

**MAPPING THE INVESTMENT POTENTIAL IN INDUSTRIAL
SYMBIOSIS
–ANALYSIS OF SURVEY DATA AND SWOT ANALYSIS**

Case SYMBI Project



Bachelor's thesis

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TIIVISTELMÄ

Opinnäytetyön aiheena oli selvittää teollisiin symbiooseihin liittyvää investointipotentiaalia SYMBI-projektin seitsemän osallistujamaan tekemän kyselytutkimuksen perusteella. Selvitys on yksi neljästä projektiin kuuluvista selvityksistä. Opinnäytetyön toimeksiantajana toimi Hämeen ammattikorkeakoulun biotalouden tutkimusyksikkö, jonka vastuulla tämän selvityksen tekeminen oli.

Kyselytutkimuksessa kartoitettiin yritysten, julkisen sektorin sekä pankkien ja investoijien potentiaalia ja halukkuutta rahoittaa teollisiin symbiooseihin ja kiertotalouteen liittyviä projekteja tai liiketoimintaa. Kysely toteutettiin avoimin kommenttikenttäkysymyksin. Vastauksia analysoitiin käyttäen SWOT-analyysiä, jonka avulla tutkittavasta kohteesta erotellaan vahvuudet, uhat, heikkoudet ja mahdollisuudet, jotta suuri määrä tietoa saadaan yksinkertaisempaan muotoon. Opinnäytetyössä hyödynnetyt SWOT-analyysin muodot ovat neli- ja kahdeksan-kenttäanalyysit.

Analyysin tuloksissa on monia maakohtaisia eroja, mutta yhtenäistä on se, että käytännössä investointien määrä on vielä vähäistä. Merkittävin yhtenäisyys osoittautui olevan tiedon puute teollisista symbiooseista ja kiertotaloudesta, mikä toimii myös merkittävimpana investointien estäjänä. Kyselytutkimukseen saatu vastausmäärä on varsin pieni, joten tuloksia ei voida vielä yleistää koskemaan kategorioiden edustajia laajemmassa mittakaavassa. Saadut tulokset ja niiden yhtenäisyys ovat kuitenkin vahvasti suuntaa antavia.

Avainsanat Teollinen symbioosi, kiertotalous, SWOT-analyysi, investointipotentiaali, SYMBI-projekti

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ABSTRACT

The aim of the bachelor thesis was to conduct a SWOT analysis of survey data related to the willingness and capability to invest in industrial symbiosis among relevant stakeholders in SYMBI project partners' regions. The commissioning party of the thesis was the Bioeconomy Research Unit of Häme University of Applied Sciences (HAMK). HAMK is one of the nine SYMBI project partners.

SYMBI project partners conducted the survey independently in their own regions and sent the results to HAMK for analysis. The survey was sent to public sector administrations, companies, banks and investors in three different versions as an open-ended questionnaire via email and online survey. The results were analysed by using two different kinds of SWOT analyses. The objective of the SWOT analysis was to identify the strengths, weaknesses, opportunities and threats concerning the investment potential in industrial symbiosis. The aim was to narrow down the scope of policies related to unlocking investments, identify new opportunities and development directions and targets.

The survey results differed by partners but the main finding was that investments in industrial symbiosis are or could be made in all of the three categories but in reality the amount was still relatively low. The main thing hindering investment potential was the lack of knowledge regarding the whole concept of industrial symbiosis. The number of answers received was low altogether. In many cases, the participants were selected by specific principles, which makes the generalisation of the answers inadequate. However, the coherence of the results from the three categories is strongly indicative.

Keywords SWOT analysis, industrial symbiosis, circular economy, SYMBI project, investment potential

Pages 77 pages including appendices 17 pages

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1 INTRODUCTION

A fundamental change in the economy is needed to fight global megatrends. Population growth, urbanisation, instability in the global economy, gentrification and as an affect the decline in resources caused by rising consumption and the effects of climate change are effecting the economy in growing amounts. Solution seeking has led to the conclusion that the current linear economy can no longer be the prevalent way of running the economy. More sustainable circular economy is now high on international agendas as it is seen as the way to deal with the global challenges. (Sitra 2016.)

Circular economy also contributes towards The United Nations sustainable development goals and particularly towards the goal 12: *Ensure sustainable consumption and production patterns*. Resource efficiency is in the heart of circular economy and in the heart of sustainable consumption and production. (UN n.d.) In sustainable development, a co-operative approach is a key aspect in business environment issues. Resource sharing among firms offers the potential to increase stability of operations, by ensuring access to critical inputs such as water, energy, and raw materials. The need for sustainability and resource efficiency pushes companies to think beyond individual firm boundaries. (Chertow & Lombardi 2005.) Industrial symbiosis is a growing business target and one of the main tools to advance resource efficiency in circular economy. Industrial symbiosis promotes the sharing of materials to minimize waste, following the example of a natural ecosystem, where everything is reused and no waste is produced.

Circular economy and industrial symbiosis are central targets in the EU and many projects are set up to promote the dissemination of the concepts. SYMBI project is one of those. The SYMBI project contributes to improve the implementation of regional development policies and programs concerning the promotion and dissemination of industrial symbiosis and circular economy. SYMBI aims to identify the advancing and hindering factors of industrial symbiosis.

Mapping the investment potential in industrial symbiosis is one of the four reports conducted during the four years of SYMBI project operation time. The subjects of the reports were already decided in the project application form. The use of SWOT analysis when analysing the survey results in this activity was also decided beforehand. The conduction of the survey started in autumn 2016 and the analyzation of the results and the conduction of this thesis started in spring 2017.

2 CIRCULAR ECONOMY

Circular economy is based on the sustainable use of resources by monitoring, minimising and eliminating waste flows by circulating materials in the economy. Circular economy strives to create the smallest possible amount of loss and waste in production and consumption. It is seen as a way for our society to increase prosperity, while reducing dependence on primary materials and energy. (Sitra 2016.)

Our current economy is mostly founded on a linear production model where products and goods are utilized on a “take-make-dispose” principle. On the linear model, products and production are based only on the initial use of the product and recycling is segregated from production. In circular economy the products and the production are already designed to be repairable, reusable and recyclable with minimum waste throughout the whole life cycle. The essential aspect in circular economy is to preserve value of materials by making them last in the economy by a long usage time, reusing, repairing and recycling the components of the goods. The designing and optimizing of products for a cycle of disassembly and reuse is called “designing out waste”. Material efficiency is one of the key factors in adapting the overconsumption of natural resources that growing population and growing middle-class cause. (Ellen McArthur Foundation 2013; see also Sitra 2015.)

Circular economy is often divided in biological and technical loops based on the main material of the process (see figure 1). Biological loops consist of processes where the main material is bio-based and biodegradable, for example agriculture, food industry, forestry, bio waste management, biochemical processes like biogas production and nutrient recovery. The material in biological loops should be biological ingredients or ‘nutrients’ that are non-toxic and can safely be returned to the biosphere— directly or in a cascade of consecutive uses (Ellen McArthur Foundation 2013). These products are the consumables in circular economy. Bio-based loops are in close connection with bioeconomy, which is one of the main agendas in the European economy (European Commission 2016). (Sitra 2015.)

As shown in figure 1 technical loops, for example, consist of mining, manufacturing and processes dealing with unrenovable and fossil resources. Technical loops that bind non-renewable natural resources are in crucial role in maintaining value as the aim in circular economy is to utilize non-renewables as little as possible so the resources that are already at use, should stay there as long as possible. The design for reuse is particularly essential in technical loops. Many non-renewable materials such as aluminium can be recycled unlimitedly. For this reason the material in technical loops are the durables, as they are made of technical nutrients unsuitable for the biosphere (Ellen McArthur Foundation 2013). (Sitra 2016; see also Ellen McArthur Foundation 2015.)

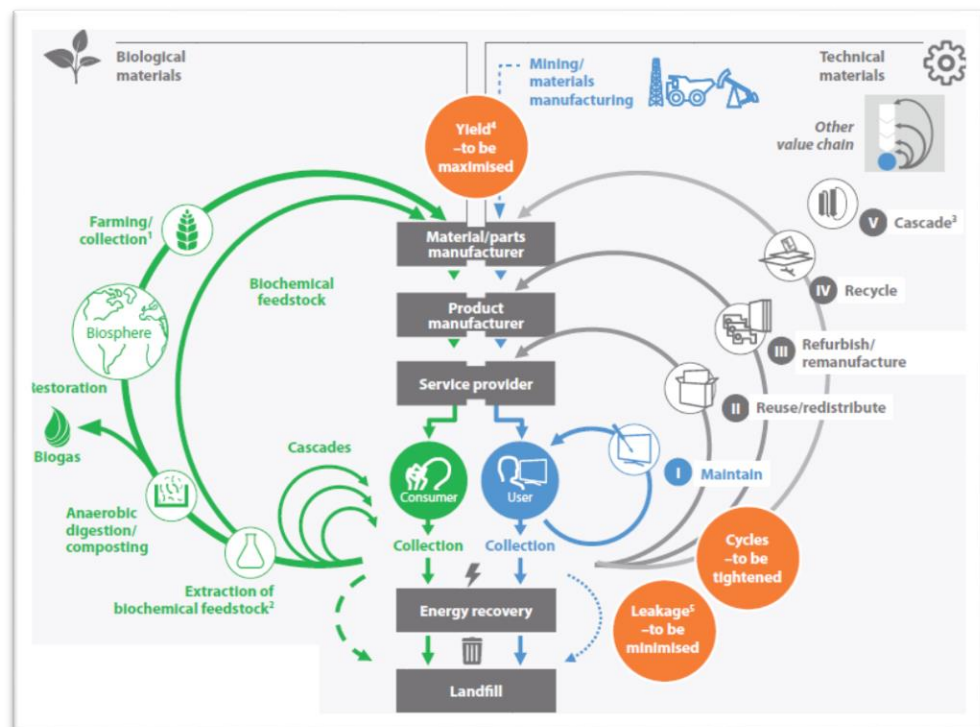


Figure 1. Circular economy illustration. Circular economy can be divided in biological and technical loops. (Sitra 2015.)

Circular economy is one of the main economic targets of the European Union. The environmental and economic benefits are recognized in several studies. For example the Club of Rome estimates that more than 75,000 new jobs would be created in Europe and the net benefit of the circular economy to European economy could be up to 1800 billion euros by 2030 (Wijkman & Skånberg 2015).

The European Commission adopted a Circular Economy Package “*Closing the loop - An EU action plan for the Circular Economy*” in December 2015. The package consists actions to transform Europe into a more competitive resource-efficient economy where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste is minimised. EU’s aim is to develop a sustainable, low carbon and competitive economy maintaining the value of products by supporting new business opportunities and more efficient ways to produce and consume. The programme of action includes measures covering the lifecycle of goods as a whole: from production and consumption to waste management and the market for secondary raw materials. The package also includes revised legislative proposals on waste to stimulate the transition towards a circular economy. (European Commission 2015.)

3 INDUSTRIAL SYMBIOSIS

Industrial symbiosis is a flow of unutilized resource from an entity, which would otherwise discard them, to another entity, which uses them as a substitute for their output. Industrial symbiosis differs from “normal” transaction between companies or organizations, where goods are sold for the purpose for which they were intended as in industrial symbiosis the product is usually waste, residual or a by-product of one entity. Both companies receive extra additional value from a resource that might otherwise be disposed or cause expenses. In other words, a resource that the originating entity has but does not want or need becomes a valuable asset. One of the main ideas behind industrial symbiosis is the mutual benefit from being resource efficient by using fewer natural resources than traditional industrial value chains (Sitra n.d.). According to many definitions, the flow of materials in industrial symbiosis does not need to be an exchange of materials between two entities. A flow of unutilized resource from an entity to another is enough for industrial symbiosis to be accomplished. (Deutz 2012.)

Industrial symbiosis focuses on the interaction between the environment, the economy and industry, and promotes the sharing of materials to minimize waste. The idea of industrial symbiosis is derived from the example of a natural ecosystem, where materials flow, everything is reused and no waste is produced.

Industrial symbiosis contributes towards circular economy as it is one of the main ways of “closing the loop” of value loss in industrial processes. In circular economy, it is essential to decouple the need for virgin raw materials in order to gain economic benefit (Ellen McArthur Foundation 2015b, 5, 16). The symbiosis improves the partner firms’ overall environmental and economic performance while contributes towards the growing need and pressure to act against climate change and regulations related to emissions and recycling. (Johnsen et al. 2015; Kusch 2015.)

There are many examples of industrial symbiosis around the world. Some of them consist of just two companies and some entails many. Perhaps one of the most famous is the Kalundborg symbiosis in Denmark Kalundborg. At the Kalundborg symbiosis, public and private companies buy and sell waste from each other in a closed cycle. Eight public and private partners exchange energy, water and materials and create 50 symbiotic exchanges as shown in figure 2. The increased costs of materials and energy is the driver of the symbiosis. The close physical distance between the companies made the installation of pipes for water and energy exchange feasible. The cooperation first started in 1961 from the need of one company and has grown over the years as more businesses were linked into the symbiosis. In 1989, the term “industrial symbiosis” was used to describe the collaboration for the first time. The support from the

municipality of Kalundborg has played a key role in growing the symbiosis but the first initiation came from the companies. (Kalundborg symbiosis n.d.; see also Ellen McArthur Foundation n.d.)

