000 jobs can be created, of which 68 thousand will be occupied by unemployed people.[1]

The last place is Strategic Impact. Poland, like many other EU member states, has begun work on the strategy of introducing CE concept into the national economy. The task of its development was entrusted to the interdepartmental circular economy team, appointed on 29 June 2016 by the Minister of Development. The appointed team has so far developed a preliminary draft document entitled "Transformation Road Map towards a circular economy". The importance of lower level might be caused by citizens feeling skeptical towards government actions, implementation of EU regulations and results of the policy.

Final prioritization of opportunities were conclusion of result from the AHP, judgement of Lower Silesia members and discussion with SH. During SH meeting, it was decided to put opportunities in PEST categories with additional category (Political, Economic, Social, Technological and Science).

3. Opportunities ranking

Opportunities that are included in Lower Silesia ranking contain those from CircE tool, opportunities report, other PP tools and Value Chain Analysis done by ITIA. In these documents there are more detailed

[1] Polska Droga Do Gospodarki O Obiegu Zamkniętym, Opis Sytuacji I Rekomendacje, IGOZ

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information about them. Here are listed Lower Silesia opportunities from raw materials, biomass and food waste sectors after using AHP methodology and after sensitivity analysis:

Table 1. Opportunities ranking

ID	Raw Materials:	PEST+Sc	AHP evaluation	sensitivity analysis	ranking
10	use of secondary raw materials obtained from the processing of waste	E	6	9	1
2	development of a technology that minimizes the impact of mining on the environment	T	7	9	2
3	production of processing machines and equipment for the mining industry and the processing of raw materials	T	10	9	3
15	Innovation infrastructures for raw materials circular solutions	T	10	8	4
5	range of scientific research and teaching facilities of the region for raw materials	Sc	2	8	5
7	use of extraction waste	T	5	9	6
4	the use of hard-to-sell materials	T	3	8	7
1	Increase of efficiency of mining and processing of raw materials	E	0	5	8
14	Databank for using waste material	E	7	5	9
13	Actions and resources in the area of CE solutions for water and wastewater	T	0	5	10
6	growing demand for innovative products/services	E	3	4	11
11	Preparing business models to promote cross-sectoral links, by creating secondary raw materials markets or promoting so-called “Industrial symbiosis”	E	1	3	12
12	Develop new underground “intelligent mine” technologies by building partnerships between various industry players, including mining companies and mining-equipment manufacturers	T	8	2	13
9	expansion of the networks of centers of reuse	T	1	2	14
8	fuller use of the products of KGHM	E	9	2	15
	Biomass:				
21	strengthening of R+D activities	P	10	10	1
20	creating norms and standards for bio-products	P	2	9	2
17	creating local bio-refinery and biogas plants	P	6	6	3
19	stimulating demand for bio-products	E	9	6	4
18	increase of local biomass and biomass waste usage for power industry	E	7	5	5
16	identification of potential of local biomass	E	5	5	6
	Food Waste:				
24	improvement of food production conditions	T		10	1

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	throughout the production process from the producer to the consumer				
22	Preventing avoidable food waste	S	5	9	2
23	Use of products from overproduction	E	2	9	3
25	proper forecasting of demand and correct marketing strategies	E	9	8	4
27	Use edible food surplus as a way of contributing to the alleviation of food poverty (e.g. social supermarkets)	S	1	3	5
26	promotion of Zero waste initiative	S	2	7	6
	Other:				
29	raising awareness for circular economy potential in citizens	S	9	9	1
28	Introduce circular economy principles into lower and higher education	Sc	8	8	2

During the judgement, opportunities were modified, added or removed. For that reason out of 49 opportunities, 28 were judged (notes from 1-10; 0 means the opportunity wasn't present in the primary list). Again, as in the case of defining the weights, all Lower Silesia members were judging the opportunities, and finally averaged number was used for the ranking (AHP evaluation column). The prioritization of opportunities was based on 15 criteria, such as Replicability, Time-scale, Coherence with RIS3, Contribution to the Local Eco-System Development, Contribution to the legislation targets, Profit, Payback Time, New Skills, Public awareness, Social Inclusion, Job Creation, Emissions Saved, Energy Efficiency, Total Resource Volume Saved, Strategic Resources Saved.

