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Challenges and Opportunities of Circular Economy Implementation in the Lesser Poland Region (LPR)

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Abstract

Circular Economy (CE) is a new strategy of development adopted by European Union (EU) authorities in 2014, aiming to boost global competitiveness, foster sustainable economic growth and generate new jobs. The CE approach keeps the added value in products for as long as possible and eliminates waste; moreover, it implies full systemic change and innovation not only in technologies, but also in organization, society, finance methods and policies. Such an approach leads to a new model of production and consumption, and a new relationship between stakeholders at the local, regional, national and EU levels. This article highlights the functions of such a new strategic model of development at the regional level, demonstrating the importance of the introduction of CE assumptions into regional development policies, programmes and plans. The text also emphasizes the active involvement of all regional stakeholders (local and regional authorities, business and finance sector, civil society and citizens) in the process of transition to a CE-based regional development model. There is a lack of studies devoted to CE opportunities, challenges and limitations for particular European regions where CE is a relatively new strategic direction. This article therefore presents a case study for CE implementation in the Lesser Poland Region (LPR). LPR stakeholders are actively investigating CE opportunities, and the first CE actions have been undertaken during the last two years. Further research appears to be needed examining the opportunities and limitations of CE implementation in the LPR to help identify the most effective means of transitioning to a CE. This study has applied state-of-the-art diagnostics for CE implementation in the LPR. The diagnostics were based on analysis of current economic, social and environmental conditions as well as on examination of strategic and operational documents.

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Keywords: Circular economy; Regional development; Sustainable economic growth

1. Introduction

Circular Economy (CE) is a new strategy of development adopted by European Union (EU) authorities in 2014, aiming to boost global competitiveness, foster sustainable economic growth and create new jobs. From the very beginning, the CE concept was focused mostly on resource and energy efficiency including the examination of effective methods of waste management. Those earlier areas of focus were represented in the first legislative document introducing CE in Germany with the Law on Recycling in 1996, and in Japan with the Basic Law for Establishing the Recycling-based Society in 2000[1,2,3]. A few years later, Chinese policy makers used the CE approach as the basis for a development strategy at the national level, adopting their Circular Economy Promotion Law in 2009. The European Union's first steps towards CE were taken in 2008 with Directive 2008/98/EC on

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Waste[4]. Since 2014, CE became a major priority for economic growth and development at the EU level with the adoption of "Towards a circular economy: A zero waste programme for Europe" (COM(2014) 398)[5] and "Closing the loop - An EU action plan for the Circular Economy" (COM(2015) 614)[6]. These are the most important framework EU documents introducing and supporting the European CE model. In January 2017, the first report on year one of CE implementation actions was released, indicating the realization of the following actions[7]:

- Adoption of the Eco-design working plan for 2016-2019.
- Presentation of Guidance on circular economy included in the Best Available Techniques reference documents (BREFs) for several industrial sectors.
- CE criteria integrated into the Green Public Procurement procedure (for buildings, roads, computers and monitors).
- Adoption of the Initiative on waste to energy.
- Introduction of Waste Shipment Regulations.
- Presentation of Guidance on the integration of water reuse in water planning and management.
- Some sector-specific actions taken for food waste, contracting and demolition, biomass and bio-based materials.
- Some innovation and investment actions taken for CE-related innovations (Innovation Deals pilot project).

All of the above actions show the importance of CE issues at the EU level, and this new model of development will bring significant opportunities for the European Community. Possible CE contribution to EU economic growth was estimated by one of the leading CE organizations – the Ellen MacArthur Foundation. According to the Foundation, the adaptation of circular economy principles in Europe can take advantage of the impending technological revolution to create a net benefit of 1.8 trillion EUR by 2030, or 0.9 EUR trillion more than the current linear development path. This would be accompanied by better societal outcomes including an increase of 3,000 EUR in per-household income, a 16% reduction in the cost of time lost to congestion, and a halving of carbon dioxide emissions compared with current levels.[8]

As the main principle of EU development is a sustainable development approach, the CE model should be introduced at the national and regional levels in all EU countries. It is clear, however, that for the time being circular economy issues are at very different stages of implementation in different countries and regions of the European community. One of the key tasks of the EU Cohesion Policy is making the circular economy a reality.[9] As recent research has shown, some countries – like Germany, the Netherlands, Finland, Denmark, Sweden, Spain – are very advanced in CE implementation, already having national plans and strategies for CE.[10] At the same time, eastern EU countries like Poland and the Czech Republic have taken only initial steps toward CE-based economic development.[11] Moreover, differing levels of social and economic development in different regions within one country can be a factor in developing strategies, approaches and tools for CE implementation, not only at the national, but primarily at the regional and local levels. That is why detailed analyses are needed for EU regions (at the NUTS2 level) with the purpose of estimating the developmental level and coherence of existing strategies, programmes and plans for regional development based on the CE model. This would also be helpful for further prioritising the main directions for CE implementation in each European region. A CE approach to regional development means a new model of relations between such stakeholders as local and regional authorities, the business and finance sector, civil society and citizens. The role of such a strategic model of development at the regional level will be highlighted in this article.