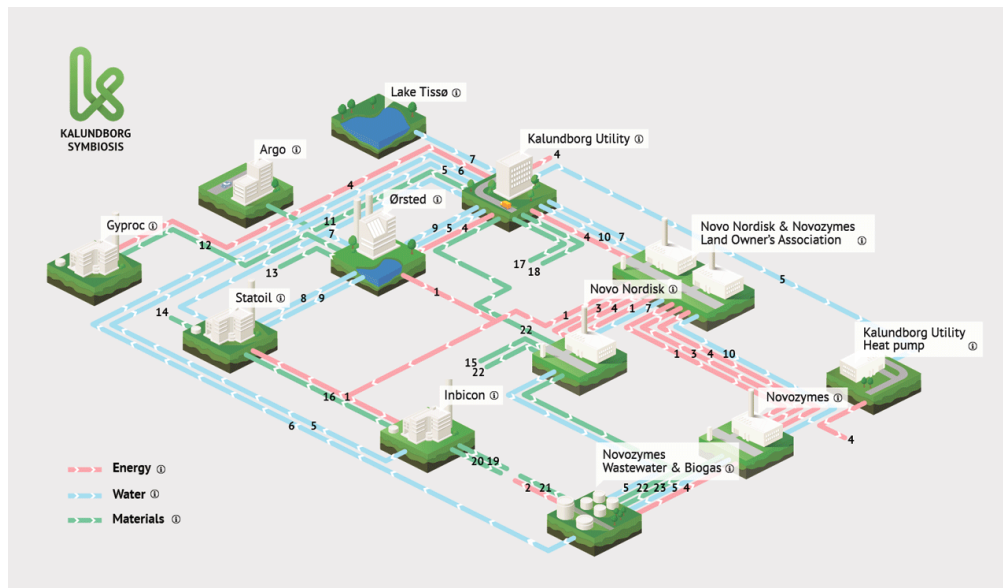


Figure 2. The Kalundborg symbiosis (Kalundborg symbiosis n.d.)

Another example of industrial symbiosis with a notable regional impact is the symbiosis in Forssa region, Finland. Eco-industrial Park in Forssa region consists of three main symbioses between ten companies showed in figure 3. Two of the symbioses are bio-based symbioses, which are based on material exchange. The symbiosis generates secondary materials such as big feed, fertilizers, biogas and biofuels from waste and by-products. The majority of the biogas is used as energy for the manufacturing process of glass wool insulation at a local construction company. The third symbiosis is based on the utilization of biogas in the area. The importance of the symbiosis is significant regionally as it reduces the need for exported materials such as soybean for big feed of fossil fuels for energy and fuel. Forssa region is one of the main regions in Häme, where the Finnish SYMBI partners are also located. (Winther 2017.)

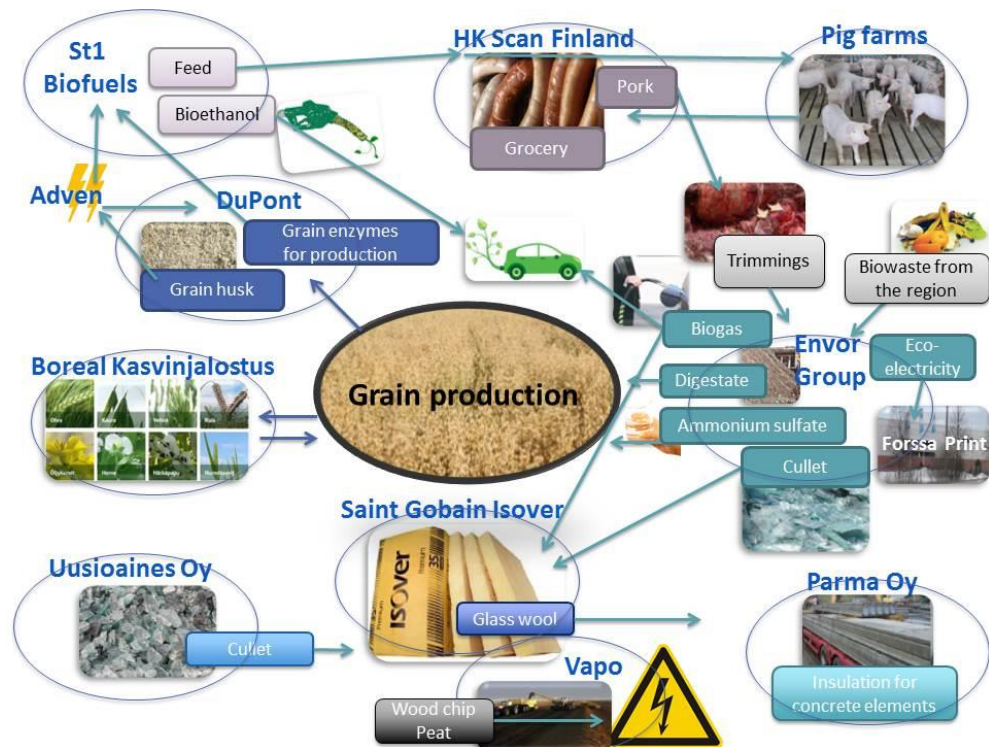


Figure 3. Industrial symbiosis in Forssa region, Finland (Caven 2015)

4 SWOT ANALYSIS

SWOT analysis is a strategic management tool. A strategy means a long-term action plan to achieve defined objectives. A strategy leads to measures that are necessary in order to achieve the objectives. SWOT analysis is a part of a situation analysis and a strategy formulation in the strategic planning process as shown in figure 4. (Phal & Richer 2007, 3–6.)

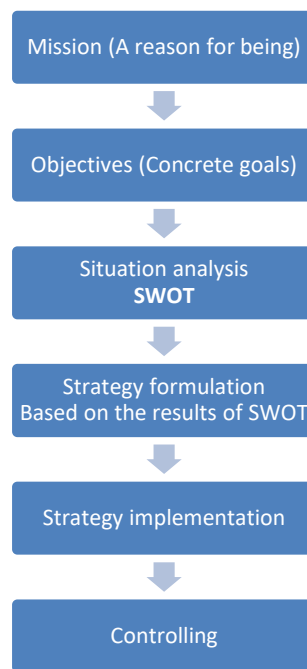


Figure 4. The six steps of strategic planning process and the placement of SWOT analysis within it. (Modified from Phal & Richer 2007, 6)

The term SWOT is an abbreviation of the words Strengths, Weaknesses, Opportunities and Threats. The analysis consists of evaluating these four factors. Some online wikis credit Stanford University Professor Albert Humphrey being the inventor of SWOT but no academic references to support this claim can be found (King 2004). The SWOT model was not introduced first by one inventor or a team of inventors, it was developed gradually and it grew overtime to become a widely used strategic planning tool. Regardless of the exact inventor of the term “SWOT”, the management tool itself has been used and documented since the 1960’s when the idea of matching internal and external parameters in general was developed. (Phal & Richer 2007, 2–3; Helms & Nixon 2010.)

SWOT analysis is usually presented on a four-fold matrix such as shown in figure 5. The four quadrants of a SWOT analysis grid are divided to internal and external factors. Strength and weakness are internal factors, as they already exist in the matter that is analysed. Strengths and weaknesses address the matters that enable or prohibit performing as well as possible. Opportunities and threats are external factors as they stem and span outside of the matter that is analysed, and are therefore environmental factors. External factors are for example currents and future trends, markets and political, economic and environmental issues. (Helms & Nixon 2010, 216.)

By listing favourable and unfavourable internal and external issues in the four quadrants of a SWOT analysis grid, it is easier to understand how

strengths can be leveraged to realize new opportunities and how weaknesses can slow progress or create organizational threats. SWOT analysis is widely used in planning purposes due to its simplicity and pervasive nature. The key in SWOT analysis is to be able to address complex strategic situations by reducing the quantity of information to improve decision-making. (Helms & Nixon 2010, 216.)

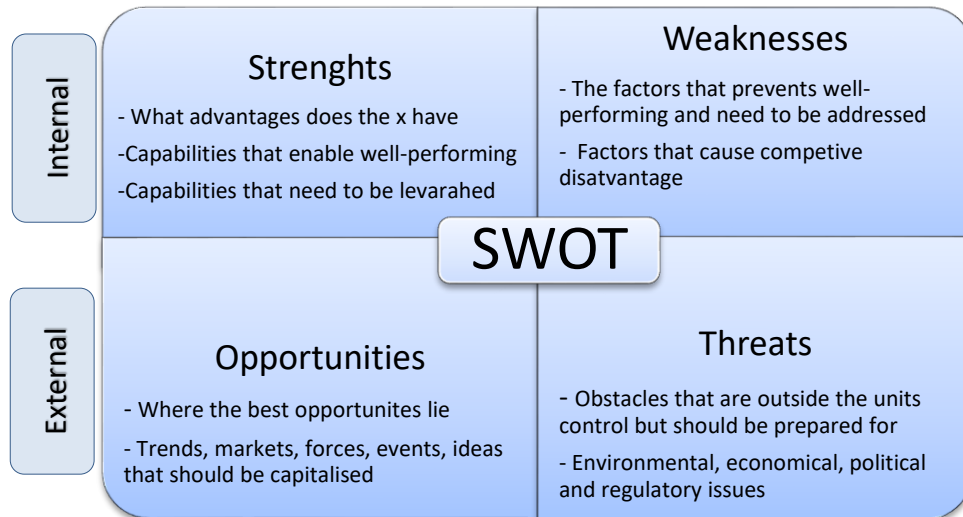


Figure 5. Basic four-quadrant SWOT matrix. (Phal & Richer 2007, 6; Helms & Nixon 2010, 216)

Even though SWOT is a widely used planning /situation analysis tool, it has also been criticized. The main critique that SWOT analysis faces is about it being too simple, just a "laundry list" put together under each of the four headings. SWOT indicates the aspects that affect the analysed matter from inside and out but does not tell what to do next and how exactly the outcome of this analysis can help the analyst in its development. This is why more advanced forms of SWOT analysis have been created to answer the need to respond to the shortages of the basic four-fold SWOT. (Pandya 2017, 12.)

One of the things in common with the advanced analysis is that instead of the original four the SWOT matrix is extended usually to eight columns. These additional columns state the actions to be made based on the results. An example of an extended SWOT is called LISA framework (shown in the figure 6). LISA framework focuses on how to utilize the findings of the SWOT analysis and enhance its developmental potential. LISA stands from the abbreviation:

- "Leverage" the strengths
- "Improve" upon the weaknesses
- "Seize" the opportunities
- "Awareness" of the threats (Pandya 2017, 12.)

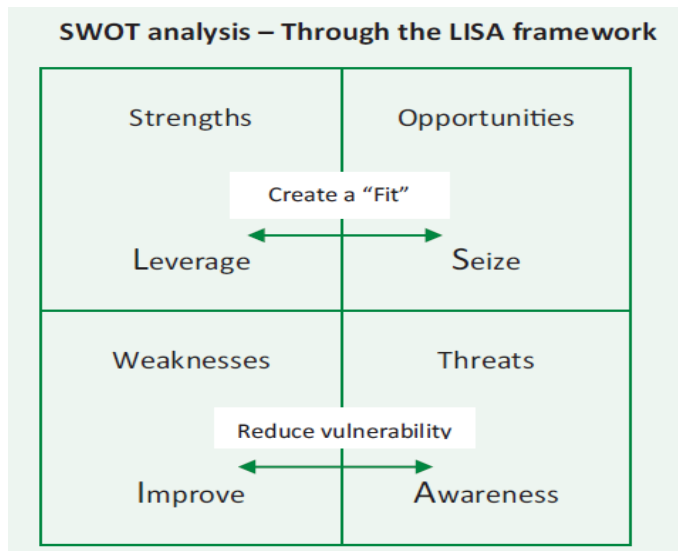


Figure 6. SWOT analysis through LISA framework (Pandya 2017, 13)

Combining LISA framework with an eight-fold matrix (Figure 7) makes SWOT analysis more active and solution focused. The SO strategy is created by leveraging the strengths to seize the opportunities. ST strategy focuses on maximising strengths to minimise threats and WO focuses on minimising internal problems to take advantage of opportunities. WT strategy is created by improving upon the weaknesses to reduce vulnerability to the threats by being aware of them. (Pandya 2017, 12; Phal & Richer 2007, 17.)

	Internal	
	Strengths	Weaknesses
External		
Opportunities	SO – strategy. Strengths meet opportunities, capitalize, seize, maximise	WO – strategy. Minimise internal problems to take advantage of opportunities
Threats	ST – strategy. Maximise strengths to minimise threats	WT – strategy Minimise and prepare. Use strengths to overcome

Figure 7. The eight-fold SWOT analysis combined with the idea behind LISA-framework

The utilization of SWOT analysis in this report, the SYMBI project activity A1.2, was already decided in the SYMBI project application form. When planning and conducting this report there was room for only deciding which kind of SWOT analysis would be utilized. A basic four-quadrant SWOT matrix was used when laying out and analysing the partner-specific results of the survey. A more advanced eight-fold matrix was then used to combine and analyse the survey results from all partners and to unravel the actions to be made based on the results of the analysis.

5 SYMBI PROJECT

SYMBI (Industrial Symbiosis for Regional Sustainable Growth and a Resource Efficient Circular) project is an international EU project focused on improving industrial symbiosis for a resource efficient economy. The aim of the project is to contribute to improve the implementation of regional development policies and programmes related to the promotion and dissemination of industrial symbiosis and circular economy. The seven participating countries are faced to policies alignment with the Circular economy strategy of the European Commission to transform Europe into a more competitive resource-efficient economy. SYMBI general objective is to empower regions to build sustainable economies, resilient to environmental pressures and climate change. The project focuses on material industrial symbiosis therefore service related symbioses are excluded from the examinations. (SYMBI 2016.)

