



Activity 2a: Methodology to survey
COVID-19 disruptions in industrial
production, manufacturing, and
waste management in SYMBI
regions

SYMBI – INDUSTRIAL
SYMBIOSIS FOR REGIONAL
SUSTAINABLE GROWTH AND
A RESOURCE EFFICIENT
CIRCULAR ECONOMY

Foundation FUNDECYT
Scientific and Technological
Park of Extremadura



CONTENTS

EXECUTIVE SUMMARY	2
1 INTRODUCTION	3
2 PARTNERSHIP	5
3 PURPOSE OF ACTIVITY	6
4 THEMATIC BACKGROUND	7
4.1 EXAMPLES OF THE IMPACT OF COVID-19 ON EU ECONOMIC SECTORS	7
4.2 COVID-19 DISRUPTIONS ON CIRCULAR ECONOMY	8
4.3 CIRCULAR ECONOMY AND POST-COVID-19 RECOVERY & RESILIENCE	10
5 METHODOLOGICAL APPROACH.....	13
5.1 SURVEY PURPOSE & RESPONDENTS	13
5.2 SURVEY FRAMEWORK: SWOT ANALYSIS.....	13
6 TIMELINE	15
ANNEX A: QUESTIONNAIRE.....	16
REFERENCES.....	20



EXECUTIVE SUMMARY

This methodology is part of SYMBI Activity 2: “COVID-19 impact, challenges and new Industrial Symbiosis opportunities joint study”, realised under the “5th call for additional activities”. It provides thematic and data collection guidelines to SYMBI project partners so that they can provide evidence from their territories on:

- The territorial disruptions caused by the COVID-19 crisis in industrial production, manufacturing and waste management.
- The impact of the COVID-19 crisis on circular waste management and Industrial Symbiosis practices.
- Potential policy responses on using Industrial Symbiosis as a tool for regional recovery efforts and building resilient economies to withstand future crisis.

1 INTRODUCTION

The term Industrial Symbiosis refers to a collaborative strategy of exchanging by-products and waste (primarily materials, energy, water) and sharing services among industrial actors; in other words, it is the process by which the waste of a certain industry becomes the raw material of another. Principally, it requires collaborations between businesses, but it may also involve other stakeholders and facilitators, such as local governments and research organisations. Industrial Symbiosis can be considered a closed-loop circular waste management approach where all the materials in manufactured products can be reused, either in the same type of product or for another in a different company. This approach focuses on bringing the products back to the company or industry of manufacture in a no-loss circular material cycle¹.

The application of Industrial Symbiosis, therefore, allows materials to be used more sustainably within a network of collaborators and reduces the environmental impact of industrial operations. Such schemes are a vital part of the circular economy, which has been the long-term goal of the European Commission, as exemplified in its Circular Economy Action Plan (CEAP)². This Plan aims to increasing Europe's sustainability, resource efficiency, and security and Industrial Symbiosis at a regional scale can play a crucial role to realise these objectives, with the potential to yield significant environmental and economic benefits.

A background study conducted to support CEAP³ estimates that applying circular economy principles across EU industries has the potential to increase the EU GDP by an additional 0.5% by 2030, creating around 700 000 new jobs. There is a business growth case for individual companies too: since industrial firms in the EU spend on average about 40% on materials, closed-loop waste management models can increase their profitability while protecting them from primary materials' price fluctuations.⁴

Nevertheless, the ongoing COVID-19 pandemic has caused major disruptions in global manufacturing, supply chains, and waste management. SYMBI partners' effort to transition towards a circular economy model has been postponed since national and regional governments as well as industries have been most concerned with responding to immediate emergencies. Securing the production of necessities by any means and the smooth operation of supply chains, however, has come at the expense of sustainability and circularity.

¹ <https://www.sciencedirect.com/science/article/pii/S0921344915300100>

² <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN>

³ <https://sdg.iisd.org/news/european-commission-adopts-circular-economy-action-plan/>

⁴ [A new Circular Economy Action Plan \(europa.eu\)](#)



At the same time, the pandemic has exacerbated the ineffectiveness of linear territorial economic models to serve as the baseline model of economic growth, raising concerns not only for territorial recovery but also for future resilience planning. Considering that industrial waste, energy demand, and CO2 emissions traditionally skyrocket after major crises, there is a pressing need to resume and further advance the circular transformation of industrial waste management in the participating SYMBI territories, in light of policy gaps uncovered by the COVID-19 crisis.