The main purpose of this paper is to examine and evaluate the current status of, and opportunities for transition to, a CE model of development in the Lesser Poland Region (LPR). To achieve this goal, the following objectives were accomplished:

- examination of the status of CE implementation in Poland at the national level and estimation of how favourable the conditions are for introduction of CE in the regions
- content analysis of current strategic and operational documents related to regional development with the purpose of evaluating the level of support for the CE model's induction in the LPR
- identification of existing CE supportive initiatives in the LPR
- identification of the main opportunities and challenges facing the CE model in the Lesser Poland Region

2. Social, economic and environmental development of the Lesser Poland Region

The modern Lesser Poland Region, also known as Małopolska Voivodeship, is situated in southern Poland. It has an area of 15,108 square kilometres (5,833 sq mi), which in terms of size ranks it among the smallest regions in the country (12th place). The region has a population of 3,372,618 (9% of the country's population), with a population density of 222 persons / km^2. The level of urbanization is about 48%. Among the 182 municipalities of the region, there are 46 urban and rural municipalities, 14 urban municipalities and 122 rural municipalities.[12,13,14.] The LPR is one of the most economically developed regions of Poland, and due to this fact, the region was recently awarded two very noteworthy titles:

- European Region of Entrepreneurship 2016 – an award from the EU Committee of Regions
- RegioStar 2016 – an award from the European Commission

Moreover, in 2016 Eurostat ranked the region among the 28 most dynamically developing regions of the EU.

The LPR has positive dynamics of social and economic development. Since the beginning of the current century, population growth has been recorded every year, although the rate of growth has been declining considerably in recent years. The average annual growth rate of the population was only + 0.13%. The dynamics of population change in the region varied spatially[12].

In accordance with the Development Strategy for the LPR for the years 2011-2020, the region is divided into 5 functional sub-regions – the Kraków Metropolitan Area, Tarnow sub-region, Podhale sub-region and Western Małopolska sub-region. The capital city of the region is Kraków. An analysis of the GDP generated in the LPR sub-regions suggests that Kraków performs not only the role of the center for LPR economic development, but also the role of the center with the greatest development potential in Poland. Kraków constitutes 41.4% of the GDP value generated in the region, which is 3.1% of the country-level value (2nd place, following Warsaw at 13.2%).[14]

In the sphere of R&D, the position of the LPR is relatively comparable with other regions of Poland. In 2014, the region occupied the second position in the country, both in terms of total internal expenditures incurred on R&D, which amounted to 1,850.3 million PLN (490.26 million USD) and expenditure per one inhabitant was 550.0 PLN (145 USD per one inhabitant). In the same year, the LPR was ranked second in terms of GERD / GDP (1.38%) and 3rd in the BERD/ GDP ratio (0.64%). In 2014, the value of manufactured gross domestic product in current prices amounted to PLN 133,974 million PLN (35,503.90 million USD). This value increased by 4.6% in comparison to the previous year (3.8% for the country as a whole). In 2015, the LPR maintained 4th place in the ranking of Poland's regions in terms of the number of registered economic entities (8.7% of all entities in the country). The number of public sector companies amounted to 7.9 thousand, and the private sector consisted of 352.9 thousand enterprises (96.9% of the total number).[12] The main branches of the LPR's economy are the technology sector, banking and food production. In addition, the province has well-developed chemical, petrochemical and metallurgical industries.[13]

The improvement of the economic situation in the Małopolskie Voivodeship over the last few years has reduced the number of unemployed. The unemployment rate in 2015 was 8.4%, which puts the voivodship in 4th place in Poland[12].

The region has also become increasingly active in terms of investment. In 2015, the share of investment in industry of total investments in the LPR amounted to 72.8%. The share of investments in the region's industry accounted for 7.3% of national investment expenditure in 2015.[12]

Lesser Poland is one of the most attractive tourist regions in Poland. In 2015, 13.9 million people visited the region (11 million of them were residents of Poland and 2.9 million were foreign visitors). By the end of 2015, the LPR was ranked as a leader in the country in terms of the number of cultural centres (444) and art galleries and lounges (65). The region ranked second place in terms of the number of museums (134) and third place in terms of the number of theatres and musical institutions (18), libraries (943) and cinemas (45). In 2015, the number of visitors to the region increased by 6.2% compared to 2014, thus maintaining an upward trend that began in 2009. In 2015, the region's visitor expenditures were estimated at 13.2 billion PLN (3.49 billion USD), 18.7% more than in 2014.[12]

The region is also very active in European Union projects realisation. In 2015, 130 projects co-financed by the European Union were launched in the LPR with a total budget of about 217 million PLN (57.51 million USD). Over 201 million PLN (52.27 million USD) were spent on projects implemented under the Lesser Poland Regional Operational Program. In the same period, the realisation of 1,512 EU-funded projects was successfully

accomplished (total budget of the projects was 12.7 billion PLN (3.37 billion USD), with the EU funding 6.5 billion PLN (1.72 billion USD). The beneficiaries of projects implemented in the region have received almost 16.6 billion PLN (4.39 billion USD) since 2007, out of which 5.3 billion PLN (1.4 billion USD) went toward beneficiaries implementing projects under the Lesser Poland Regional Operational Program.[12]