The project is funded by the Interreg Europe program. Interreg Europe funds interregional cooperation projects in the field of research and innovation, SME competitiveness, low-carbon economy and environmental and resource efficiency, SYMBI being part of the latter. The general objective of Interreg Europe programs is to promote the exchange of experience and good practices among European Union countries. (Interreg Europe 2016.)

The SYMBI consortium consists of nine partners from seven EU countries: Spain, Italy Greece, Slovenia, Hungary, Poland and Finland (see table 1). The partners differ from each other in size and as organizations. Most of the partner organisations are public sector organisations operating regionally in their countries. The most vastly operating organisation comes from Slovenia, as the Slovenian partner is a nationally operating governmental body. The smallest partner organisation is the Greek partner whose operation area is regional in the city of Kozani.

Table 1. Introduction of the SYMBI partners

Partner	Abbreviation	Country	Local/ Regional/ National	Role in the project
Foundation FUNDECYT Scientific and Technological Park of Extremadura	FUNDECYT	Spain	Regional	Lead Partner
Environment and Territory Regional Ministry	Andalusia	Spain	Regional	Partner
The Malopolska Region	Malopolska	Poland	Regional	Partner
Chamber of Commerce of Molise	COC - Molise	Italy	Regional	Partner
Government Office for Development and European Cohesion Policy	SVRK	Slovenia	National	Partner
Municipality of Kozani, Development and Planning Bureau	Kozani	Greece	Local	Partner
Pannon Novum West-Transdanubian Regional Innovation Non-Profit Ltd	PA-NOV	Hungary	Regional	Partner
Regional Council of Häme	HAME	Finland	Regional	Partner
Häme University of Applied Sciences Ltd	HAMK	Finland	Regional	Advisory partner

6 MAPPING THE INVESTMENT POTENTIAL IN INDUSTRIAL SYMBIOSIS (ACTIVITY A1.2)

The aim of the activity A1.2 "Mapping the investment potential in industrial symbiosis" was to find out the willingness and capacity of relevant stakeholders to make investments in developing industrial symbiosis in partners' regions and analyse the investment capacity. The activity was conducted by a survey and it consisted of four phases:

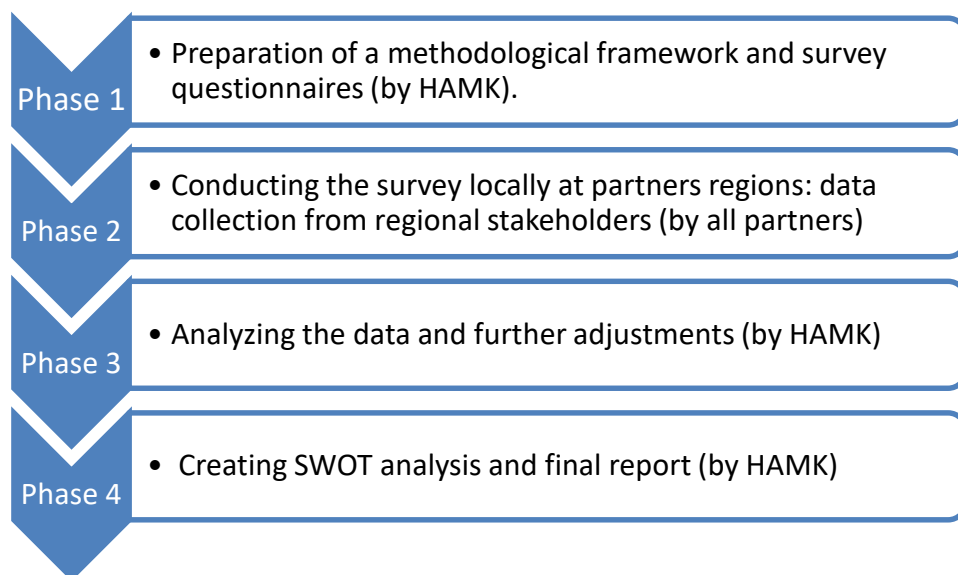


Figure 8. The four phases of the activity A1.2

The first phase was the preparation of a methodological framework of the activity. The survey was conducted in the second phase of the activity. The aim of the survey was to map the willingness and capability to invest in industrial symbiosis among relevant stakeholders. The survey was done in three different versions: one for companies, one for public sector administration and one for banks and investors. The target number of answers in the three categories were:

- companies 10
- public sector administrations 2
- banks and investors 5

The questionnaire consisted of open-ended questions targeting the ability to allot financial support to industrial symbiosis projects and possible involvement in such projects. Based on the results of the survey a SWOT analysis was made to compose the findings. The third and the fourth phase, as shown in Figure 8, focused on the analyzation of the survey data and creation of the SWOT analysis. The objective of the SWOT analysis was to narrow down the scope of policies related to unlocking investments in industrial symbiosis and to identify new opportunities and areas to enhance the investment potential.

6.1 Research questions

The aim with the original format of the questionnaires was to design them to be short and simple in order to reach vastly extended coverage. The partners had the change to modify the survey questionnaires, as they preferred. The modified questionnaires can be found as appendix 1 and 2. Most of the partners used the original format of research questions but

especially the Slovenian partner modified the questionnaire with extra questions. The original format of the questionnaires were like follows:

QUESTIONNAIRE FOR COMPANIES

1. Basic information
 - * Name of respondent
 - * Company or organization
 - * Country and region
 - Revenue
 - Number of staff
 - *compulsory questions

Are you already involved in industrial symbiosis? Answer question 2 or 3.

2. YES, we are already involved in industrial symbiosis
 - How big were the investments and what were the estimated payback times for the investments? (Please describe as many cases as you feel appropriate)
 - What is this symbiosis all about: giving/receiving materials, utilizing/sharing other resources?
 - What kinds of objectives, obstacles or drivers are involved in industrial symbiosis according your experience?
3. NO, We are not already involved in industrial symbiosis
 - Would you think industrial symbiosis could be beneficial for your company?
 - Could it be giving/receiving materials, utilizing/sharing other resources? If possible, explain what are these materials or resources.
 - Would you be willing to invest in industrial symbiosis, how much (€ and/or % of revenue)? What would be the expected time for payback?

QUESTIONNAIRE FOR MUNICIPALITIES AND CITIES, REGIONAL BUSINESS DEVELOPMENT AGENCIES, REGIONAL ADMINISTRATION AND COUNCILS, NATIONAL ADMINISTRATION AND MINISTRIES, NATIONAL INNOVATION AGENCIES

1. Basic information
 - Name of respondent
 - Company or organization
 - Country and region
 - Operational level
 - municipal
 - regional
 - national

2. Are you able to allot financial support for companies in creating industrial symbiosis? Do you have a budget for supporting circular economy and/or industrial symbiosis investments?

What is the budget per year and what are the conditions supporting your decision to invest? If the budget is not fixed, please explain.

3. Do you have other way of supporting companies in their activities among circular economy and/or industrial symbiosis investments?

Please explain.

QUESTIONNAIRE FOR INVESTORS AND BANKS

1. Basic information

Name of respondent

Company or organization

Country and region

2. Are you willing to invest in industrial symbiosis or circular economy in general? Do you have instruments for supporting circular economy and/or industrial symbiosis investments?

- What are these instruments and what are the conditions supporting your decision to invest?

6.2 Data analysis methods

The survey data was analysed through open coding and SWOT analysis. Open coding is a commonly used method when analysing qualitative survey data. SWOT analysis was chosen because its pervasive nature. SWOT analyses are common in Interreg projects as a useful starting point to steer the development and implementation of policies at territorial level. The SWOT analysis is anticipated to highlight the areas on which public authorities should focus, by taking into account both enabling and inhibiting factors, at internal and external level (e.g. strong public administration staff capacity vs. limited funding possibilities, innovative business culture vs. abundance of raw materials). Overall, making industrial symbiosis happen, especially in areas lagging behind, requires careful planning and realistic estimations; to this end, the SWOT analysis is expected to assist in the definition of directions and boundaries, based on the territorial potential identified through this research. (N. Kritsinelis, personal communication, May 8, 2017)

Open coding is a method to analyse qualitative data as a stage-by-stage process. In open coding, the data is read through several times to break the information into pieces in order to examine closely and compare relations, similarities and dissimilarities. After reading the data, several times the aim was to find tentative labels for chunks of data that summarize key findings. Open coding is not guided by the researchers'

theoretical assumptions, but by the data itself. The results should not be based on existing theory but instead on just the findings that emerges from the data. The main aspects of open coding are:

- Identify the underlying issue and phenomenon.
- Identify the actors involved and the roles they play.
- Identify the reasons attached to the phenomenon.
- Identify strategies to achieve the goal. (Flick 2009.)

7 THE SURVEY RESULTS

The distribution of the survey was selected by each SYMBI partner with the aim to achieve the target number of answers. All of the partners distributes the survey via email or as an online survey. Table 2 entails the survey results from each partner in the three stakeholder groups. The “sent” column covers the number of sent surveys to the specific stakeholders. The “replies” column covers the replies received and the “analysable” column covers the number of which received answers entitled enough information in order to be analysed. Some of the replies were unsuitable to be analysed because they did not entail enough information such as basic information of the company (name of the organisation) or most (90 % or over) of the questions were left unanswered. SYMBI project focuses on material industrial symbiosis so in case the reply represented industrial symbiosis situation from service sector, the answer was unanalysed.

Table 2. Survey results by partners in the three categories

Partner	Companies			Public sector			Investors and Banks		
	Sent	Replies	Analysable	Sent	Replies	Analysable	Sent	Replies	Analysable
FUNDECYT (ES)	250	8	7	5	3	3	10	3	2
Andalusia (ES)	15	4	4	8	1	1	0	0	0
Malopolska Region (PL)	16	3	3	9	1	1	1	0	0
Molise (IT)	-	-	13	-	-	4	-	-	2
SVRK (SL)	2000	388	121	250	141	35	13*	31	2
Kozani (GR)	2	1	1	5	5	5	1	0	0
Pannon Novum (HU)	-	9	-	-	5	-	-	2	-
HAMK (FI)	3067	77	76	19	6	6	18	5	5

- No information available

* The investors were asked to send the questionnaire forward

There is a notable division between the answers received from the three categories. Most answers were received from companies then from public sector and few answers were received from investors and banks (exception Kozani, Table 2). The partners also contacted more companies than organisations from the two other categories.

The only partner who managed to reach the target number of answers in all of the three categories was the Finnish partner HAMK. The Italian and the Slovenian partner were close as they managed to reach the target number of answers in two of the categories (companies and public sector). The most difficult stakeholder group to reach has been investors and banks. The partners' own conclusions about not receiving the target number of answers are found later in the report of partner-specific results. The Finnish partners both come from the same region (Häme region) so the survey was done in cooperation with the two partners. This is why there is only one set of results from Finland, compared to Spain where the partners come from different regions and thus conducted separate surveys. The Hungarian partner Pannon Novum conducted the survey but the results were not translated and ready to be analysed by the time of conducting this thesis.

7.1 Overview of the companies

The review about the size of the companies gives a better overview of the sampling that was chosen for the survey. Micro companies are those with less than 10 employees. Small are those with 10 to 49 persons employed and medium sized companies are those with 50 to 249 persons employed. Large enterprises are the ones with 250 or more employees. (Eurostat 2016.)

Some observation can be made based on the size of the companies. With no exception, the most replies were received from micro companies because the SYMBI partners conducted mostly small organisations (Figure 9). Other possible reason for the higher involvement from micro-sized companies is that they might be easier to contact and approach and that they might be more interested in profiting from cooperation, which is essential in an industrial symbiosis. In most cases, the SYMBI partners chose companies they already have cooperation with and these appear to be local micro companies. Micro companies might also struggle less with bureaucracy compared to larger enterprises, which makes the participation in such surveys and projects easier.

The Slovenian partner is the only nationally operating company, which explains the highest number of answers. The majority of companies in Slovenia are micro and small enterprises, to a lesser extent also medium enterprises. The size of the companies participated in the survey from Andalusia region and the Hungarian partner Pannon Novum was not

available. A conclusion can be drawn that micro companies seem to be more interested in the involvement of industrial symbiosis projects and invest in such projects in SYMBI partners regions. However, further research could be needed to support this conclusion.