To that end, SYMBI regions need to develop new recovery and resilience pathways and fully take advantage of the circular economy opportunities offered by major EU and national restructuring initiatives (such as the EU Green Deal), to combat this significant lag in applying symbiotic models of waste management. The Industrial Symbiosis approach will be a key policy pillar in the future planning of the European Commission in addressing the COVID-19 short and long-term environmental and economic impact, as demonstrated, for instance, in the Next Generation EU package that will aim to support EU Member States to recover, repair, and emerge stronger from the crisis⁵. Therefore, SYMBI partners share the pressing need to make the most from any recovery funds to be made available.

To that end, SYMBI Activity 2 will enable partners to survey the territorial specificities of the COVID-19 impact in each partner region and identify common gaps and possible policy solutions, on the road to implement the most suitable measures to provide flexible and fast support for symbiotic and circular waste management of industrial value chains without deviating from sustainable growth agendas. Thereupon, SYMBI partners will be able to employ industrial symbiosis as the centerpiece of their economic recovery agendas while at the same time planning for resilience in case of similar future crises.

⁵ [https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/658186/IPOL_BRI\(2020\)658186_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/658186/IPOL_BRI(2020)658186_EN.pdf)

2 PARTNERSHIP

In the context of the Interreg Europe 5th call, the SYMBI project brings together nine partners in total, from seven Member States (Spain, Poland, Italy, Slovenia, Greece, Hungary, and Finland).

Table 1: The SYMBI partnership under the Interreg Europe 5th call for additional activities

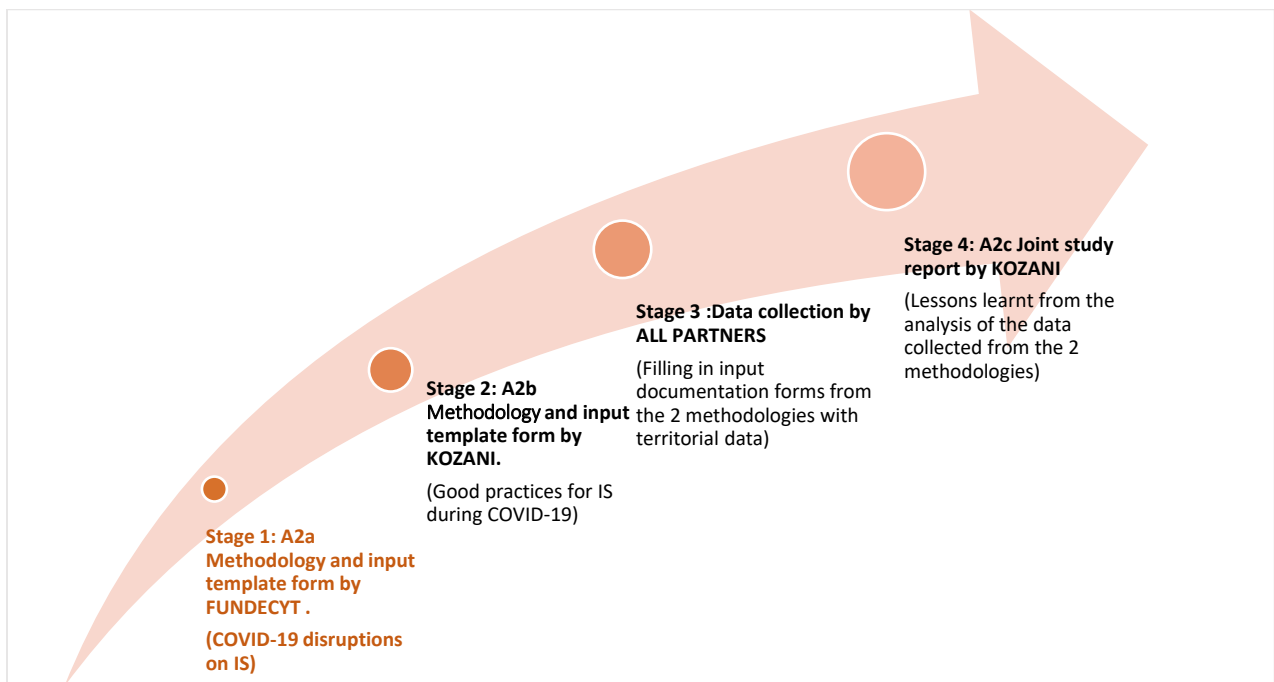
Country	Partner organisation
	Foundation FUNDECYT Scientific and Technological Park of Extremadura (FUNDECYT)
	The Malopolska Region (MALOPOLSKA)
	Chamber of Commerce of Molise (CoC-Molise)
	Government Office for Development and European Cohesion Policy (SVRK)
	Municipality of Kozani, Development and Planning Bureau (KOZANI)
	Pannon Novum West-Transdanubian Regional Innovation Non-Profit Ltd (PANOV)
	Regional Council of Häme (HAME)
	Häme University of Applied Sciences Ltd (HAMK)
	Regional Development Agency of the Ljubljana Urban Region (RDA-LUR)