The economic potential and attractiveness for investment of the region has therefore made it one of the leading regions in the country. This outcome is also due to good transport infrastructure, the region's location on international transit routes, and favourable conditions for investment (creating special economic zones, advanced scientific and research facilities). The largest investors in the region are ComArch, Motorola, Delphi, IBM, Electrolux, Shell, Telefonika, Philip Morris, Pliva, Man, and Mittal Steel.[13]

At the same time, the region has some environmental problems; the most serious of them is air pollution. Krakow is classed as one of the most polluted cities in the world according to a World Health Organiation (WHO) study.[15] In the report, Krakow was ranked 8th among 575 cities for high levels of PM 2.5 and 145th among 1,100 cities for levels of PM 10. The problem of high air pollution spans the whole LPR. The main air contaminants include, among other things, particulate matter, benzo(a)pyrene and nitrogen dioxide. Hazardous air quality is a common problem particularly during the colder months when many residents use solid fuels (mostly coal) for household heating. Burning these fuels in heating appliances releases many pollutants into the air. Furthermore, sometimes users of these stoves burn garbage, despite the fact that doing so is forbidden. Each year, pollution levels begin creeping up in autumn, and readings for PM 10 regularly surge above 100 μg/m3.[15]

Waste statistics for the region show that in 2015, about 795.5 thousand tonnes of municipal waste were collected in the LPR, including 505 thousand tonnes from households. Since 2013 there has been an upward trend in the amount of municipal waste collected (from 702 thousand tonnes in 2013 to 795.5 thousand tonnes in 2015). Since 2005, a systematic increase in the amount of waste collected selectively has been observed. In 2015 about 190.2 thousand tonnes were collected, but this is still only 23.9% of all collected municipal waste.[12]

The largest stream of generated waste for the region is non-hazardous wastes produced by the industrial, agricultural, crafts and services sectors. Recovery is the main means of their treatment. In 2015, 8.9 million tonnes of industrial waste was transferred to recovery. In 2015, as a result of current business activity in the LPR, 10 million tonnes of industrial waste was generated.

According to the Waste Management Plan for the LPR, among the main problems of regional waste management are[16]:

1) For municipal waste: low levels of municipal waste collected per capita in rural areas, too high a share of mixed municipal waste in the whole stream of waste collected, the small number of points for selective collection of municipal waste, improper distribution of waste management installations in particular parts of the region, low awareness among the majority of the population in the region about the possibility of waste prevention, reduction and selective collection, and an improper charging policy for environmental use (landfilling levies are too low in relation to other forms of management or disposal of waste, resulting in a system that does not promote a waste management hierarchy)

2) For other selected types of waste:

- lack of appropriate education and information on the risks related to waste of electric and electronic equipment (WEEE) and the handling of such waste
- uncontrolled disassembly of used vehicles in the so-called "shadow economy sector" and used vehicle abandonment
- low selective collection rates of construction waste and often their contamination with other types of waste; storage of this type of waste in places not intended or prepared for this purpose ("wild landfills").

To summarize, it should be noted that the region has significant economic and social potential, but at the same time features environmental problems including an inadequate waste management system and air pollution. All of these aspects should be taken into account when evaluating opportunities and challenges of transitioning to a CE model in the LPR. To better understand the Lesser Poland Region's adoption of CE, the national level background of CE policy should be analysed, which will be addressed in the next chapter.

3. CE development in Poland

In 2015 during the public consultation of *Closing the loop - An EU action plan for the Circular Economy*[6] with EU Member States, Poland presented its main national priorities for transition to CE:

- innovation, strengthening cooperation between industry and the scientific community, and effective implementation of innovative solutions in the economy
- the creation of a European market for secondary raw materials, facilitating their flows
- ensuring the high quality of secondary raw materials through sustainable production and consumption
- development of the services sector

The first work on these CE priorities in Poland started almost one year ago. The Inter-ministerial Committee for Circular Economy was established in June 2016. Representatives from nine ministries became Committee members, drawn from the Ministry of Development; Ministry of Environment; Ministry of National Education; Ministry of Energy; Ministry of Infrastructure and Construction; Ministry of Science and Higher Education; Ministry of Family, Labour and Social Policy; Ministry of Agriculture and Rural Development; and Ministry of Health. The Ministry of Development is the main state body responsible for the organizational issues and effectiveness of the Inter-ministerial Committee's work. The composition of the Committee shows the strategic importance and interdisciplinarity nature of the circular economy concept.[17]

The main tasks of the Committee include[17]:

- defining the strengths, weaknesses, opportunities and threats (SWOT analysis) of transition toward a CE model in Poland
- expressing opinions regarding European Union initiatives for transition to CE
- developing an action plan for the implementation of a CE in Poland, specifying, in particular, the objectives and priorities of the actions along with their time horizon and the institutions responsible for their implementation
- monitoring of future CE action plan implementation

The first document prepared by the Committee was the *Draft Roadmap for Circular Economy Transition*[18] presented in December 2016. The main goal of the document is the preparation of an action plan for increasing resource efficiency and waste reduction in Poland. It should also include a much broader scope of activities to provide effective tools to transition from a linear economy to a circular economy. There are four main avenues proposed in the document :

I Sustainable industrial production
II Sustainable consumption
III Bio-economy
IV New business models.