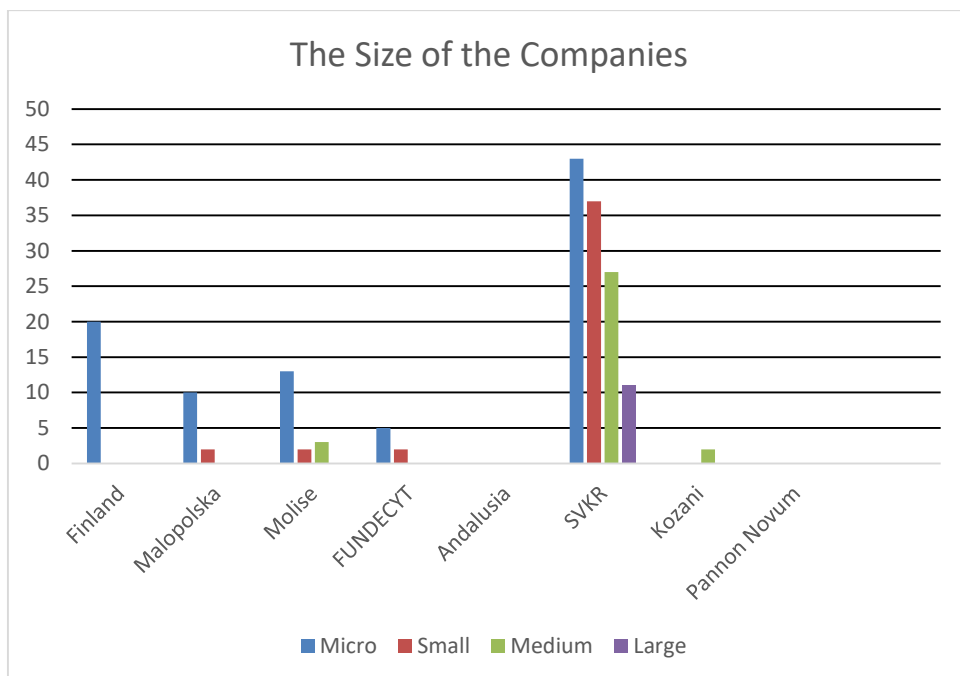


Figure 9. The amount of the companies that took part in the survey classified by size

7.2 FUNDECYT Spain

Foundation FUNDECYT Scientific and Technological Park of Extremadura is a public body agency operating regionally in the Extremadura autonomous community. FUNDECYT selected the coverage of the survey by the existing activity in innovation and relevancy in industrial symbiosis and regional location in the Extremadura region. The questionnaire was sent to the stakeholders via online survey.

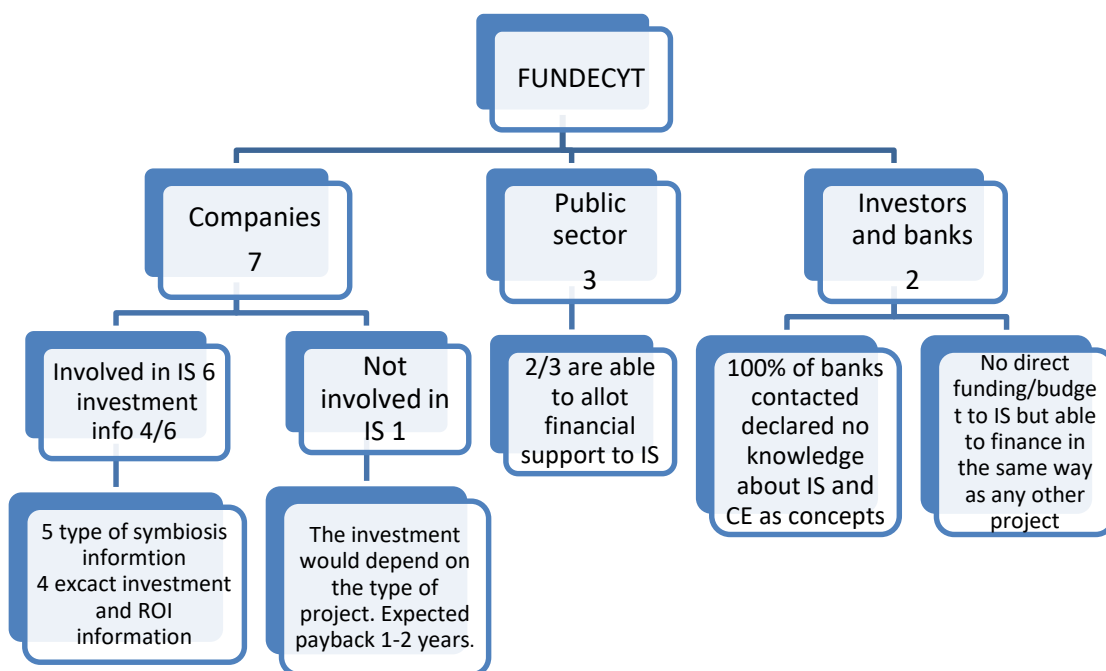


Figure 10. The distribution of the survey results in the three categories

7.2.1 Companies

FUNDECYT approached companies that are already oriented to innovation according to FUNDECYT's databases. FUNDECYT used the original format of research questions when approaching companies. The questionnaire was sent to 250 companies and from the 8 replies they received, seven were analysable (Table 2). According to FUNDECYT, the companies that answered the questionnaire are already working in topics related to circular economy and are innovative with a high participation in researching activities. Rest of the organizations from which no answer was received appear to have lack of understanding of concepts related to industrial symbiosis and circular economy according to FUNDECYT. Five of the seven organisations who answered the survey are involved in industrial symbiosis and four of these invest in it (Figure 10). The announced investment information varies from around 100.000 euro to 300.000 euro with the payback time of 2-5 years. The one company that is not involved in industrial symbiosis projects stated that the investment would depend on the type of project and expected payback time would be 1-2 years. If the payback time is expected to be as short as 1-2 years, it might be a restricting factor in participating in industrial symbiosis projects as such projects might be harder to find or execute.

Some of the companies reported objectives related to the participation in industrial symbiosis projects. These are:

- To develop a new productive model for the region that is capable of generating value in processes that otherwise would not have it.

- Take advantage of new opportunities.
- Offer products with long life cycles, and products for cascade lifecycles.

7.2.2 Public sector

The study area for public sector organisations was national and chosen from specific departments that count on funds for innovation for companies. FUNDEFYT added questions to the original format of research questions when approaching public sector organisations. The questionnaire can be found from annex 1. The additional questions regarded having support investments in industrial symbiosis and circular economy in the past and about the conditions of receiving a fund. The questionnaire was sent to five public sector organisations and three replies were received. Two of the public sector represents are operating nationally and one regionally in Extremadura. One of the national organisation was able to allot financial support for companies in creating industrial symbiosis and this has been done through research and development projects and in supporting companies in Horizon 2020 (EU fund for research and innovation). The organisation funds a wide range of research projects but it does not have a specific budget for supporting these investments. The terms and condition of a grant is research and development activities with a technological challenge and financial capability. The other national public sector organisation does not invest in or support industrial symbiosis projects. The regionally operating public organisation has supported investments in industrial symbiosis or circular economy projects and it is able to allot financial support to companies in creating such projects by minority shareholding, participatory loans and conventional loans.

7.2.3 Investors and banks

FUNDECYT approached 10 investors and banks with the survey and received three answers from which two were analysable (Table 2). As shown in annex 1 the extra questions were added to the beginning of the questionnaire about the level of knowledge related to circular economy and industrial symbiosis and 100 % of banks contacted declared no knowledge about these concepts. Both of the investment sector organisations have not supported investment in industrial symbiosis or circular economy. However, they stated to be able to allot financial support to companies in creating the two aspects with traditional banking instruments, such as guarantees for credits (see figure 10, p. 18).

7.2.4 SWOT analysis and conclusions

FUNDECYT managed to achieve the minimum number of answers with public sector but not with companies or investors and banks. According to

FUNDECYT, the possible reasons for not achieving the target number of answers is due to a lack of understanding related to the topics. The fact emerged especially from the answers received from investors and banks as they declared to have no knowledge about these concepts.

Based on the results of the survey some chunks of data can be categorized under the four quadrants of SWOT analysis. Strengths represent the aspects within the organisation that have a positive impact on investment potential towards industrial symbiosis (IS) and circular economy (CE). The main driver in financing IS and CE operation is the economic benefit from receiving value and creating new products from streams such as waste and side streams that cause expenses in a business as usual situation. Positive experiences from companies in industrial symbiosis projects are met when the investment has been around 100.000 euro to 300.000 euro with the payback time of 2-5 years. At public sector, the strengths concerning investment potential are the many ways of giving finance especially in the field of innovations and new technology. In addition public sector has other ways of supporting IS and CE projects such as information tools. The strengths that appeared from investors and banks are that the traditional banking instruments also apply to industrial symbiosis projects.

The weaknesses are the negative aspects that hinder the investment potential in the organisation. With companies and investment sector, the most significant weakness is the lack of knowledge of the whole idea of symbiotic cooperation between companies. A lack of understanding creates lack of interest. In the public sector, the investment seems to be still at a vague stage as the public sector organisations were not able to give any specific investment information. Neither investors nor banks have specific procedures of funding IS and CE projects.

Opportunities and threats come from outside of the organisation and are affected by the current and general national and regional situation. A general threat occurs to be that if the level of knowledge does not rise the situation might not progress. On the other hand, the level of knowledge can be seen as an opportunity, as by increasing it in any of the three categories it might have a positive effect to the other. Companies seeking funding for IS and CE projects give the investment sector encouragement to create instruments tailored to such action and the availability of funding encourages companies to get involved. The general interest towards such activities gives the public sector regional development possibilities. A threat related to the investment potential is if the conditions to participate are too strict, for example the expected payback time for investment is relatively short so that the short-term outcome is prioritized over the medium-long-term strategies that might bring profit in the long run.

<p><u>Strengths</u></p> <p>Companies:</p> <ul style="list-style-type: none"> -to generate value from new process and products -take advantage of new opportunities <p>Public sector:</p> <ul style="list-style-type: none"> -many ways of giving finance -also other supporting instruments such as information tools <p>Investors and banks:</p> <ul style="list-style-type: none"> -same ways of funding companies in general apply also to IS 	<p><u>Weaknesses</u></p> <p>Companies:</p> <ul style="list-style-type: none"> -lack of information and knowledge -lack of understanding and interest - legislative, technical, economic, commercial (psychological barrier on the products of second uses) - expected payback time too short which might restrict the possibility to participate in IS projects <p>Public sector:</p> <ul style="list-style-type: none"> - no direct investment information <p>Investors and banks:</p> <ul style="list-style-type: none"> - no knowledge about IS and CE - no direct funding instruments for IS or CE
<p><u>Opportunities</u></p> <ul style="list-style-type: none"> - to increase knowledge <p>Companies:</p> <ul style="list-style-type: none"> -take advantage of new opportunities -to offer products with long life cycles, and products for cascade lifecycles <p>Public sector:</p> <ul style="list-style-type: none"> - raise public awareness in a bigger scale <p>Investors and banks:</p> <ul style="list-style-type: none"> - create specific funding instruments for IS and CE 	<p><u>Threats</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - the short-term outcome is prioritized rather than the medium-long-term strategies that need to be adopted when starting cooperation <p>Public sector:</p> <ul style="list-style-type: none"> - lack of activity regarding to IS and CE <p>Investors and banks:</p> <ul style="list-style-type: none"> - if the level of knowledge does not rise rapidly enough, situation might not change

Figure 11. SWOT analysis of the survey results from FUNDECYT

7.3 Andalusia Spain

The second Spanish partner is an Environment and Territory Regional Ministry operating regionally in Andalusia. The organisation is a public body organisation focused on general direction for environmental prevention and quality. Andalusia used the original format of the research questions. The target area of the survey was the whole Andalusia region with the aim to contact private and public organisations from all of the Andalusia provinces. Replies came mainly from Seville and Malaga

provinces, which are the two largest provinces in Andalusia. The questionnaire was sent to the stakeholders first in English and later on translated to Spanish because of the low level of answers. The assumption from Andalusia was that the stakeholders had difficulties understanding the aim of the questionnaire as many of them have very low experience related to EU-funded projects. This might be the reason Andalusia received only five answers all together from public (1 answer) and private (4 answers) organisations and failed to reach the target number of answers, see figure 12. Andalusia stated having difficulties in knowing how to address investors and banks so they ended up not approaching the investment sector at all.

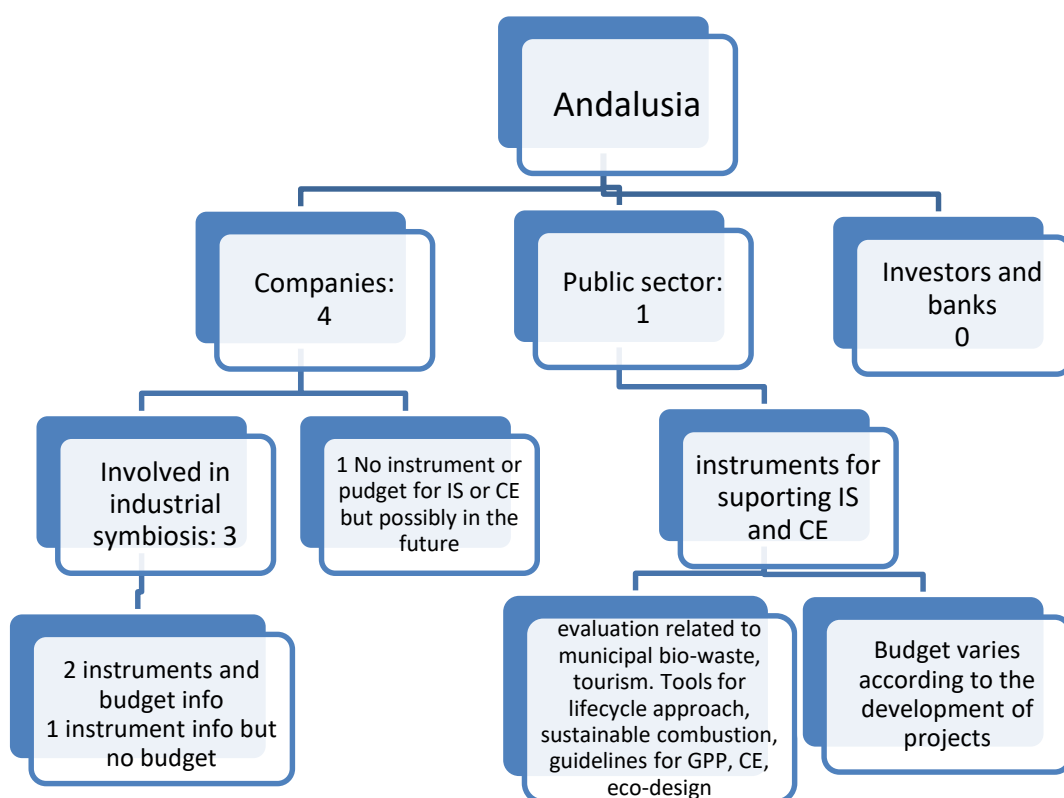


Figure 12. The distribution of the survey results in the three categories

7.3.1 Companies

The questionnaire was sent to 15 companies and four analysable answers were received (table 2). Three out of four companies were involved in an industrial symbiosis project and two of these invested in industrial symbioses:

- Company 1 provided investment information from three cases related to steel production and the reuse of ferrous slag. According to the company the investment, fixed and variable cost and

payback times for the three cases above, depends on the access to the market of the secondary raw materials (EAF Slag). The two fundamental variables are the investment cost that is higher or lower depending on the quality of aggregates to produce and the market price. Both are consequence of the legal status and the level of access to the markets of these secondary aggregates. The easier and simpler the access to the market, the more likely it reaches the natural aggregate market price. The company emphasizes that a strong and reliable legal framework is necessary to avoid technical and administrative barriers. However, barely the investment are not enough, it is also necessary to streamline the relations between companies facilitating the access of secondary raw materials to market having the same conditions as than natural resources. The three cases were:

1. Case: Investment of 600 000 euro with the payback time of 5,5 years. The case represents the ideal situation in which there is free market access for slags in equal conditions than natural aggregates. This kind of case where secondary materials have equal market conditions compared to virgin materials is rare in Spain.
 2. Case: Investment of 400 000 euro with the payback time of 2,2 years. The case represents an intermediate situation, when only 70 % of slag produced enters the market as a basic quality aggregate, still with waste status and thus at lower price. In this case and due to the difficulties and barriers, there is not any premium quality demand. This case is typical to the company and in Spain in general.
 3. Case: Investment of 0 euro with the payback time of 1,2 years. The case shows the situation in which the slag cannot freely enter the market, mainly due to bureaucratic difficulties and the lack of promotion of its use among consumers. Because of the administrative problems, ignorance or mistrust in such case it is common to acquire natural aggregates instead, even though the steel aggregates amply would meet the performance specifications. (Typical case in Spain).
- Company 2 has a budget for circular economy research and development of 10 million euros for 2016-2020.

One of the organisations has non-monetary ways of supporting industrial symbiosis and circular economy such as co-organizing a Circular Economy Day. The aim of the event was to analyse the creation and development of green companies and promote the access for research, funding, development and innovation projects for Andalusian firms. The event also strived to move forward innovation, competitiveness, in long run generate employment, and increase market opportunities.

7.3.2 Public sector

The questionnaire was sent to eight public sector organisations and one answer was received. The organisation had different tools to support the implementation of circular economy, in the rural, urban and industrial areas through various regional, national and European innovation projects. Budget varied according to the development of the projects.

7.3.3 SWOT analysis and conclusions

Andalusian partner's own conclusions about the low level of response is that it probably was too early in terms of SYMBI project development to expect higher participation from the stakeholders. Methodological documents were still being completed and no stakeholder meeting had yet taken place, so the stakeholders did not know that much about the project. Andalusia supposes they would get much better feedback if the questionnaire had been sent after the project had gained some recognisability. In addition, the fact that there is a general lack of awareness at all stakeholder levels affects the result.

The strengths that emerge from the survey results from companies were about the creating of value with new projects and awareness rising about funding possibilities through a campaign. From the Andalusian results, a main finding can be categorized as a weakness, threat or an opportunity depending on the current market demand, price and the legal status of the material. The access to the market and the market price determine the investment conditions when dealing with secondary raw materials. With public sector a weakness and a threat is the low level of response that comes across as low level of interest towards such projects. Opportunities and threats generally lie within the legal framework and level of technical and administrative barriers.

<p><u>Strengths</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - activities among CE and IS present - launch new ideas, services, and projects to obtain social and environmental value - other supporting instruments such as information tools and awareness raising through event organisation <p>Public sector:</p> <ul style="list-style-type: none"> - other supporting instruments such as information tools and awareness raising and evaluation services <p>Investors and banks:</p> <ul style="list-style-type: none"> - no information available 	<p><u>Weaknesses</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - the investment, fixed and variable cost and payback times depend on the access to the market of the secondary raw materials and their legal status - mistrust towards the secondary raw material among consumers - secondary raw material cannot compete equally with - bureaucratic difficulties in entering the market <p>Public sector:</p> <ul style="list-style-type: none"> - no direct investment information <p>Investors and banks:</p> <ul style="list-style-type: none"> - no information available
<p><u>Opportunities</u></p> <ul style="list-style-type: none"> - increase knowledge <p>Companies:</p> <ul style="list-style-type: none"> - the investment, fixed and variable cost and payback times depends on the access to the market of the secondary raw materials and their legal status - facilitate the access of secondary raw materials to market in the same conditions than natural resources <p>Public organisations:</p> <ul style="list-style-type: none"> - create a strong and reliable legal framework to avoid technical and administrative barriers <p>Investors and banks:</p> <ul style="list-style-type: none"> - no information available 	<p><u>Threats</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - technical and administrative barriers hinder investments <p>Public organisations:</p> <ul style="list-style-type: none"> - interest towards such projects appear to be low <p>Investors and banks:</p> <ul style="list-style-type: none"> - no information available

Figure 13. SWOT analysis of the survey results from Andalusia

7.4 Molise Italy

The Italian partner Chamber of Commerce (COC) of Molise Region is a public body organization supporting regional businesses. COC of Molise selected the stakeholders who were most interested in the project activities and approached them by sending the survey via email, as online

survey through phone interviews and through meeting one to one in the COC premises. Molise used the original format of research questions. The questionnaire was sent to the stakeholders in Italy and the received answers were translated into English. The coverage was selected from the Molise regional area. The total number of stakeholders approached was altogether from public, private and financial sector about 45 organisations. The ones thought to be the most reactive and interested in the project were selected to participate in the survey. Therefore, the results from COC of Molise represent the most active stakeholders in the fields of circular economy and industrial symbiosis. Most of the replies came from Isernia province, which is the smaller province of the two provinces in Molise region. The reason for receiving most answers from Isernia might result from the fact that there is a substantial number of small and medium-sized enterprises active in several fields of economy.

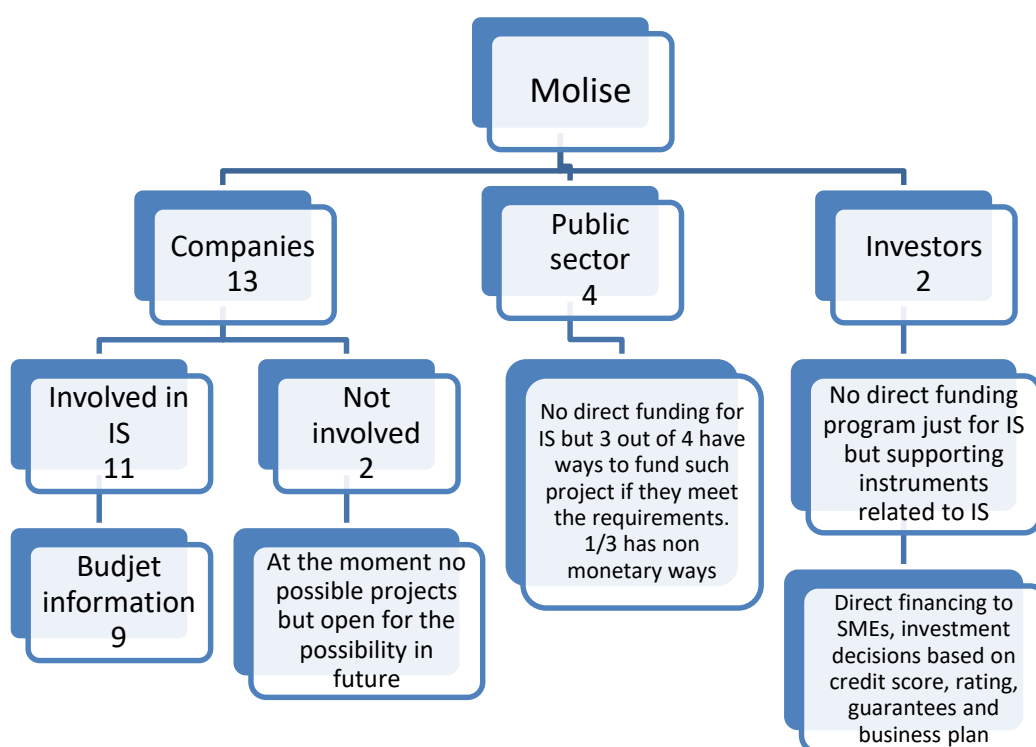


Figure 14. The distribution of the survey results in the three categories in the Molise region

7.4.1 Companies

COC of Molise received most answers from companies and managed to cross the target number of answers in this category. As figure 14 shows, most of the companies 11/13 were involved in industrial symbioses. The companies which were not involved in any industrial symbiosis at the moment were open for the possibility to invest in an industrial symbiosis process in case there was a rapid return on investment or information

available about the benefits or revenues of the invest, at least in broad outlines. Investment information from the companies from Molise region were:

- Sharing of secondary resources (bio- and technical materials): investment of approximately 1 % of the turnover within 3–5 years of ROI (return on investment).
- Providing biowaste materials: investments for industrial symbiosis amount of 200,000.00 euro and 350,000.00 euro to be achieved by 2017. The estimated ROI time is three years.
- Giving and receiving waste material (technical materials): annual average investment in euros: 7 / 800,000.00 with a 3-year ROI time.
- Company does apply Industrial Symbiosis in its process but does not invest in it.
- Not possible to quantify the size of investment as all our industrial activity is suited to maximize waste reduction.
- No specific investment dedicated to industrial symbiosis because all the company's production process is covered by the concept of industrial symbiosis.

Five of the respondents operated in the same innovative compost project where a group of companies collaborated in order to obtain a new product from the olive mill wastes. The objective of the project was to study a different way to recycle the production wastes. The project was arranged with the support of the public contribution of the Molise Region. The investments varied from 95.000 to 190.000 euros in three and a half years' time.

7.4.2 Public sector

COC of Molise received four answers from public sector organisations (Figure 14). None of the respondents had direct funding for industrial symbiosis projects but three out of the four had financial ways of supporting companies, especially in the field of innovations and technology. One of the respondents stated that even though the organisation is engaged in industrial symbiosis initiatives they are unable to allocate financial resources to companies. Instead, they had various non-monetary supporting tools such as information tools, like directing enterprises towards possible financing instruments, particularly at EU and national level.

The results from public body organisations show that the public sector has potential investment channels or at least the knowledge to guide enterprises to these channels. The reason that these channels are not yet utilized in the field of industrial symbiosis and circular economy may have to do with the lack of information and knowledge regarding these two aspects. According to COC of Molise, the survey results reflected the local economic situation, as the responds from public authorities were low.

7.4.3 Investors and banks

COC of Molise received two answers from investors and banks (Figure 14). One reply came from a national Italian bank and the other from a financing company offering services for local enterprises in the Molise region. The national bank stated that they do not have direct funding for industrial symbiosis or circular economy but they support companies that implement industrial symbiosis processes through direct funding to small and medium sized enterprises. The bank is also considering more direct funding instruments for industrial symbiosis and circular economy. However, it does not occur from the answer what kind of instruments these would be. The financing company has developed investment instruments related to industrial symbiosis for setting up business networks in which more operators from the same or different sectors can pool their resources to boost the economic gains and energy saving. The financial means to do so are loans, guarantees, financing the purchase of useful machines to the recovery and processing of waste products.

7.4.4 SWOT analysis and conclusions

According to COC of Molise, the survey results reflected the local economic situation as the responds from public authorities, banks and investors were low. The results from especially financial institutions reflected the lack of attention payed to circular economy at local and national level even though EU has been trying to promote circular economy as the only solution to waste reduction and reuse of by-products.

Based on the results of the survey, some chunks of data can be categorized under the four quadrants of SWOT analysis. One of the strengths was that the companies that had already invested in industrial symbioses had mainly positive experiences especially regarding cost decreases in waste disposal and through energy saving. New business actions, products and better control of supply chain were also drivers that the companies brought out. Also environmental aspects such as “industrial symbiosis leads automatically to respect towards environment” and smaller environmental impacts through reducing the amount of waste were mentioned. In addition, the companies that were not yet part of industrial symbiosis would be willing to invest if suitable opportunity arose. The companies emphasized that it is important to assure a clear aim within the companies participating in the industrial symbiosis. All the companies should be very motivated and committed in order to reach the objective.

The strengths from the public sector were that they possess many ways for funding. Even though no direct funding for companies exist, there are other ways to support actions in innovation and technology and to guide companies to find suitable financing. The only result from the survey

where investors had created a specific financing instrument to advance industrial symbiosis concerning cooperation was found from Molise.

The weaknesses and threats correlated with the lack of willingness to take risks. The general lack of expertise and information was also present in the results from Molise. If information never spreads the diffusion of industrial symbiosis and circular economy investments might happen too slowly.