3 PURPOSE OF ACTIVITY

This methodology, drafted by FUNDECYT, includes data collection forms and tools, as well as a thematic background, to enable project partners to survey territorial COVID-19 disruptions in industry, manufacturing, and waste management SYMBI businesses. To that end, the activity will pinpoint which industrial sectors are vulnerable and require additional policy intervention, and, subsequently, which Industrial Symbiosis policy priorities should be on the top of the list in regional recovery and resilience plans and 2021-2027 policy instruments.

This activity will incorporate elements of a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats; see section 5). The methodological approach developed here will also ensure that partners will identify common policy gaps and new opportunities for recovery and resilience in SYMBI regions. Activity 2 is divided into four Stages as shown in the figure below, with activity this deliverable covering Stage 1.

Table 2: SYMBI Activity 2



4 THEMATIC BACKGROUND

4.1 EXAMPLES OF THE IMPACT OF COVID-19 ON EU ECONOMIC SECTORS

According to the European Parliament report “Impacts of the COVID-19 pandemic on EU industries”⁶, the majority of EU industries have been negatively affected by the pandemic, with the manufacturing, construction, chemical, food and drinks, and agriculture being the ones that have been affected the most. Sectors such as tourism and aviation that are dependent on human contact and interaction have also experienced a significant economic slowdown due to the pandemic, and they are likely to suffer for extended periods from the crisis.

Manufacturing

The COVID-19 impact on manufacturing affected all three areas that underpin standard manufacturing cycles and processes, namely production, demand, and supply chains. In 2020, the resilience of European value chains was tested. The COVID-19 pandemic unveiled weaknesses, as many businesses were initially unable to cope with shortages in supplies caused by closed borders and closed manufacturing sites. The manufacturing subsector of the automotive industry faced increased challenges during the first wave of the pandemic, due to the disruptions of the automotive supply chains in Europe and beyond (especially China). In particular, the global chip shortage that occurred due to the pandemic resulted in the closedown of many automaker suppliers and car dealers. This has significantly affected car manufacturing with many countries facing a severe decrease in their sales.

Construction

The situation across the EU is very diverse for the construction industries, in some Member States, it was possible to continue activity more or less as before the pandemic (e.g. in Germany), while in some countries (such as Italy, Spain, Slovakia, Ireland or France), construction sector activities were severely limited. While the European Green Deal has major implications for the construction industries and will require major adaptations, it is claimed that the green transition and the need to shift to a circular and climate-neutral economy will have significant positive effects on the sector.

Even if in most countries construction industries have been allowed to take up production quickly again, several difficulties arose due to the confinement measures and travel bans, such as labour shortages, supply chain disruptions leading to shortages of construction material, as well as additional costs due to intensified health and security measures.

⁶ [Impacts of the COVID-19 pandemic on EU industries \(europa.eu\)](#)

Agriculture

EU's agricultural sector is facing dramatic labour shortages due to lockdown and border closures that prevent thousands of seasonal workers from reaching the farms during the harvest period but also accessing markets to sell their products, which has resulted in an increase in food waste. The impact on the sector is expected to be long-term, as several major European agricultural producers, including France, Germany, Italy, Spain, and Poland, have proved to be particularly vulnerable. For example, according to Coldiretti⁷, the Italian organisation representing farmers in the country, over a quarter of the food produced in the country relies on approximately 370 000 regular seasonal migrant workers. Around 100 000 farmworkers may not be able to come to Italy this year, and the figure may be double for France.