The highest evaluated criteria were in order: Total Resource Volume Saved, Replicability, Contribution to the legislation targets, Strategic Resources Saved, New Skills and Profit. Lower rated second half were in order: Emissions Saved, Energy Efficiency, Contribution to the Local Eco-System Development, Payback Time, Coherence with RIS3, Public awareness, Job Creation and Social Inclusion as the last. Criterion Time-scale was not assessed by all members, therefore it is not presented in the order. This assessment results from character of the opportunities. Lower Silesia members along with SH decided to classify them to PEST analysis. Therefore there are 11 Economic, 9 factors, 4 Social, 3 Political and 2 Science factors.

Although assessment was done by using many criteria, the result was not satisfying. Therefore sensitivity analysis was performed such as considering barriers and feasibility of each opportunity. The results from this analysis is shown in column 5. It was done by discussion and exchange of opinions and it mainly represents subjective evaluation of Lower Silesia members.

Finally, the ranking was formed as it is shown in column 6. The opportunities were classified in three project sectors: Raw Materials, Biomass and Food Waste with two general opportunities, named here as 'others'. The final prioritization represents the opportunities evaluated by Lower Silesia members and SH as it is shown of the graph below. The graphs are divided into 4 quadrants, which represents high value opportunities, that are important for both Lower Silesia and SH in section 1, High value opportunities from business pov in section 2, low value opportunities in section 3, and high value opportunities from regional institution pov. Presented opportunities are arranged in order of highest value.

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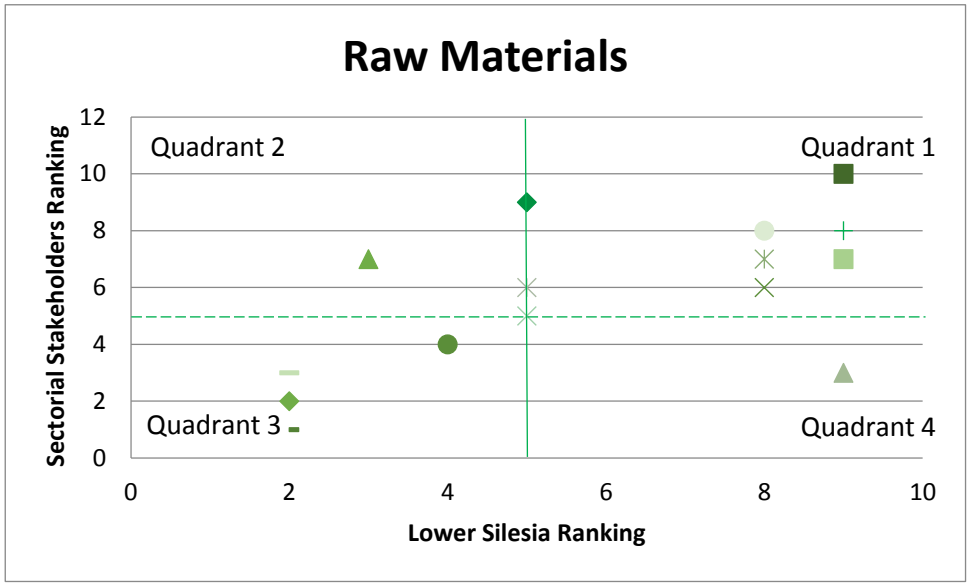

Figure 2. Raw Materials prioritization

High value opportunities in Raw Materials sector are:

- 2. development of a technology that minimizes the impact of mining on the environment
- 7. use of extraction waste
- 10. use of secondary raw materials obtained from the processing of waste
- 15. Innovation infrastructures for raw materials circular solutions
- 5. range of scientific research and teaching facilities of the region for raw materials
- 4. the use of hard-to-sell materials

High value opportunities from business pov:

- 1. Increase of efficiency of mining and processing of raw materials
- 14. Databank for using waste material
- 13. Actions and resources in the area of CE solutions for water and wastewater
- 11. Preparing business models to promote cross-sectoral links, by creating secondary raw materials markets or promoting so-called “Industrial symbiosis”

High value opportunities from regional institution pov:

- 3. production of processing machines and equipment for the mining industry and the processing of raw materials

Low value opportunities:

- 6. growing demand for innovative products/services
- 9. expansion of the networks of centres of reuse
- 12. Develop new underground “intelligent mine” technologies by building partnerships between various industry players, including mining companies and mining-equipment manufacturers
- 8. fuller use of the products of KGHM

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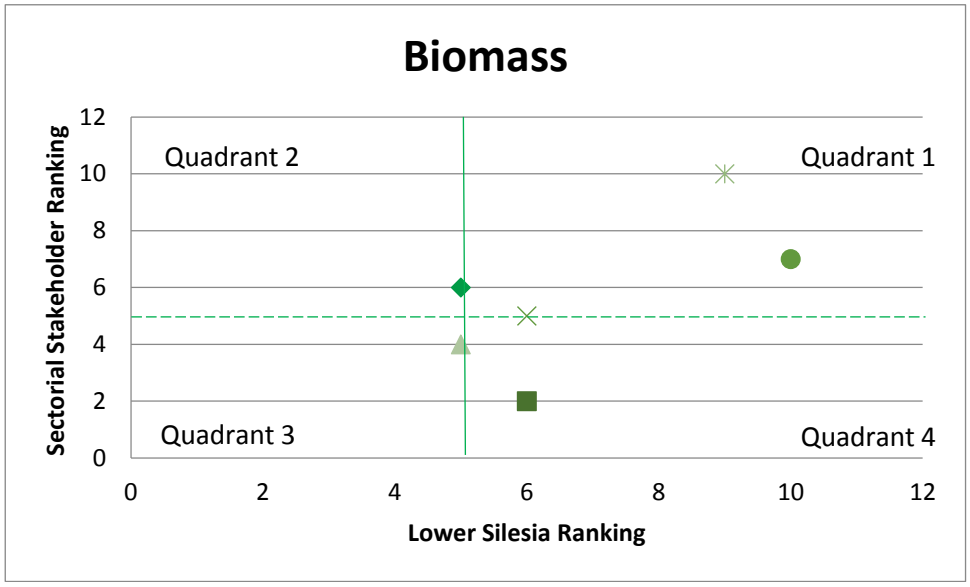

Figure 3. Biomass prioritization

High value opportunities in Biomass sector are:

- 20. creating norms and standards for bioproducts
- 21. strengthening of R+D activities

High value opportunities from business pov:

- 16. identification of potential of local biomass
- 18. increase of local biomass and biomass waste usage for power industry

High value opportunities from regional institution pov:

- 19. stimulating demand for bioproducts
- 17. creating local biorafinery and biogas plants