<p>Strengths</p> <p>Companies:</p> <ul style="list-style-type: none"> - positive attitude towards financing IS projects (also) in the future - sharing of skills and processes - new business transaction and products - reducing of costs (esp. in waste disposal and energy saving) - better control of supply chain - smaller environmental impact (reducing amount of waste) <p>Public sector:</p> <ul style="list-style-type: none"> - many ways of giving finance especially in the field of innovations and new tech - other supporting instruments such as information tools <p>Investors and banks:</p> <ul style="list-style-type: none"> - direct funding instruments for advancing industrial symbiosis - same ways of funding companies in general apply also to IS 	<p>Weaknesses</p> <p>Companies:</p> <ul style="list-style-type: none"> - no willingness to invest unless there is certainty about revenue/benefits, return of investment which indicates to low level of willingness to take risks - lack of know-how - not enough recompensing to companies acting towards IS <p>Public sector:</p> <ul style="list-style-type: none"> - financing can only happen locally <p>Investors and banks:</p> <ul style="list-style-type: none"> - low level of knowledge about IS and CE - the direct funding instrument for IS is not called in this specific way
<p><u>Opportunities</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - the commitment of the companies participating, clear aims and strong motivation are the keys to success 	<p><u>Threats</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - routine activities can overwhelm the entrepreneurs - responsibilities are not clear which leads to lack of the promotion of the initiative - possible lack of motivation and direction

<p>Public sector, Investors and banks:</p> <ul style="list-style-type: none"> - by increasing knowledge and funding instruments the activity among the IS and CE increases 	<p>Public sector:</p> <ul style="list-style-type: none"> - the diffusion of information happens too slowly <p>Investors and banks:</p> <ul style="list-style-type: none"> - IS and CE related financing instruments are not promoted as such
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Figure 15. SWOT analysis of the survey results from Molise

7.5 Malopolska Poland

The Malopolska Region is a regional public authority (one of 16 in Poland). The Malopolska Region received four answers altogether, three from companies and one from public sector. Large enterprises that have the highest level of environmental awareness were the ones approached as they were thought to be the easiest. The principles for selecting the coverage was the existing business activities among energy sector, industrial symbiosis and large industrial establishments. The questionnaire was sent via email at the Malopolska region.

The Malopolska Region encountered difficulties in receiving a large number of answers from companies and institutions, and did not manage to reach the target number of answers. Furthermore, the Malopolska Region did not receive any answers from investors and banks (see figure 16). The reason for this might be the lack of knowledge about the idea of circular economy and industrial symbiosis. None of the companies and institutions responded every question so the questionnaire was only partially completed. According to Malopolska, an issue effecting the results might be that some companies may not realize that they are using industrial symbiosis in their facilities. On the other hand, it is difficult to receive an answer from companies, which are not involved in industrial symbiosis or circular economy. Moreover, according to Malopolska, many private organisations are not interested in answering any surveys and dedicating their time to activities that do not bring direct profits.

Another comment from the Malopolska Region concerns the national policy on investing in circular economy and industrial symbiosis projects. At the national and regional levels in Poland, there are no dedicated funds such projects. The only way is to combine other funds supporting environmental issues like the National and Regional Fund for Environmental Protection and Water Management.

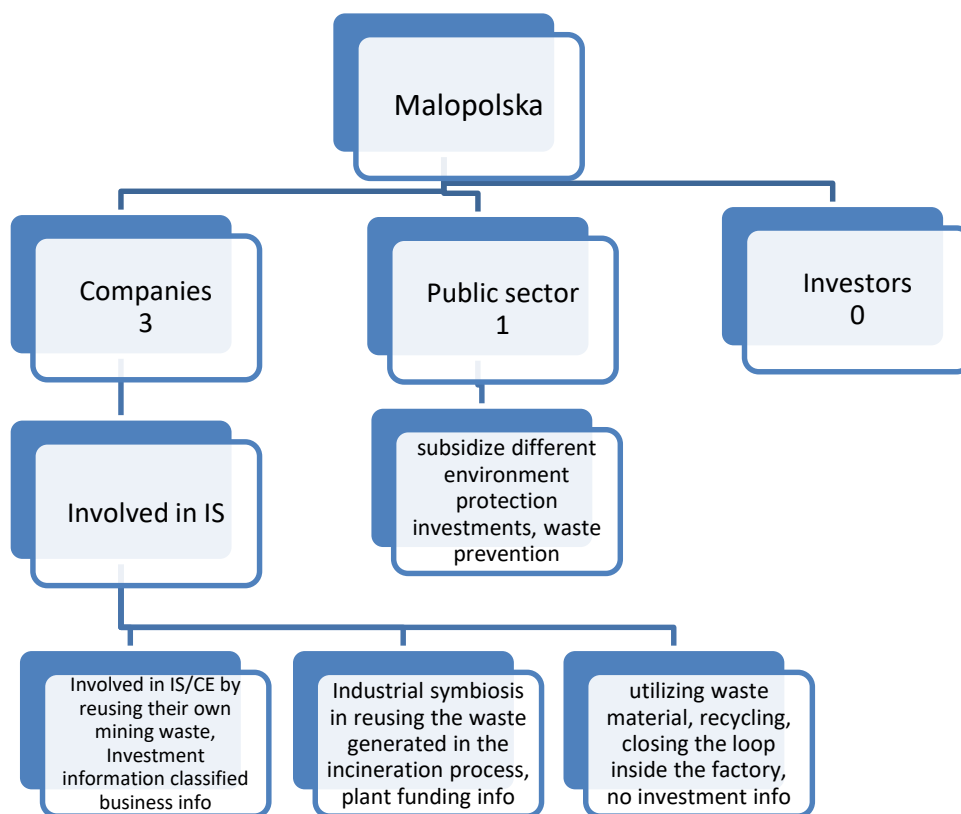


Figure 16. The distribution of the survey results in the three categories in the Malopolska region

7.5.1 Companies

The Malopolska region contacted 16 companies and received three answers, which all were analysable as can be seen from table 2 (page 15). All of the three companies are involved in industrial symbiosis and/or circular economy:

- Zinc and lead mining and metallurgy plant is involved in industrial symbiosis and circular economy by reusing its own mining waste. Investment information is classified as business information. Objective in participating in circular economy and industrial symbiosis is the maximum utilization of primary and secondary input material.
- Industrial symbiosis in reusing the waste generated in the incineration process in the waste incinerating plant –like bottom ashes are reused as a material for roads construction industry. Scarp is reused as an input material in iron industry. The reuse process consist also of electricity production and waste heat recovery for the municipal heating system purpose. One third of the total cost of the incineration plant was subsidized by the Cohesion Fund (EU fund for less developed countries).

- Circular economy through recycling and using paint waste to produce alternative fuel. Technical water recovery – closing the loop inside the factory. No investment information available.

7.5.2 Public sector

The Malopolska region contacted nine public sector organisations with the survey and received one answer (see table 2, page 15). The organisation is a regional fund which subsidizes different environment protection investments in order to contribute towards Environmental Protection Law. All measures, which could potentially limit the regional waste stream, are entitled to subsidize. The regional fund have also subsidised biogas plants which are able to produce electricity and thermal energy and mechanical and automatic municipal waste separation plants with alternative fuel production plants.

7.5.3 Investors and banks

The Malopolska region contacted one organisation from the category investors and banks but did not receive any answers (see figure 16, page 31). According to the Malopolska region, this might be due to the lack of knowledge about the idea of circular economy and industrial symbiosis or lack of interest to participate and dedicating their time to activities that do not bring direct profits.

7.5.4 SWOT analysis and conclusions

Based on the results of the survey, some chunks of data can be categorized under the four quadrants of SWOT analysis as shown in figure 17 (p. 33). A general strength is the utilization of EU funds and different environmental protection investments that can in some cases also capitalise industrial symbiosis and circular economy projects. The lack of knowledge is present also in the Malopolska region. In addition, a misunderstanding about industrial symbiosis as a concept arose from some results. In one case the company had not realised that industrial symbiosis are present in their operation and in another case the utilizing of companies own waste in a closed cycle was reported as industrial symbiosis when it in fact is not. However, the latter case does fall into the category of circular economy. A general weakness and a threat, if not fixed, is that there are no dedicated funds to subsidize this kind of projects at the national and regional levels in Poland.

<p><u>Strengths</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - utilization of cohesion Fund <p>Public sector:</p> <ul style="list-style-type: none"> - able to subsidize different environment protection investments <p>Investors and banks:</p> <p>(no information received)</p>	<p><u>Weaknesses</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - lack of knowledge about the idea of circular economy and industrial symbiosis - administration regulations - lack of supporting mechanism for large enterprises -no direct investment information <p>Public sector:</p> <ul style="list-style-type: none"> -no direct investment information - lack of knowledge about the idea of circular economy and industrial symbiosis <p>Investors and banks:</p> <p>(no information received)</p>
<p><u>Opportunities</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - maximum utilization of primary and secondary input material <p>Public sector:</p> <ul style="list-style-type: none"> - create national and / or regional fund to encourage such activities <p>Investors and banks:</p> <p>(no information received)</p>	<p><u>Threats</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - some companies might not realize that they are using industrial symbiosis in their facilities <p>Public organisations:</p> <ul style="list-style-type: none"> - lack of activity regarding to IS and CE <p>Investors and banks: (no survey data received)</p> <ul style="list-style-type: none"> - lack of knowledge about IS and CE or lack of interest

Figure 17. SWOT analysis of the survey results from Malopolska

7.6 Kozani Greece

The Greek SYMBI partner is the Municipality of Kozani, a local public development and planning bureau. The organisations approached with the survey were the main stakeholders for Municipality of Kozani for the SYMBI project. The coverage area was the Municipality of Kozani and West Macedonia region. The survey was sent to the stakeholders via email. Kozani used the original format of research questions. Kozani did not manage to reach the target number of answers in the three categories. One organisation from the investment sector was approached but no

answer was received (see figure 18). According to Kozani industrial symbiosis and circular economy concepts are very new in Greece. This makes it difficult to find stakeholders who understand the meaning of the concepts and would provide accurate answers. Accordingly, any SWOT analysis could not have been done from the survey results of Kozani.

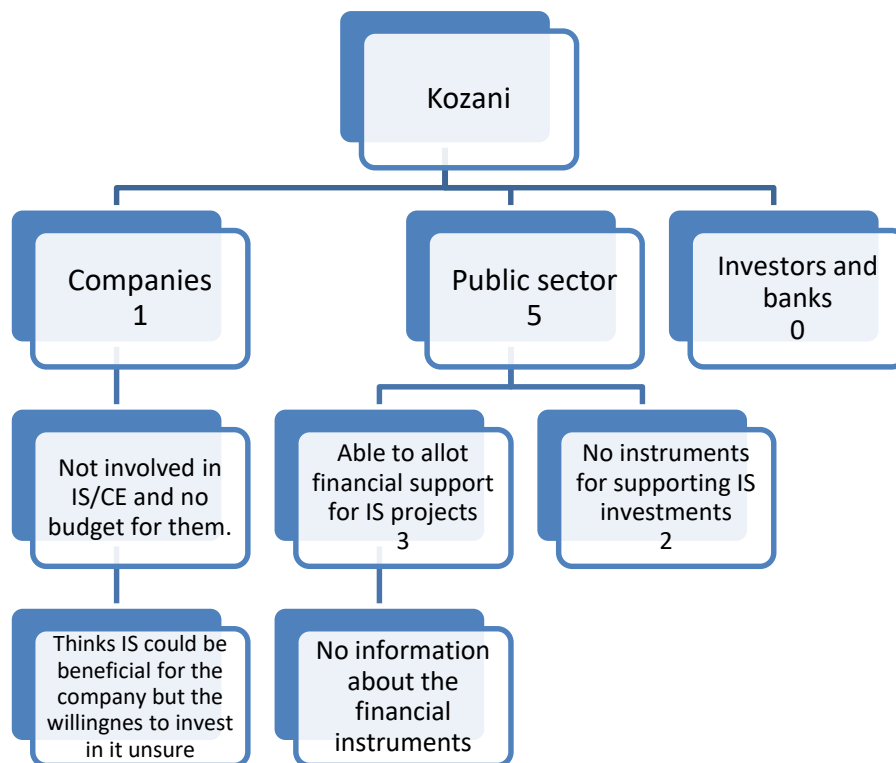


Figure 18. The distribution of the survey results in the three categories

7.6.1 Companies

The municipalities of Kozani sent the survey to two companies and received one answer (Figure 18). The company in question is a waste management company, which is not involved in industrial symbiosis project and does not invest in it. However, the company thinks that the participation in such projects could be beneficial in the future.

7.6.2 Public sector

The municipalities of Kozani sent the survey to five public sector organisations and received answers from all of them, as shown in figure 18. Two of the organisations were not involved or did not have budgets or instruments for supporting industrial symbiosis or circular economy. Rest of the organisations were able to allot financial support to companies in creating industrial symbioses. The question which kind of support that would be was left unanswered. The public body organisation were:

- a development agency

- a centre for research and technology
- a regional public body.

7.7 SVRK Slovenia

Slovenian Government Office for Development and European Cohesion Policy (SVRK) is a national public authority focused on development policies. SVRK is the only SYMBI partner that operates nationally which explains the largest number of answers received among the SYMBI partners. The survey was sent to stakeholders from all 12 Slovenian statistical regions. SVRK elaborated the original format of research questions and added extra questions to get more accurate information (appendix 2) thus also the more specific and informative observations of the Slovenian results. The questionnaire was sent via online survey and it was publicly available on SVRK's website. The target number of answers was achieved with companies and public sector but not with investors and banks (Figure 19).