Poland Circular Economy areas in Draft Roadmap are presented in Fig.1.

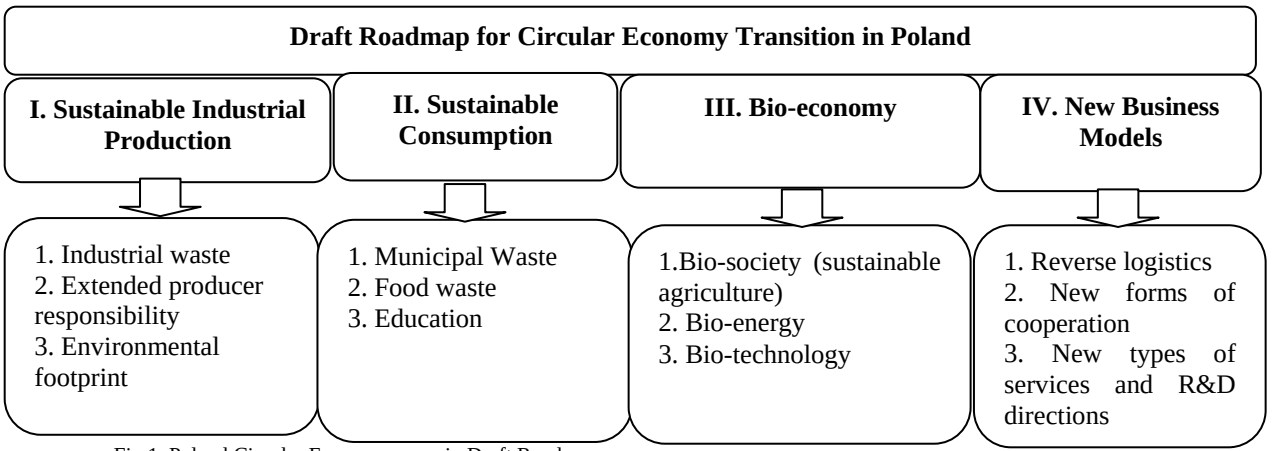

Fig 1. Poland Circular Economy areas in Draft Roadmap

Source: *Own work based on Draft Roadmap for Circular Economy Transition.*[18]

Further works on finalisation of the *Roadmap for Circular Economy Transition* will be prepared with the active involvement of all possible stakeholders. The CE concept has a broadly interdisciplinary character and should cover not only changes in technological processes, but also implementation of the extender responsibility of producers in the whole value chain. This demands a paradigm shift in consumption, establishing new patterns of production and consumption to create in Poland a CE society. That is why business sectors, NGOs, the academic and research community, and local and regional authorities were invited to work together on developing the *Roadmap's* fast and effective transition to CE. Four thematic working groups were created, taking into account key priority areas proposed in the *Draft Roadmap* – wastes, bio-economy, business models, and promotion and education actions.

The *Roadmap for Circular Economy Transition* will be one of the elements of successful realisation of the *Poland Strategy for Responsible Development for 2020 (with the perspective to 2030)*[19] where Strategy of Transformation to Circular Economy was mentioned as one of the strategic projects. Another Polish national level document which has already taken into account the recommendations and assumptions of *"Towards a circular economy: A zero waste programme for Europe"*[6] and *Closing the loop - An EU action plan for the Circular Economy* (COM(2015) 614)[6] is the updated *National Plan of Waste Management 2022 (NPWM 2022)*[20] adopted by the Council of Ministers of Poland in July 2016. The document set new waste management targets to be met and possible means by which this could be achieved, taking into account a national CE-supportive environment.

One more national level initiative related to CE transition is a planned CE pilot project for five rural and urban-rural communes in Poland. The main purpose of the project is developing good practices of circular economy implementation at the local level, with special focus on non-urbanized areas. This pilot project will be coordinated by the Ministry of Environment and financed by the National Fund of Environmental Protection and Water Management

All the above-mentioned actions without doubt are important steps on the path to a circular economy transition, but those actions deserve further analysis and evaluation. Firstly, the specific roles of all stakeholders involved in the implementation of planed CE actions at the national, regional and local levels should be identified. There have been some attempts to undertake such an evaluation and prepare recommendations for the Polish government as regards CE policy implementation. One example of such an initiative is the project "Polish Path to Circular Economy"[21] of the Institute of Circular Economy (a professional CE think tank in Poland), supported by the European Environmental Bureau, the MAVA Foundation for Nature and the European Commission. This initiative provided recommendations for government policy development to implement CE. The following main strategic areas were mentioned: raw materials exploration, design, production and regeneration, distribution, consumption, waste collection, recycling, residual wastes and the socio-economic system.