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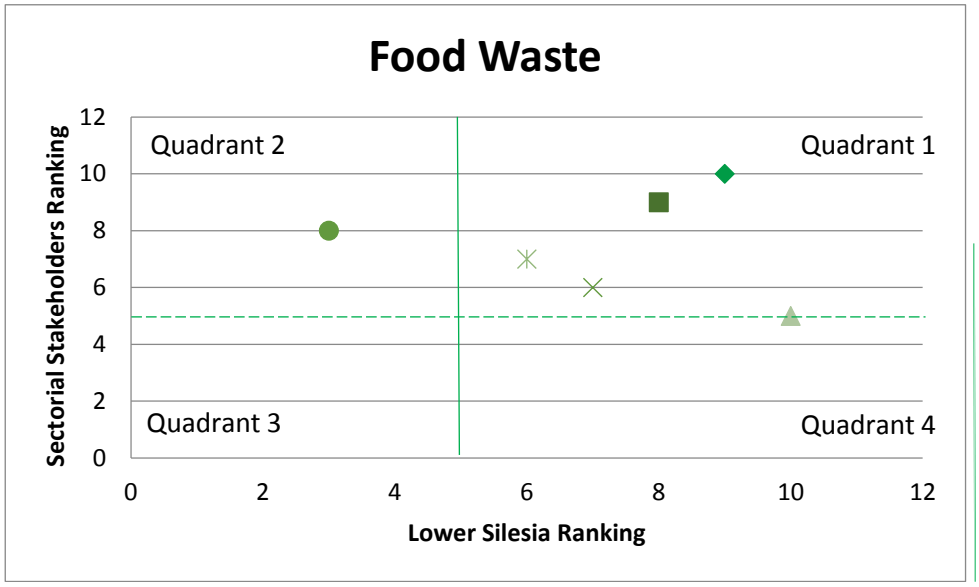

Figure 4. Food Waste prioritization

High value opportunities in Food Waste sector are:

- 22. Preventing avoidable food waste
- 23. Use of products from overproduction
- 24. improvement of food production conditions throughout the production process from the producer to the consumer
- 25. proper forecasting of demand and correct marketing strategies
- 26. promotion of Zero waste initiative

High value opportunities from business pov:

- 27. Use edible food surplus as a way of contributing to the alleviation of food poverty (e.g. social supermarkets)

Section Other contained only two opportunities, such as:

- 29. raising awareness for circular economy potential in citizens
- 28. Introduce circular economy principles into lower and higher education

Final prioritization ranking with SH consideration presents as below.

Raw Materials:

1) 2. development of a technology that minimizes the impact of mining on the environment
2) 7. use of extraction waste
3) 10. use of secondary raw materials obtained from the processing of waste
4) 15. Innovation infrastructures for raw materials circular solutions
5) 5. range of scientific research and teaching facilities of the region for raw materials
6) 4. the use of hard-to-sell materials
7) 1. Increase of efficiency of mining and processing of raw materials

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8) 14. Databank for using waste material
9) 13. Actions and resources in the area of CE solutions for water and wastewater
10) 11. Preparing business models to promote cross-sectoral links, by creating secondary raw materials markets or promoting so-called “Industrial symbiosis”
11) 3. production of processing machines and equipment for the mining industry and the processing of raw materials
12) 6. growing demand for innovative products/services
13) 9. expansion of the networks of centres of reuse
14) 12. Develop new underground “intelligent mine” technologies by building partnerships between various industry players, including mining companies and mining-equipment manufacturers
15) 8. fuller use of the products of KGHM

Biomass:

1) 20. creating norms and standards for bioproducts
2) 21. strengthening of R+D activities
3) 16. identification of potential of local biomass
4) 18. increase of local biomass and biomass waste usage for power industry
5) 19. stimulating demand for bioproducts
6) 17. creating local biorafinery and biogas plants

Food Waste:

1) 22. Preventing avoidable food waste
2) 23. Use of products from overproduction
3) 24. improvement of food production conditions throughout the production process from the producer to the consumer
4) 25. proper forecasting of demand and correct marketing strategies
5) 26. promotion of Zero waste initiative
6) 27. Use edible food surplus as a way of contributing to the alleviation of food poverty (e.g. social supermarkets)

Other:

1) 29. raising awareness for circular economy potential in citizens
2) 28. Introduce circular economy principles into lower and higher education

4. The Stakeholders

SH were asked to review the opportunities list and primary ranking after AHP analysis done by Lower Silesia members. The process included two SH meetings (10.10.2018 and 11.12.2018) and individual interviews. During SH meeting, representatives of various industries and science were presented CircE prioritization AHP methodology along with primary comments and conclusions. During the discussion there were many suggestions and comments to the methodology, like using different criteria for every sector or judging the criteria “globaly” and “localy” or “from government pov” and “entreprise pov”. SH also made a few points

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how to adapt the priority ranking to enclose it the best way into Policy Instrument. Mr. Mirosław Bachorz proposed PEST analysis to categorise the opportunities. All detailed comments were videly discussed during personal interviews, which occured in November.