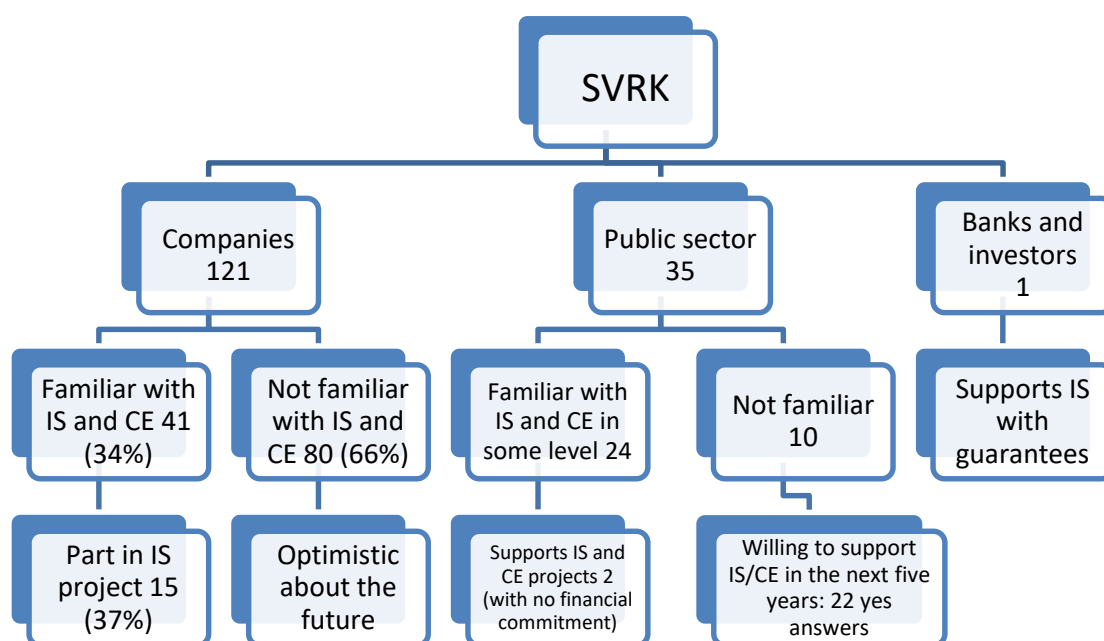


Figure 19. The distribution of the survey results in the three categories

7.7.1 Companies

The questionnaire was sent directly to over 2.000 recipients (i.e. companies) in all Slovenian statistical regions. The information was also sent via numerous other channels, such as chamber of commerce and regional development agencies, asking the companies to further disseminate the information about the survey. The results and feedback

show that the majority of the surveys were collected around three major Slovenian cities, namely Ljubljana (corresponding to “Osrednjeslovenska” region), Maribor (corresponding to “Podravska”) and Celje (corresponding to “Savinjska” region). Results also confirm the balanced distribution of answers around the regions.

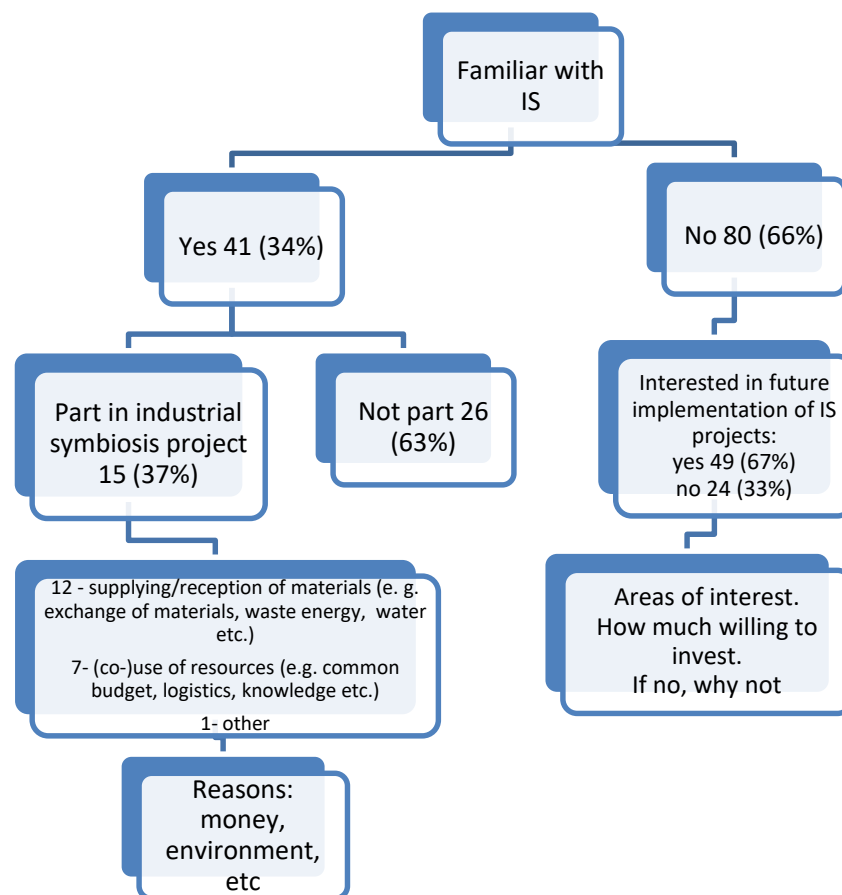


Figure 20. The distribution of the survey results from the companies

Most of the companies (66 %) SVKR received feedback from, were not familiar with the concept of industrial symbiosis (Figure 20). The Slovenian survey entailed a paragraph where industrial symbiosis was explained to the recipients. The introduction followed by a question about now that they were informed of the concept do they think that the implementation of such projects would be beneficial for the company and would they be willing to support it, 49 opted yes and 24 no. Most (67 %) of the companies would be willing to support projects related to industrial symbiosis. SVKR assumed that the results show that with more promotion activities and incentives, companies would be willing to support such projects. The areas the companies stated to be interested in were (multiple answers were possible):

- 29 answers: supplying/reception of materials (e.g. exchange of materials, waste energy, water etc.)

- 27 answers: (co-)use of resources (e.g. common budget, logistics, knowledge etc.)
- 4 answers: “other”, such as:
 - Common procurement.
 - Our activity is consultancy and planning.
 - Information and technological infrastructure.
 - Use of knowledge in new projects.

The results show that companies interests are equally distributed between the two categories of the type of symbiosis, which can lead to a conclusion that industrial symbiosis should be equally developing and promoting all relevant areas. The amount of money the companies would be willing to invest in industrial symbiosis projects was divided to three categories:

1. Numerical, ranging from 1.000 euro to 25.000 euro.
2. Percentages, ranging from 0, 5 % to 10 %.
3. Depends on projects and its budget.

The companies which stated that even when informed about industrial symbiosis, the implementation of such projects would not be beneficial for the company and therefore would not be willing to support it, gave multiple reasons for it. The most common reason was the experience that the nature of the organisation is not suitable for such projects:

- We are dealing with different activity.
- We are service sector, no such options.
- We do not produce anything like this.
- We do not have similar products.
- Our products are made out of our factory.
- We recycle the metal that we produce.
- No economy of scale.
- Lack of information about the topic, Slovenian cooperation culture is low.
- We do not see cooperation possibilities in our case.
- We do not have appropriate waste.
- We use most of our waste and side products.
- We have very few waste or side products (1 family basket per week).
- We are not ready as society for such synergies.
- We doubt that our incoming materials are waste of another industry.

From the 41 companies that were familiar with the concept of industrial symbiosis, 15 (34 %) were also part of an industrial symbiosis project, as figure 20 on page 36 shows. The financing of these projects was from different EU financial mechanisms. The area of industrial symbiosis the projects represented was mostly about supplying and/or receiving materials, (multiple answers were possible as some companies were dealing with many symbioses):

- 12 answers: supplying/reception of materials (e.g. exchange of materials, waste energy, water)

- 7 answers: (co-)use of resources (e.g. common budget, logistics, knowledge)
- 1 answer: benefiting synergies and development of new products.

One of the additional questions targeted the reason for participating in industrial symbiosis project. The most common reasons were cost decreases throughout closing the material loop and waste management.

- Optimal development of science, economy and society, inclusion and diversity.
- Waste management, cost decrease and cooperation.
- Closing the material lifecycle, looking for new opportunities and development of new value chain.
- Reducing deposited metallurgical waste.
- Recycling and circular economy are economic and environmental need and the only alternative of regional development.
- Cause we are interested in circular economy.
- Better use of biomass.
- New knowledge, mutual exchange of knowledge with the aim to develop new products.
- Legislation and awareness to protect the environment.
- Reducing different types of costs.

The obstacles the companies reported to have faced when implementing these projects had in most cases to do with problem in forming a partnership with other companies. In addition, obstacles related to human and public body resources and prevalent price level were notable. All the received answers:

- Incomprehension of less developed partners that do not see the benefit.
- Partner search, lack of trust and knowledge about potentials.
- Not enough use of secondary materials in civil engineering
- Incomprehension of companies.
- Government's poor reaction to needs in economy.
- Human resources are overloaded.
- High costs of recycling, transport and destruction of goods.
- Logistical problems.

The companies were also asked about the amount of money they have invested in industrial symbiosis projects in the past five years (in euro). Six numerical answers were received. Many answers were "Do not know". When asked about the average period of redemption of investment with these projects, only two numerical answers were received, one stating two years, second stating five years. In addition, there were two answers where companies could not estimate the period. When asked about the plan to invest in industrial symbiosis projects also in the coming five years, only nine answers were received but all of them were positive. The amount of money the companies planned to invest in industrial symbiosis projects

in the next five years varied from 10.000 to 250.000 euro. In some cases, investments depend on legislation and incentives for bioeconomy.

From the 41 companies that stated to be familiar with industrial symbiosis as a concept, 26 were not part of such project at the moment. The reasons for not being part of industrial symbiosis correlated with the lack of information and knowledge about such projects and because the nature of the organisation does not provide opportunities to join such projects:

- Nature of the organization.
- No real opportunity in the past, with our activity, we do not produce much waste.
- Due to typology of work, we do not produce side products (waste).
- We are understaffed.
- We sell the waste (as a side product) to China through the preponderant of the company.
- I hear for that for the first time.
- We have not received the offer.
- We have no other side products but the metal, which we reuse in our company.
- We have not detected the need.
- We are not informed about this project.
- Due to overwork, we cannot manage this.
- We do not know the project.
- Lack of information.
- Still in a decision making process.
- We have just been informed about it.
- We use the side products to heat the rooms.
- We have no conditions for this.
- We are currently working on other projects.

7.7.2 Public sector

SVRK targeted and addressed the public sector in all Slovenian statistical regions. Majority of respondents came from two (south)eastern regions (i.e. Pomurska and Jugovzhodna) which are considered less developed in comparison to central and west regions. SVRK assumes that there is a higher interest in these less developed regions to find new potentials for growth and development, therefore public sector in these regions are more inclined to new concepts and ideas. In total, the survey was sent directly to 250 recipients and 141 answers were received, out of which 35 were analysable.

Most of the public sector organisations were partially familiar with the concepts of industrial symbiosis and circular economy. However, the answers show that a small proportion of public institutions are fully familiar with the concepts (see figure 21 on the following page). There is

thus a room for information and dissemination activities in order to equip them with the necessary knowledge about these two concepts.

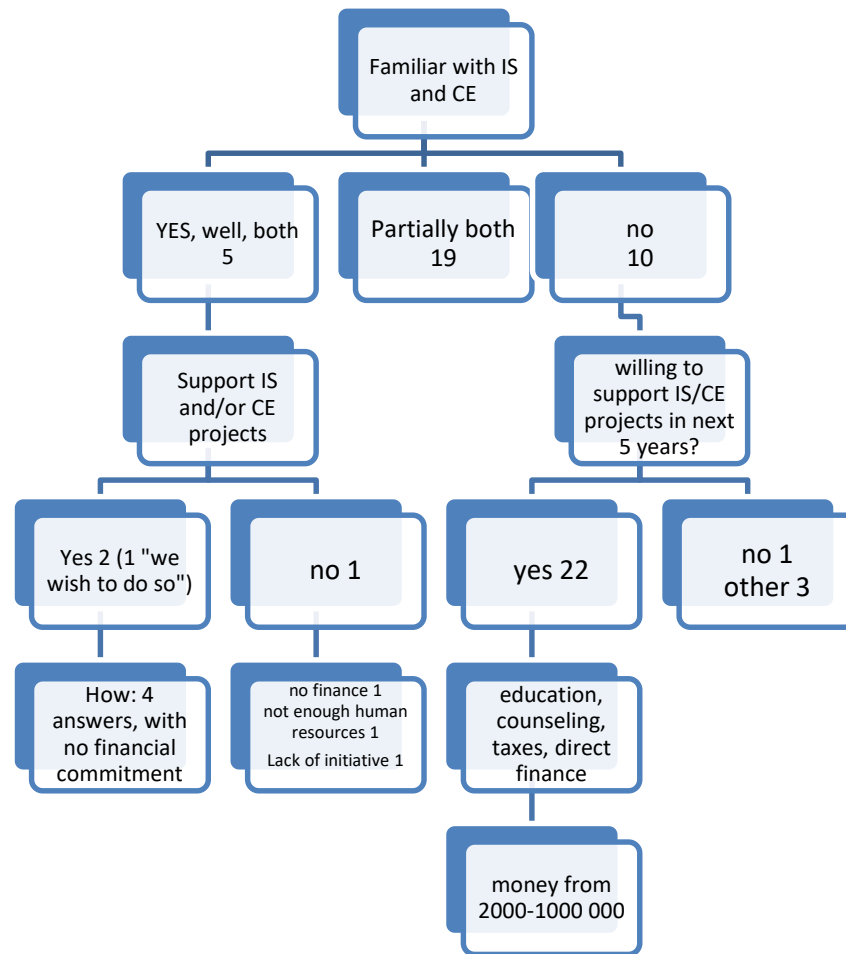


Figure 21. The distribution of the survey results from public sector

From the public sector organisations that were familiar with the concepts of industrial symbiosis and circular economy, only four answered the questions about supporting such projects. Two opted “yes”, one “no” and one “other”, meaning that they wish to do so in the future (see figure 21). The way the public sector respondents stated to support such projects were all related to non-financial commitment:

- Education / training and information activities (2 answers).
- Setting up standards (1 answer).
- Supportive environment / counselling (1 answer).