Chemical industry

The pandemic is also having a major impact on the chemical industry. Demand for chemicals is experiencing severe shocks across end markets with rising demand for pharmaceuticals, food and drinks, and disinfectants. Chemical companies exposed to these sectors are reporting a record of outbound volumes. In addition, the prices of the chemical feedstock have dropped, with the price of crude oil suffering its biggest drop. This collapse caused a major shift in chemical feedstock prices and global competition. In particular, the COVID-19 crisis has resulted in the closure of work sites, with only a few companies being well equipped with digital technologies that can support them in a remote working model. In addition, the pandemic is changing consumers' behavior, as they have been placing a higher value on sustainability, considering also products based on criteria such as circularity and carbon footprint. Several studies⁸ have shown that implementing an Industrial Symbiosis approach in the chemical industry may prove beneficial in achieving a balanced co-development between economy and environment, reducing energy consumption and decreasing wastewater discharge. Thus, the COVID-19 crisis is a great opportunity for the chemical industry to further develop Circular Economy and Industrial Symbiosis schemes.

4.2 COVID-19 DISRUPTIONS ON CIRCULAR ECONOMY

A staple element of the European Union's industrial and waste management strategy has been the transition to a circular economic model. However, the transition towards such a model has been slow, as most EU regions lack relevant expertise on applying Industrial Symbiosis approaches as well as effective raise-awareness campaigns on this issue. Another barrier identified is that circular waste management approaches, and this is particularly relevant for Industrial Symbiosis schemes, require technology-intensive

⁷ <https://www.euractiv.com/section/agriculture-food/news/italy-looks-to-non-eu-migrants-plug-gap-in-agricultural-workforce/>

⁸ <https://aip.scitation.org/doi/pdf/10.1063/1.4992907>

processes that need high-level testing protocols to ensure that the waste is of appropriate quality and thus are in accordance with the specification set by the companies involved. Most EU regions lack of monitoring tools to ensure the quality of the waste, while most companies believe that waste valorization is expensive and (in most cases) recycling is more expensive than buying raw materials⁹.

The lag in advancing Industrial Symbiosis at a regional level became even more difficult due to the COVID-19 restrictions and the ensuing travel bans and lockdowns in EU countries and beyond. Disruptions in supply chains across a variety of industries occurred, especially at the beginning of the COVID-19 crisis - and circular business models are no exception. Before the pandemic, the long distances between relevant actors (e.g. between companies producing waste and companies that could use it as input material) was, in some cases, one of the main reasons that circular approaches to waste management were not feasible. Supply chains naturally suffer from fragmentation and geographical dispersion, therefore lockdowns and travel bans due to COVID-19 made the situation more difficult, with the World Trade Organization projecting a 32% decline in global trade¹⁰. Such short-term adjustments pose great challenges to companies dependent on a continuous inflow of secondary materials. For example, demand has declined for some market segments, such as aluminium recycling geared to the automotive industry.

Supply chain interruptions create an unstable situation in the raw material market with raw material shortages and the reduction of the numbers of suppliers being a significant challenge for businesses that depend on these materials for their production processes. It is instructive that countries accounting for 65% of global manufacturing and exports (i.e. China, USA, Korea, Japan, France, Italy, and the UK) were some of the hardest hit by the COVID-19 crisis. In addition, with industries looking to recover from the COVID-19 restrictions and companies trying to stock back up, the prices of the raw materials have doubled.

In addition, the COVID-19 crisis led to the suspension of business-to-business collaborations, collection rates and inter-regional flows of end-of-life materials; waste management and Industrial Symbiosis processes were the first to be affected, since they are primarily dependent on a business-to-business approach. Due to the closure of businesses, the generation of industrial waste was reduced, which led to a suspension of the waste exchange mechanisms and, as a result, a lack of primary materials. For example, the EU aluminium industry has struggled to compete with international supply, closing some production sites and increasing imports of primary metals. Regarding the shipping operations, due to ongoing issues with COVID-19 and travel restrictions, shipping companies function on a reduced schedule and with a significant increase in their prices. This leads to severe interruptions of waste management and Industrial

⁹ [Understanding barriers to circular economy: cases from the manufacturing industry | Emerald Insight](#)

¹⁰ [A critical analysis of the impacts of COVID-19 on the global economy and ecosystems and opportunities for circular economy strategies \(nih.gov\)](#)

Symbiosis processes since the latter are founded on an interconnected network, where shipping may be a key link of the network.