It should be noted that, in addition to national level initiatives, the issue of special roles for local and regional authorities in transitioning to a CE model should be better analysed. This is urgent because, in the end, it will be the operational task of the more local authorities to create favourable conditions for the achievement of CE strategic targets. Cities and regions are the main place where the circular society will succeed or fail, because the effective development of local initiatives and local networks and relationships will define Poland's CE transition. As was mentioned in *Delivering the Circular Economy. A Toolkit for Policymakers (Ellen MacArthur, 2015)*[22]*:*

> *Cities in particular… have a key role to play in the transition to the circular economy, with an excess of both the challenges and opportunities. A high density of businesses (especially retailers) and consumers makes cities concentrators of flows… As within city boundaries consumption is often higher than the production of goods, setting up local loops and increasing self-sufficiency can be of interest. Cities are also a hotbed of innovation: incubator spaces, maker labs and urban farming are just three examples. City governments can in certain instances move faster than their national counterparts, especially when united in city networks.*

As the above text indicates, innovative and competitive cities and the regions in which they are situated will be the driving force for CE strategy implementation. Regions in the EU are the most important units responsible for sustainable development, being at the core of cohesion policy realization; therefore, in addition to national strategies and programmes for CE transition, authorities should be preparing strategic and operational documents at the regional level to transition to a CE model of development.

The above considerations suggest the CE concept requires much more detailed analysis from the regional development point of view, covering more areas than planned in the current draft version of the *Roadmap for Circular Economy Transition*[18] at the national level. Each European region should thus have its own strategy for CE transition taking into account not only the EU and national priorities, but analysing its unique, local potential, in

addition to adopting best practices from other European regions. The next chapters of this paper will examine the current situation in the LPR, considering the opportunities and challenges of realizing the CE model of development.

4. CE ideas support mechanisms in the Lesser Poland Region

An evaluation of opportunities and challenges of CE implementation by the regional and local authorities of Lesser Poland should begin with an analysis of existing policies and their instruments of support from the CE point of view. Only on the basis of such evaluation is it possible to identify a proper direction for CE model implementation in the region, identifying which instruments of regional policy could be the most effective at strengthening development potential.

It should be noted that regional strategic development of the LPR is planned at two levels – the strategic programmes level (for the time being there exist ten strategic programmes) and the operational documents level. The themes of development policy at those two levels are defined by the *Development Strategy of the Lesser Poland (Małopolska) Region 2011-2022*.[14] This is the overriding document for all other documents regarding regional self-government. One other strategically important document that regulates financial support for regional strategic programmes and operational documents' realization is the *Investment Plan for Lesser Poland (Małoposlka) for 2015-2023*.[23] This document is the starting point for information about all financial sources and their allocations for regional development policy realization. The mentioned documents identify the direction of regional development, and analysis should be carried out from the point of view of their compatibility with CE implementation in the region, considering concrete initiatives of regional authorities .

For this study, the first document analyzed determines the scope of intervention in the developmental policy being conducted in the regional sphere – *Development Strategy of Lesser Poland Region (Małopolska) for 2011-2020*[14]. According to this document, the main regional development goal is "*effective use of regional opportunity potentials for economic development and increase of social and spatial coherence of LPR in regional, national and European dimension"*. The first evaluation of this strategy, conducted for the years 2011-2013, shows the appropriateness of strategic goals and positive changes in the social and economic life of the region. A detailed evaluation of the strategy's implementation for the period 2014-2016 will be carried out in 2017. The planned evaluation should clarify whether it is possible to scale up the regional potentials on the basis of the current strategy or if it would be better to modernize or even prepare a new strategy and adapt this document to new realities, including CE assumptions. For the time being, the strategy specifies seven fundamental areas of development policy. These were evaluated here for their potential impact on the CE model of development for the LPR (table 1). Strategic programmes that support the strategy's realization were also included in this analysis as they relate to the area of development policy.

Although the strategy in general creates favorable conditions for the region's successful development and that majority of its elements could support a transition to the CE model, additional CE ideas should be introduced in this document. Special attention should be paid to such strategic areas of the CE model as management of natural resources, identification of key industry for CE-based development, sustainability in energy and the agricultural sector (with special focus on bio-economy), focusing not only on municipal waste but also on other types of wastes important for CE implementation. It has been proposed to introduce more actions supporting such building blocks of CE as zero waste economy, sharing economy, service economy, low-carbon economy, and social economy[35-40].

As was already mentioned, at the beginning of the year, the Council of Ministers presented a new national *Poland Strategy for Responsible Development for 2020 (with the perspective to 2030)*[19] This strategy includes recommendations for public policies and suggests updates and changes to national, regional and local development public policies, taking into account more recent challenges that have appeared, influencing models of development at both the micro and macro level. The future strategy for LPR development, its strategic programmes and operational level documents, should thus be updated to better adapt them to new global and local realities and developmental trends. What is also particularly important here is identification of key priority sectors important for CE model implementation in the LPR region.

Table 1. Identification of support level for the CE model in Development Strategy of Lesser Poland Region (Małopolska) for 2011-202014 and strategic programmes for the Strategy realization.