On 13th November 2018 Mr. Adam Watras from Włodzimierz Trzebiatowski Institute of Low Temperature and Structure Research PAS expressed his opinion on Raw Materials and pointed out the most important opportunity "Use of secondary raw materials obtained from the processing of waste". This might result from activities of the Institute in which Mr. Watras is involved. Morover for him "raising awareness for circular economy potential in citizens" and "Introducing circular economy principles into lower and higher education" are opportunities of big importance.

The authors of "Inventory of the amount of deposited mining waste generated during mining and processing of rock raw materials in the province Lower Silesia in 2010-2016 in active mining plants" study, which was commissioned for purpose of CircE project, are University of Technology employees who also are CircE project stakeholders composed of Mr. Jan Blachowski, Mrs. Urszula Kaźmierczak and Mrs. Justyna Górniak-Zimroz. Their judgment and knowledge about the region structure greatly improved final results of prioritization and had a contribution in discussions. They selected "use of secondary raw materials obtained from the processing of waste" and "use of extraction waste" as opportunities of the biggest importance. They also chose the opportunities from section 'Others' as significant.

Representatives from MPWiK (Municipal Water and Sewerage Company) Przemysław Chrobot and Tomasz Konieczny put emphasis on significance of water and wastewater treatment process and new possibilities concerning CE on the individual meeting on 8th November 2018. Moreover they suggested inclusion of lower education and not only university courses for the promotion of CE principles. For them "Actions and resources in the area of CE solutions for water and wastewater" is of the greatest importance. This opportunity is a combination of few smaller points including "Infrastructure of CE solutions for water", "Minimalisation of wastewater stream", "Valorization of industrial wastewater ", "Valorization of treated wastewater", "Recovery of materials from industrial and municipal wastewater streams" and "Use of gray water".

Big input in the analysis and discussion was provided by Poltegor Institute – Mr. Mirosław Maliszewski and Mrs. Barbara Rogosz on 15th November 2018. They helped with rewording the opportunities names with wide knowledge of mining law. Moreover they explained the issues concerning regional situation, history and barriers concerning raw materials sector. For them "Increase of effectiveness of raw materials extraction and processing" is the most significant opportunity. Mrs. Rogosz also had an input in biomass sector opportunities prioritization.

SH from Banking School Mr. Mateusz Rak, who is working on social business engagement, chose "Preparing business models to promote cross-sectoral links, by creating secondary raw materials markets or promoting so-called 'Industrial symbiosis'" as the most important opportunity in raw materials sector, "models of economic activities in bioeconomy" in biomass sector and "Preventing avoidable food waste" in food waste sector.

Thanks to the wide interest and professions of CircE SH, there were possible exchange of opinions and knowledge concerning various CE aspects. Therefore the assessment of opportunities was also very diverse.

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This report was created by Economy Division in Marshal's Office in cooperation with regional stakeholders of CircE project, where are the representatives of the institutions such as:

"Poltegor - Institute" Institute of Opencast Mining, MPWiK Municipal Water and Sewerage Company in Wrocław, EKOEFEKTYWNOŚĆ Mirosław Bachorz, University of Science and Technology Faculty of Geoengineering, Mining and Geology and Faculty of Chemistry, Ekomotor sp. z o.o, WSB University in Wroclaw and Włodzimierz Trzebiatowski Institute of Low Temperature and Structure Research PAS.

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