Lack of workforce due to lockdown is another COVID-19 disruption on circular economy. COVID-19 restrictions oblige employees to work from home which leads to the reduction of the personnel working on Industrial Symbiosis projects. Yet, the work required for an Industrial Symbiosis cannot be carried out remotely, thus the COVID-19 crisis showed us that digitalisation and emerging technologies should be some of the areas of focus in the post-pandemic world.

Finally, policy priorities shifted drastically due to the COVID-19 crisis. As policy efforts were focused more on critical sectors (essential services and products), single-use plastics became a hygienic necessity, and circular waste management strategies faded from the spotlight. This led to low financial support from regional or local governments to businesses to apply Industrial Symbiosis schemes or circular approaches to waste management and also a difficulty to acquire the appropriate technology and infrastructures for waste valorization. There is a falling investment in critical infrastructure and technology which risks in slowing down circularity transition, which requires significant investment in new logistics solutions, circular product design, and new manufacturing methods, to name a few.

4.3 CIRCULAR ECONOMY AND POST-COVID-19 RECOVERY & RESILIENCE

The COVID-19 crisis has led businesses to re-think their needs and production patterns in general. Thus, creating a policy path to advance circular economy is particularly topical in light of the post-COVID-19 recovery. Transitioning to such an economic model can contribute to job creation and retainment, assisting at the same time in building resilient value chains as well as in other issues of critical importance, from resource scarcity to biodiversity and climate change¹¹. Yet currently only 8.6% of the EU economy is circular while over 90% of the raw materials used are not returned to circulation¹².

Unemployment features as one of the most prominent regional challenges in the wake of COVID-19, with sharp drops in job loss across major economies. Policy-makers are understandably looking for ways to quickly restore higher employment levels as part of the socio-economic recovery of EU regions, and circular economy opportunities can be part of the solution, as circular business models typically shift resource use from high dependence on imports to more local inputs. Even though this transition could negatively affect employment in some sectors (e.g., raw materials production or some parts of manufacturing), overall, circular economy operating models strengthen the long-term retainment of jobs compared to their 'linear' counterparts.

¹¹ [how-to-create-a-national-circular-economy-road-map.pdf \(sitra.fi\)](#)

¹² https://www.g20-insights.org/policy_briefs/localising-the-circular-economy-imperative-in-a-post-covid-19-era-place-trade-and-multilateralism/

Circular waste management also contributes to reducing environmental pressures, therefore helping regional economies to become more sustainable during the post-COVID-19 economic recovery. That is, transferring and sharing of resources between businesses and industrial sites translates into less sourcing of raw materials, an increase in the recycling of energy and water, as well as less in reduced waste in landfills. This has a positive impact on the regional biodiversity and the environment, as the overexploitation of land is avoided, climate risks are mitigated (e.g. water shortages), and greenhouse gas emissions are reduced. For example, around 45% of total CO₂ emissions in the EU can be traced back to industrial production (e.g. of cars, food, clothes). Circular approaches to industrial production can assist in cutting them in half, as these can be traced to industrial emissions for the production of materials.

Policy responses have been initiated across Europe in an attempt to mitigate the impacts of the pandemic and to help the recovery. On 11 March 2020, the European Commission presented a new Circular Economy Action Plan (CEAP)¹³, as part of the European Green Deal¹⁴, which is Europe's new agenda to enhance sustainability. The new Action Plan announces initiatives along the entire life cycle of products, promoting circular economy processes, promoting sustainable consumption, and aiming to ensure that the resources used are kept in the EU economy for as long as possible¹⁵. The CEAP aims to boost EU GDP by an additional 0.5% by 2030 and create about 700 000 new jobs¹⁶.