Areas of development policy from the strategy + strategic programmes (SP) related to the area	Direction of development policy of particular importance for CE	Potential influence on CE development
Activity and knowledge-based economy area + Strategic programmes: *Intellectual Capital and Labor Market* *Regional Innovation Strategy*	• Development of Intellectual Capital • Comprehensive Support for Modern Technologies • Building the Knowledge-based Infrastructure of the Region • Development of Professional Education and Support for Employment • Strengthening and Promoting Entrepreneurship	Every direction of development policy from this area would in fact be contributive to CE as the CE model, based on modern ICT, demands new knowledge and skills (especially digital skills, social and civil skills, learning skills, initiative and entrepreneurship skills), new relationships; cooperation among enterprises, R&D units and universities, public-private partnership mechanism development.[24] Professional education and support for employment is also particularly important since the CE model brings substantial changes for the labor market, altering its existing paradigm.[25,26] The region should therefore be prepared for quick reaction to changing market demand and minimization of high transition costs for regional labor market players.
Heritage and Leisure Industries + Strategic programme: *Heritage and Leisure Industries*	• Sustainable Development of Infrastructure and Commercialization of Leisure Services	Key actions for supporting this area are based on the idea of sustainable development, including creating a sustainable cultural landscape. Such activities are also supportive for CE assumptions in their direction of sustainable mechanisms of each sphere of regional development.
Infrastructure for Communication Accessibility + Strategic programme: *Transport and Communication*	• Kraków as a Modern International Transport Network Node • Creation of Sub-regional Transport Nodes • Increasing Transport Accessibility of the Region's Lowest Accessibility Areas • Support for the Instruments of Integration • Transport System Management • Development of Infrastructure for Information Society	The main policy directions in the strategy in this area will be highly supportive for introduction of the CE model in the region due to the fact that they include ecological and sustainable transport development, an increasing role for regional transport, public transport, bicycle infrastructure and "park & ride" systems. All these elements are important because, as recent research has shown, CE implementation will change the role of local and regional transport not only in passenger transportation (new models of passenger transport service, but also in the business sector. Supply chains will be shorter, which has a positive influence on both transportation costs and the environment.[21,27,28]
Krakow metropolitan area and other sub-regions + Strategic Programmes: *Sub-regional Programme of Development* *Territorial Marketing*	• Development of Kraków Metropolitan Area • Development of Małopolska sub-regions	Focus on strengthening Krakow metropolitan functions – development of the regions and macro-region (in cooperation with the Upper Silesia region of Poland) is favorable for CE implementation because it shows regional authorities' cooperation to reach cohesion policy goals and strengthen weaker sub-regions via their main cities. This is important because highly developed urban areas are particularly important for CE implementation[29,30]
Development of cities and rural areas + Strategic Programmes: *Rural Areas* *Regional Innovation Strategy*	• Economic Development of Small and Medium Cities as well as Rural Areas • Functional Space Management at the Local Level	Key actions planned will result in an increase in the urbanization level, more sustainable spatial planning within the region, This is supportive for CE as sustainable spatial planning is one of the core drivers for the CE model. Such spatial planning creates favorable conditions for the development of industrial and urban symbiosis, which are integral elements of the CE model.[31,32]
Ecological, health and social safety	• Improvement of Ecological Safety and Utilization of Ecology for the Development	The general idea of actions proposed within this area are appropriate for CE transition due to activities related to improvement of waste management systems, reduction of air pollution, more effective water

+ Strategic programmes: *Environmental Protection Health Protection*	of Małopolska • Improving Social Safety: Integrating Social Policy • Supporting the System of Public Safety Management	resource management, renewable energy development, and social security improvement. This area of the strategy is, in fact, the most relevant for the CE model of development. Some its current indicators for achievement are, however, not satisfying for the CE model. For example, the planned indicator for municipal waste selectively collected for 2020 is 21.65%. This indicator seems to be too low in light of new waste management targets presented in the CE package (50% of municipal waste prepared for reuse and recycling in 2020, and 65% in 2035). The CE goal would not be achievable with the existing strategic waste recycling targets. Here also the main waste management problems mentioned in the updated Waste Management Plan for the Lesser Poland Region[16] should be taken into account, as presented above.
Management of the region's development + Strategic Programmes: *Territorial Marketing South Poland Strategy of Development* *Social Inclusion*	• An Efficient System of the Region's Strategic Management • Shaping and Developing of Civic Activity and Strengthening of Social Capital • Development of Territorial Cooperation	This thematic area of the strategy is not strictly related to the CE model of development, but could also create favorable conditions for faster transition to it. This may be possible due to a special focus on shaping and developing civil activity and strengthening social capital. Both of these aspects are particularly important for CE, because it would help create new relationships based on a higher trust level.[33,34] It also could result in more effective collaboration among stakeholders involved due to new means of communication, new information and services exchange.

Source: Own work based on Development Strategy of Lesser Poland Region (Małopolska) for 2011-2020[19] and strategic programmes for the Strategy realization.