In particular, adopting circular waste management approaches could alleviate the negative impacts of COVID-19 mentioned in the previous section. For instance, introducing a generalized Industrial Symbiosis network at local level would translate in shorter supply chains, decreased dependency from businesses beyond regional borders as well as reduced reliance on value chains that extend beyond the European Union. Another aspect that circular waste management could assist in strengthening regional resilience regards the shift of EU manufacturing to green energy and digitalization. That is, Industrial Symbiosis can assist regions in moving away from the traditional polluting and energy-intensive industry to an economy based on renewable energy, smart materials and digital technology, focusing on the sectors that use the most resources and where the potential circularity is high.

Relevant examples can be drawn from the packaging and plastics production industries, the construction sector, and manufacturing. The packaging and plastics production industries experienced an exponential growth during COVID-19 mainly due to the increase demand for packaged goods and the high use of health equipment such as masks, visors and gloves. To that end, Industrial Symbiosis could facilitate the implementation of the new CEAP, which suggests new mandatory requirements for recycled content, includes new criteria on what plastics are allowed on the EU market, and promotes the reduction of packaging. Construction is another sector that faced significant disruptions due to the pandemic and one

¹³ <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN>

¹⁴ https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

¹⁵ [Overview - Circular economy - Eurostat \(europa.eu\)](https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&plugin=1)

¹⁶ https://ec.europa.eu/commission/presscorner/detail/en/IP_20_420



with high potential for advancing circular approaches to waste management. For example, one of the CEAP strategies will focus on creating a sustainable built environment, promoting circularity principles for buildings. Relevant regional authorities could take advantage of this opportunity to promote Industrial Symbiosis in multi-function buildings, by promoting conducive legislation. Finally, due to the COVID-19 crisis, manufacturing has been forced to change and/or halt its practices at an unprecedented rate, given the scarcity of resources and to accelerate digital transformation. One way to facilitate the transformation of the sector towards circularity would be to promote the roll-out of digital innovation and digitalization, such as developing additive manufacturing technologies (3D printing) and online sharing platforms¹⁷, through Industrial Symbiosis networks.

¹⁷ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7164912/>

5 METHODOLOGICAL APPROACH

5.1 SURVEY PURPOSE & RESPONDENTS

The aim of the survey conducted within SYMBI Activity 2 is to collect data in partner regions on:

- The territorial disruptions caused by the COVID-19 crisis in industrial production, manufacturing and waste management.
- The impact of the COVID-19 crisis on circular waste management and Industrial Symbiosis practices.
- Potential policy responses on using Industrial Symbiosis as a tool for regional recovery efforts and building resilient economies to withstand future crisis.

The survey will be implemented through a single questionnaire addressed to all SYMBI project partners. Although it is not required, each project partner is strongly advised to complete the questionnaire after consulting regional stakeholders; for example, each partner could hold a focus group/consultation meeting with representatives from regional Industrial Symbiosis schemes (e.g. eco-industrial parks) and businesses, regional waste management authorities and consultants, as well as any other regional and/or national actor with knowledge of Industrial Symbiosis in your territory.

5.2 SURVEY FRAMEWORK: SWOT ANALYSIS

The survey incorporates elements of a SWOT analysis framework (Strengths, Weaknesses, Opportunities, Threats). This is a dynamic method for evaluating the potential and overall capacities of a subject matter such as policy actions (measures, solutions, practices, processes) undertaken by public authorities and businesses. The focus here is restricted to the impact of the COVID-19 crisis on partnership regions and countries (territorial coverage).

The rationale of the SWOT framework is to guide future action by matching strengths with opportunities in order to ward off potential threats and overcome harmful weaknesses. This method enables decision makers to be realistic about what they can attain and where they should focus on achieving the biggest impact, considering aspects that may not have been previously examined or discussed in depth. SWOT analysis consists of four categories:

Strengths

This factor documents the intrinsic assets of SYMBI regions, including the areas where the region performs particularly well, as well as the state of its resources, and specifically presents the success factors that each SYMBI region can use as an advantage to support successfully by-products exchanges in the context

of circular economy. Strengths differ from opportunities in that the latter is external and regions have no control over the presence/frequency of these aspects.

Weaknesses

Weaknesses comprise regional attributes and resources that work against a successful outcome. In the context of this project activity, these elements put up additional barriers for regional authorities considering to develop and implement interventions/measures for promoting Industrial Symbiosis schemes and circular economy approaches to waste management.

Opportunities

This factor is used to identify areas in which SYMBI regions could expand their activities based on their strengths. In our case, it includes the external circumstances created by the pandemic that enable the SYMBI regions to create a path towards a circular economy with Industrial Symbiosis as its centrepiece.

Threats

Threats refer to the disruptions caused by the COVID-19 crisis, which may jeopardize SYMBI regions' plans for a circular economy. By identifying threat, regional strategies could be updated to include plans to neutralise and/or avoid those threats; for example, in case of that financial threats restrict the rollout of Industrial Symbiosis, the SWOT analysis framework will point out that regional strategies could concentrate on interventions that do not require significant financial resources such as raising public awareness.

Based on the above, the questionnaire addressed to SYMBI project partners has the following sections:

- **Section 1:** To identify the state of play in the partnership regions.
- **Section 2:** To identify regional disruptions to implementing Industrial Symbiosis / Circular Waste Management Approaches (threats).
- **Section 3:** To pinpoint vulnerable industries in SYMBI regions (weaknesses).
- **Section 4:** To determine regional characteristics that could facilitate the deployment of Industrial Symbiosis as a recovery and resilience pathway (strengths).
- **Section 5:** To identify how the deployment of Industrial Symbiosis / Circular Waste Management Schemes can support regional recovery and resilience planning (opportunities).

6 TIMELINE

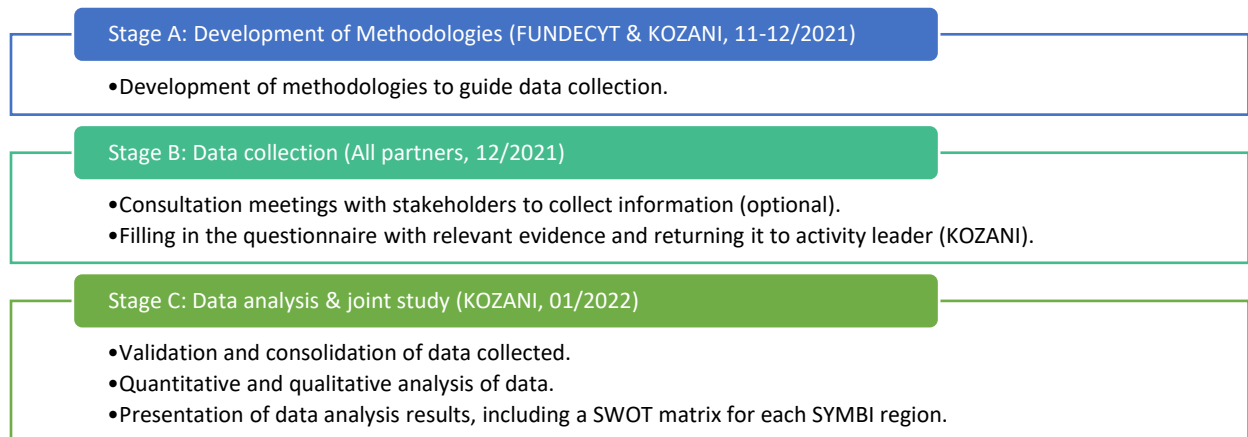
After project partners receive the first version of this methodology by the end of November 2021, feedback is expected within two weeks; revisions and comments will be incorporated into the final version.

Each partner will provide evidence that cover its own geographical territory. The deadline for SYMBI partners by filling in the “Questionnaire” (Annex A) is the end of December 2021. All responses should be gathered and delivered in an integrated format. Finally, the evidence collected will be analysed and used for drafting the joint study, the final deliverable of SYMBI Activity 2, which is to be delivered by KOZANI (activity leader) until the end of January, 2022.

Activity milestones

Data collection and analysis will be implemented in three stages, as indicated below.

Figure 1: Timeline of SYMBI Activity 2



ANNEX A: QUESTIONNAIRE

QUESTIONNAIRE FOR SYMBI ACTIVITY 2

“Surveying COVID-19 disruptions in industrial production, manufacturing, and waste management in SYMBI regions”

Section 1 – State of Play: Description of the current situation (weaknesses)

Please briefly describe in what way and to what extent the COVID-19 crisis has impacted industrial symbiosis and circular economy in your region.