At the same time, national priorities for the CE model of development should be taken into account, along with specific sectors that were identified as strategically important for the national economy. One such national priority for development is intelligent reindustrialisation with a special focus on the development of a modern industrial sector. Intelligent reindustrialisation is one of the strategic projects identified in the strategy for CE. Country specific intelligent reindustrialisation in this case includes the following[19]:

- transportation industry (e.g. e-buses, rail vehicles, specialized vessels)
- professional electronics (e.g. smart energy meters, inverters, car chargers, sensors)
- specialized ICT sector (e.g. fintech, machine automation, cyber security, computer games, bioinformatics)
- aerospace industry (e.g. drones, satellite components)
- pharmaceutical industry, medical devices and modern medical services (e.g. e-medicine, therapies, biosimilar medicines)
- mining systems (e.g. intelligent mine)
- recovery of raw materials
- eco-construction (e.g. passive buildings, picoenergetics, wooden buildings)
- high quality food industry
- defence industry

Prioritisation of industrial sectors is important because it is strongly related to the level of financing for those sectors. Among the most important instruments for such financing are R&D programmes and direct investments. Having prior financial support for those areas should be interlinked with national intelligent specialisations and regional intelligent specialisations. The national intelligent specialisations of Poland were updated in 2016, and took into account the assumptions of the *Poland Strategy for Responsible Development for 2020 (with the perspective to 2030).* At the same time, the Lesser Poland regional intelligent specialisations were adopted in 2015 and have not been changed since then. LPR specialisations include life science, sustainable energy, information and communication technologies (including multimedia), chemistry, manufacture of metals and metal products (except machinery and equipment), electrical engineering and machine industry, creative industries and leisure industry.[41]

Priorities for identification of regional specialisations in the LPR did not consider updated national priorities and should eventually be re-evaluated by working groups responsible for their identification and description. The CE model's priorities and concept of intelligent development, which could assist in the above process, should also be treated as a criterion for updating in the LPR.

In addition to official strategic and operational documents that specify regional development policy and that could be supportive of the CE model, the current study analysed regional authorities' initiatives that help to create a favourable environment for fast and effective transition to a CE.

One of the most important regional initiatives of the Lesser Poland regional authorities is participation in the international project SYMBI, or "Industrial Symbiosis for Regional Sustainable Growth and a Resource Efficient Circular Economy", of which the Marshal Office of the Małopolska Region is a partner. The project, financed by the Interreg EU programme, will contribute to the improvement of regional development policies and programmes related to the promotion and dissemination of Industrial Symbiosis and Circular Economy.[42] One of the main goals of the project is "*…supporting the transition towards a resource-efficient economy through industrial symbiosis, establishing territorial synergies to manage waste and exchange energy & by-products as secondary raw resources".*[42] Lesser Poland regional authorities and their partners from regions of Finland, Spain, Italy, Hungary, Greece, and Slovenia are currently working on project realisation, and already have shared experience in preparing public policies and their opportunities in support of the CE model through such instruments as green public procurement and public-private partnership. They are currently identifying how these and other public policy instruments could be supportive for industrial symbiosis and CE, and how regional authorities could encourage better cooperation among producers and whole supply chains. This effort would also be helpful in creating favourable conditions for extended producers' responsibility. This year, the project partners are preparing case studies for describing best practices of industrial symbiosis in the regions involved. Project activities have not only a promotional character, but also result in first attempts to introduce CE assumption at the level of both operational and strategic documents for the LPR. The first document that was updated in March 2017 is the *Waste Management Plan of LPR*[16] in which the concept of CE was introduced and new EU regulation related to waste management targets was mentioned. The document identified the main CE areas in which the region should focus while realising the long-term waste management plan. Industrial symbiosis was chosen as one of the main instruments for such policy realisation. Also introduced were numerous actions focusing on waste reduction based on CE assumptions as follows:

- regional educational campaigns for households, focusing on responsible and sustainable consumption, second hand usage and exchange of goods
- regional educational campaigns for encouraging business sector focus on responsible and sustainable purchasing, introduction of different sizes of nutritional portions, promotion of regional and seasonal products, developing cooperation with food-sharing organizations for elimination of food waste
- using GPP instrument in offices of public administration and organizations for which they are responsible
- introducing EMAS in public organizations and popularizing this approach among other organizations within the region
- elimination of paper usage and introducing e-documents solutions where this is allowed by national and regional legislation

These instruments encourage local consumers and producers to cooperate on a new level that considers opportunities for creating closed-loops, using secondary raw materials, and setting up regional markets for such types of materials.

Ultimately, the SYMBI project presents an opportunity for Lesser Poland's regional authorities to learn which instruments are most effective. This includes evaluating those instruments already used by more advanced (from the CE point of view) regions of Finland, Spain and Italy, and examines how such practices could be introduced into the regional policies of the LPR and the policies of the various stakeholders involved (the business sector, NGOs, academic and research communities).

One more document to be updated to introduce CE ideas at the regional level of the LPR is the *Spatial Management Plan for the Lesser Poland (Małopolska) Region*[43] This document is important because spatial management policy could determine how industrial and urban symbiosis could be introduced, organizing regional public spaces important for creating favourable conditions for developing such key CE building blocks as collaborative economy, service economy and social economy.