If applicable, include information regarding the economic sector(s) that were most affected (e.g., business closures and/or layoffs).

Click here to enter text.

Section 2 – Threats: Regional disruptions to implementing Industrial Symbiosis / circular waste management approaches

Q1: Please indicate how much each of the following business disruptions, caused by the COVID-19 crisis, are having an impact on your region’s economic sectors and circular economy practices.

1: Negligible / no impact

2: Low impact

3: Medium impact

4: High impact

5: Very high impact

N/A: Not applicable / No answer

Supply chain interruptions: Businesses experienced a breakdown in the manufacturing flow of goods and/or their delivery to customers.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Waste exchange interruption: The quality/quantity of industrial waste has decreased, and as a result businesses could not carry out circular waste management (e.g. lost a source of secondary materials).	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Lack of appropriate workforce: COVID-19 restrictions obliged employees to work from home which led to the reduction of the personnel and businesses' overall capacities to carry out on Industrial Symbiosis / circular waste management projects.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Raw material scarcity: There is a shortage in several key raw materials, affecting the businesses that were dependent on these materials for their production processes.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Change in policy priorities: Due to the COVID-19 crisis, regional authorities focused more on critical sectors (e.g. all available funds were spent in healthcare), de-prioritising Industrial Symbiosis / circular waste management approaches.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Increase in prices of materials: With industries looking to recover from the COVID-19 restrictions and companies trying to stock back up, prices of key materials have significantly increased.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Reduction of logistics/shipping operations: Due to COVID-19 restrictions, transportation delays have caused significant disruptions for materials and by-products exchange.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
<i>Other (please describe any other COVID-19 disruptions on Industrial Symbiosis / circular waste management processes in your region)</i>						
1. Click here to enter text.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
2. Click here to enter text.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>

Section 3 – Strengths: Regional characteristics that could facilitate the deployment of Industrial Symbiosis as a recovery and resilience pathway

Q2: Please indicate which of the following factors that are favourable for deploying Industrial Symbiosis / circular waste management in a post-COVID-19 scenario can be found in your region.

Well-developed industrial networks: The region has already developed the necessary industrial infrastructure to support Circular Economy and Industrial Symbiosis schemes (e.g. eco-industrial parks).

Proximity of industrial operations: Regional businesses are in proximity with each other, which can reduce the shipping operations needed in Industrial Symbiosis and Circular Economy schemes.

Innovation capacity: The region hosts research organisations, universities and/or agencies that perform research in the fields of circular waste management, waste exchange and valorisation.

Conducive policy framework: The regional policy framework is conducive to Circular Economy and Industrial Symbiosis schemes or there are relevant policy initiatives underway.

Trained workforce: The region has experienced personnel to develop the technology needed and manage Circular Economy and Industrial Symbiosis schemes.

Relevant experience: Regional businesses have a track record in implementing and/or getting involved in Industrial Symbiosis and/or Circular Economy initiative.

Economic outlook: The region is in a growth trajectory and businesses look for investment opportunities in the fields of Circular Economy and Industrial Symbiosis.

Accessibility to funding: The region has in place funding initiatives that (could) support Circular Economy and Industrial Symbiosis schemes.

Section 4 – Opportunities: Regional recovery and resilience through the deployment of Industrial Symbiosis / circular waste management schemes.

Q3: Please indicate the level of Industrial Symbiosis' / circular waste management's positive impact in addressing regional needs within a recovery and resilience post-COVID-19 policy agenda.

1: Negligible / no impact

2: Low impact

3: Medium impact

4: High impact

5: Very high impact

N/A: Not applicable / No answer						
Make regional economies more resistant to future crises, strengthening regional value chains.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Create new business opportunities and jobs by facilitating a new economy on waste exchange and valorisation.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Improve the quality of the environment, reducing CO2 and greenhouse gas (GHG) emissions.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Improve the management of regional resources.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Decrease the reliance on supply chains beyond your region.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Support the digital transformation of businesses.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	N/A <input type="checkbox"/>
Q5: Based on your answers above, please further elaborate how your region/territory could benefit from industrial symbiosis. Would it be a useful tool for recovery and resilience?						
Click here to enter text.						

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