In addition to SYMBI project realisation, the regional authorities of Lesser Poland recently organized numerous actions focusing on waste prevention. Such actions in 2013-2016 included the following[16]:

- educational campaign "You Segregate - You Recover" with the purpose of dissemination of information on the Waste Management Plan of the LPR and the new municipal waste management system

- regional competition “LPR Clean Community” in cooperation with the Voivodeship Fund of Environmental Protection and Water Management with the purpose of identifying and promoting LPR rural and rural-urban communities that have the most effective systems of waste management at the regional level
- regional competition “Pass it on” for association of housewives in rural areas with the purpose of organizing information actions aimed at promoting a waste management hierarchy, waste reuse, exchange, and decoration and repair of old and used goods
- upcycling of LPR promotional materials after rebranding – the “Eco campaign promoting waste management hierarchy: recycling / upcycling, promotion of repair networks and reuse”; actions taken were focused on upcycling of outdated banners and sewing of ecological bags distributed among the LPR population, and carrying out an information campaign on a radio station dedicated to the prevention of waste

All the above mentioned actions show the commitment and readiness of LPR authorities to start the transition to a CE model of development. The special role of the various stakeholders involved is emphasized, because it would be impossible to implement institutional changes in the region without effective supportive mechanisms. Here it is important to identify challenges and opportunities that the new model of development could bring for the LPR, thus the next chapter of this study presents a SWOT analysis for the CE model.

5. Challenges and Opportunities for CE in the Lesser Poland Region

The evaluation of the present situation carried out in the previous chapters related to the level of support for CE in the LPR has made it possible to prepare a SWOT analysis for CE model implementation, and to predict the main challenges and opportunities that this model could bring for the region (Fig.2).

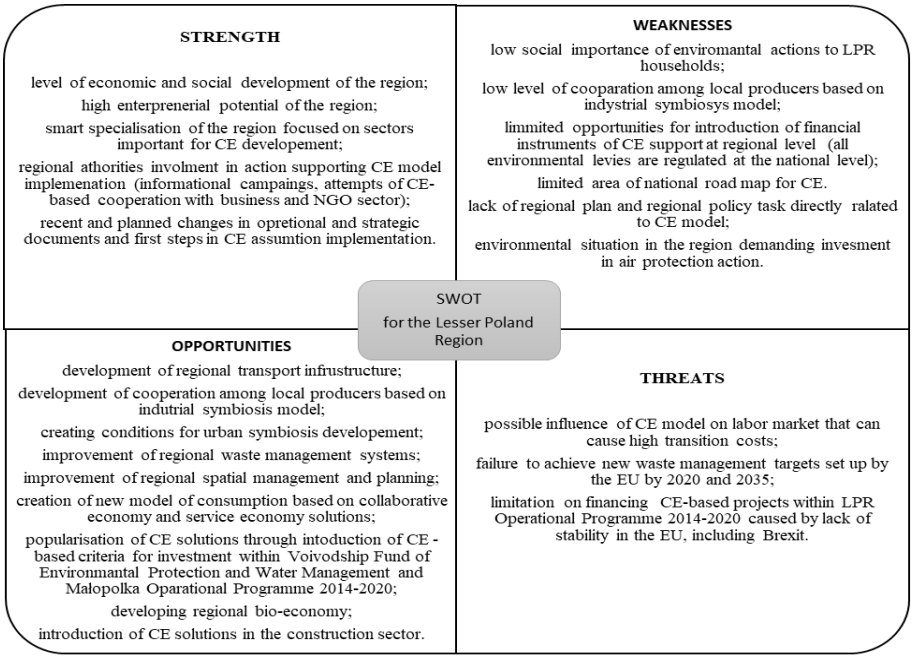

Fig. 2. SWOT analysis of CE model implementation in Lesser Poland Region.

6. Conclusions

Summing up the present status of CE implementation in the LPR, it should be noted that such a new model of development will provide new opportunities and significantly contribute to regional development. Important considerations include the national background for CE implementation and the adaptability of specific regions within the country. As preliminary analysis has shown, national authorities in Poland have already started to build CE strategy at the central government level, working on a basic roadmap for CE implementation. Nevertheless,

many obstacles are apparent on the path to CE transition at both the national and regional levels, firstly because of imbalances in regional development that pose region-specific difficulties.

The Lesser Poland Region, analysed here from the point of view of readiness for CE transition, appears to be reasonably well prepared for the initial changes. Regional authorities and other stakeholders have indicated their openness to introducing and using CE ideas. This would be done *inter alia* due to the introduction of new legislative and organizational instruments supportive of CE-based development, but more in-depth analysis is needed of the cost of such transition, and a specific framework to estimate and monitor the effects of the CE model's implementation in the LPR still needs to be developed. Simultaneously, regional authorities in cooperation with the business sector, NGOs, academic and research communities, and other possible stakeholders should develop a plan for CE that accounts for all the pros and cons, resources involved, required timelines, and costs of CE transition. For this purpose, diagnostics and SWOT analysis will be highly supportive. The preceding analysis has shown numerous opportunities for the CE model in the LPR, but at the same time threats and weaknesses should not be forgotten in order to eliminate all possible risks. Such analysis creates added value and would be supportive for building a regional development strategy for the LPR based on a CE model.

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