Public sector organisations were to list the key criteria, based on which they decide to allocate the support and only one answer was received: maturity of companies, their understanding, sample group and representation of different areas, company size, sharing and accepting values, recognition of added value in this field. Only one answer was received for the next three questions related to the investment information:

1. How much money you have allocated on yearly basis for this type of projects in the past five years: 15.000 euro
2. Will you continue supporting projects in circular economy and / or industrial symbiosis also in the coming five years?: Yes
3. How much money will you allocate for this area in the next five years (or next year if you cannot state the mid-term plans?): 100.000 euro in year 2017

The public sector organisations stated reasons for not supporting projects related to circular economy and industrial symbiosis as “we do not have financial resources available, we do not have enough human resources, lack of initiative in private sector”. However, most of the public body organisations that opted being only partially or not at all familiar with the two concepts were positive about the future as 22/29 would be willing to support such projects in the next five years. Only one stated not to be willing to support such projects, as they believed that municipality does not have competences. In addition, three “other” answers was received:

- Maybe
- We cannot influence on a decision, but we can suggest to the management to secure the financial resources in the budget, where the budget needs to be approved by the Municipality's council.
- Is financial support of local communities allowed and is this kind of financing foreseen in the system for financing the municipalities?

The type of projects the public organisations would be willing to support in the next five years were (multiple answers were possible):

- Education / training and information activities (15 answers)
- Supportive environment/counselling (11 answers)
- Remission of paying taxes/other contributions (8 answers)
- Direct financial support to companies (7 answers)
- Tax relief (5 answers)
- Setting up standards (2 answers).

The amount of money the organisations stated to be willing to invest in the next five years varied from 2.000 to 1.000.000 euro. Descriptive answers such as “don’t know, depends on the possibility of cooperation, work of employees” were also provided.

The amount of answers was so low that the results only represent the situation in the few organisations that provided the answers and cannot be generalised to represent the whole group. However, some conclusions can be drawn concerning the lack of activity. The low level of answers can reflect the low level of information and participation in such projects and the fact that public sector organisations rarely ensure financial-related benefits to projects on circular economy and industrial symbiosis.

7.7.3 Investors and banks

SVRK received 31 answers from investors and banks (as shown in table 2, p. 15), out of which only two were valid and only one questionnaire was complete. SVRK approached the stakeholders also via phone calls to encourage them to fill in the questionnaire but they were unwilling to participate, which shows that the interest among the potential investors is relatively low/non existing. The company that completed the survey was familiar with industrial symbiosis and circular economy and was part of such projects. The instruments used to support the projects were guarantees and favourable loans. The criteria used when deciding which projects to support was stated to be “the company’s own criteria”. The company also plans to support circular economy and industrial symbiosis projects in the next five years.

7.7.4 SWOT analysis and conclusions

Based on the results of the survey, some chunks of data can be categorized under the four quadrants of SWOT analysis as shown in figure 22. Strengths represent the aspects that have a positive impact on investment potential that emerge from the answers and are already present within the organisation and its operation. Weaknesses are the negative aspects that hinder the investment potential within the organisation. Opportunities and threats come from the outside and are affected by the current and general national and regional situation.

From the Slovenian answers, a strong interest towards industrial symbiosis and circular economy projects is notable. According to SVRK based on additional observations and particularly in-person conversations, a vibrant interest among stakeholders to take part in similar projects was present, since they are recognizing the importance and potential of circular economy and industrial symbiosis. Moreover, projects are seen as a solid basis for networking and getting in touch with relevant stakeholders.

<p><u>Strengths</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - many different EU financial mechanisms utilized - closing the material lifecycle, looking for new opportunities and development of new value chain and products - recycling and circular economy serve the economic and environmental need 	<p><u>Weaknesses</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - lack of knowledge about the concepts of IS and CE - partner search, lack of trust, equality and knowledge about potentials - government's poor reaction to needs in economy - human resources are overloaded
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<ul style="list-style-type: none"> - cooperation and the exchange of knowledge - legislation and awareness to protect the environment - reducing different types of costs, especially in waste management - reduction of waste and better use of resources <p>Public sector:</p> <ul style="list-style-type: none"> -also non-monetary ways of supporting IS <p>Investors and banks:</p> <ul style="list-style-type: none"> - IS and CE as concepts are familiar - already support projects in the field of IS and CE - some traditional banking instruments are suitable for supporting industrial symbiosis and circular economy (such as guarantees and favourable loans) 	<ul style="list-style-type: none"> - high costs of recycling, transport and destruction of goods - logistic problems (geographical dispersion of companies) <p>Public sector:</p> <ul style="list-style-type: none"> - a small proportion of public institutions are fully familiar with the concept of CE and IS - assumption is that public entities do not or rarely ensure the financial-related support to projects on circular economy and industrial symbiosis - lack of initiative in private sector - lack of capability affect the budget -organizational believe that municipality does not have competences - lack of finance <p>Investors and banks:</p> <ul style="list-style-type: none"> - the interest among the potential investors is relatively low/non existing
<p><u>Opportunities</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - plans to invest in IS projects in the next five years - investment depends on legislation and incentives for different areas (e.g. bioeconomy) <p>Public sector:</p> <ul style="list-style-type: none"> - willingness to support IS in the future is present <p>Investors and banks:</p> <ul style="list-style-type: none"> - the plan is to support IS and CE projects in the next five years 	<p><u>Threats</u></p> <p>Not enough knowledge about the advantages and concept of IS and CE</p> <p>Companies:</p> <ul style="list-style-type: none"> - investment depends on legislation and incentives for different areas (e.g. bioeconomy) <p>Public sector:</p> <ul style="list-style-type: none"> - willingness to support is minor <p>Investors and banks:</p> <ul style="list-style-type: none"> - the interest among the potential investors is relatively low/non existing

Figure 22. SWOT analysis of the survey results from SVRK, Slovenia

7.8 HAMK Finland

Häme University of Applied Sciences (HAMK) is a higher education organisation operating in the Häme region. HAMK is a public education and research institution. HAMK used the original format of the survey when approaching the stakeholders. The stakeholders were approached via email that entailed a link to an online survey. HAMK managed to reach the target number of answers in all of the three categories as shown in the following figure 23.

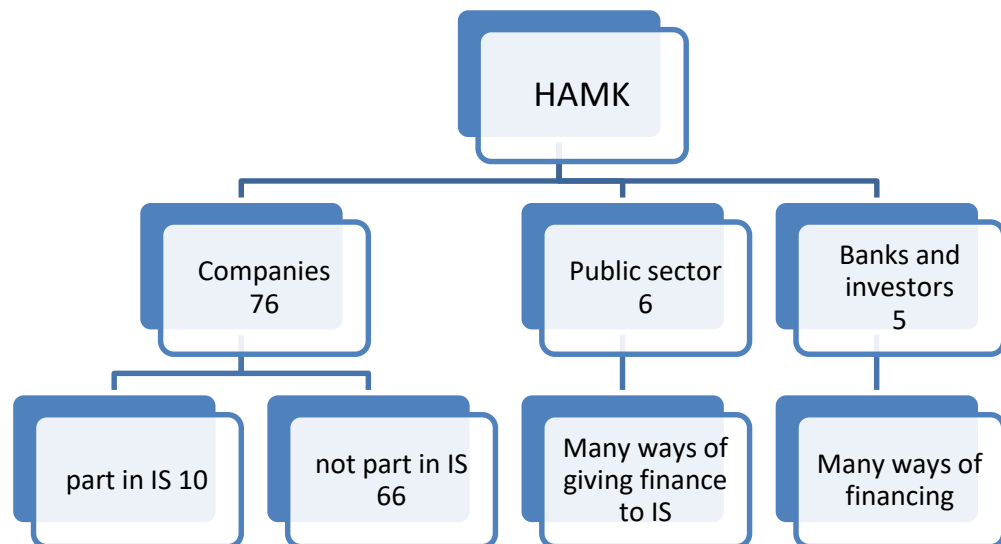


Figure 23. The distribution of the survey results in the three categories from Häme region

7.8.1 Companies

The survey was sent to 3067 companies from which 76 analysable answers was received (see table 2, p. 15). The first mailing was as an attachment of The Federation of Finnish Enterprises (Häme region) newsletter. Because of the low number of answers, the link to the survey was sent again to more specific group of companies (the exact extent of the delivery is not documented). From the analysable answers, 20 represented companies from service sector and therefore were excluded from analysis as SYMBI is focused on material industrial symbiosis only. From the companies that participated the survey, 10 were involved in industrial symbiosis projects, however also four of these reported symbiosis were service related. The investment information related to the current industrial symbiosis projects varied from 0 to 15,3 M euro and the estimated payback time for the investment varied from three months to 10 years. The industrial symbiosis projects were about:

- We give steel chip and scrap to scrapyards for free or for minimum price. Can subcontracting chain be called as industrial symbiosis? We consider that as normal business activity.
- Receiving recycled raw material.
- Procurement of new research equipment.
- Giving
- Reclaiming and reprocessing of others waste and side products as raw material or energy
- Our sport centre has a room for a gym instructor. The instructor is using the room only few evenings a week. We started to rent the room also for two massage therapists at times when the gym instructor is not using the room.

The results show that some of the companies did not fully understand what industrial symbiosis is about and described typical transactions between companies or did not know that they were actually already involved in industrial symbiosis. None of the companies was involved in specific industrial symbiosis projects. Within the survey, the first symbiosis about sharing working premises was reported.

The companies were asked about the objectives, obstacles or drivers involved in industrial symbiosis according to their experience. Obstacles reported, were about the difficulties related to problems in cooperation and then again, objectives and drivers were about the extra value that cooperation brings:

- Jealousy / envy. (obstacle)
- Combining complementary technologies. Cooperation of companies. Producing more comprehensive services to customers. (Growth. Competitiveness.) (objectives, drivers)
- Profitability of SMEs (objective)
- The problem is that you are “married” to another company if you cannot pay the loan in time. (obstacle)
- Objectives are to be carried out the work performance from the subscriber to the highest quality. Obstacles: none so far.
- Stiffness in municipal sector concerning work carried out subcontracting. (obstacles)
- Economic indicators. (drivers)

The 66 companies that were not involved in industrial symbiosis (Figure 23 and 24) were asked if they thought industrial symbiosis could be beneficial for their company and what the symbiosis would consist of: giving/receiving materials or utilizing/sharing other resources. The amount of answers received was 34, but only nine were relevant. Most of them dealt with giving waste and left over materials:

- At times we have left over newspapers and other prints, volume varies from few hundred to a couple of thousand.
- Recycling waste and food loss/spoilage to e.g. energy. Giving spoilage products to reuse. Packing material could be reused/recycled.

- We are interested for example sharing machine resources.
- Recyclable furniture.
- Hard metal waste.
- Sharing of materials coming from building/demolition could be possible
- Wood, metal.
- Straw, vegetable waste.
- We are producing wood-based waste that we cannot use our self for example in heating.

When asked about the willingness to invest in industrial symbiosis (euro and or the percentage of revenue) and about the expected time for pay back the amount of answers was 31, from which 11 were willing to invest:

- 1 % of revenue
- We are willing to invest, if the time for payback is one or two years and the investment can be utilized for long time
- 3 % of revenue, 2 years payback period
- 5 % of revenue, 3 years payback period
- yes, hard to say in euros, but good idea pays to be involved, 5 years payback period
- 1000 euro, 6 months
- Depending on a project, we can be involved in gathering private investment capital for building IS. Capital input can be 20-20000 euro, 5-8 % interest rate, for 3—5 years and input corresponding holding in symbiosis during the investment.
- 20 % of revenue
- Yes, from my own work contribution.
- Max. 1000-1500 euro/year and payment should be in several part payment. Provided that investment will be profitable.
- 1000 euro/year.

The objectives, obstacles and drivers among the companies who had not been involved in industrial symbiosis were mostly about the lack of knowledge and understanding related to the subject in general. All together 27 answers were received:

- Lack of knowledge, fear of competition.
- Lack of knowledge, lack of vision, lack of partners.
- Objectives are high. Obstacles are legislation and expensive investment costs.
- What means IS or driver? I have experience but I do not understand the terms used.
- Financing, coordination, time management.
- Symbiosis traditionally need a leading company strong enough (motivated and persistent) and partner companies with similar attitude. Often the problem is to find suitable partners that find it beneficial to be involved in symbiosis. Effective drivers are common vision of the development path that includes also economical aims and indicators for all parties and actions.
- Obstacles are perhaps in locked attitude and lack of creative thinking.

- Lack of knowledge and networks.
- The whole idea of IS is unfamiliar. Need for information about IS and possibilities for small business. More networking with other entrepreneurs touching my subject field.
- Obstacles are lack of cooperation and finding a common will. Cooperation does not work unless everyone feels equal.

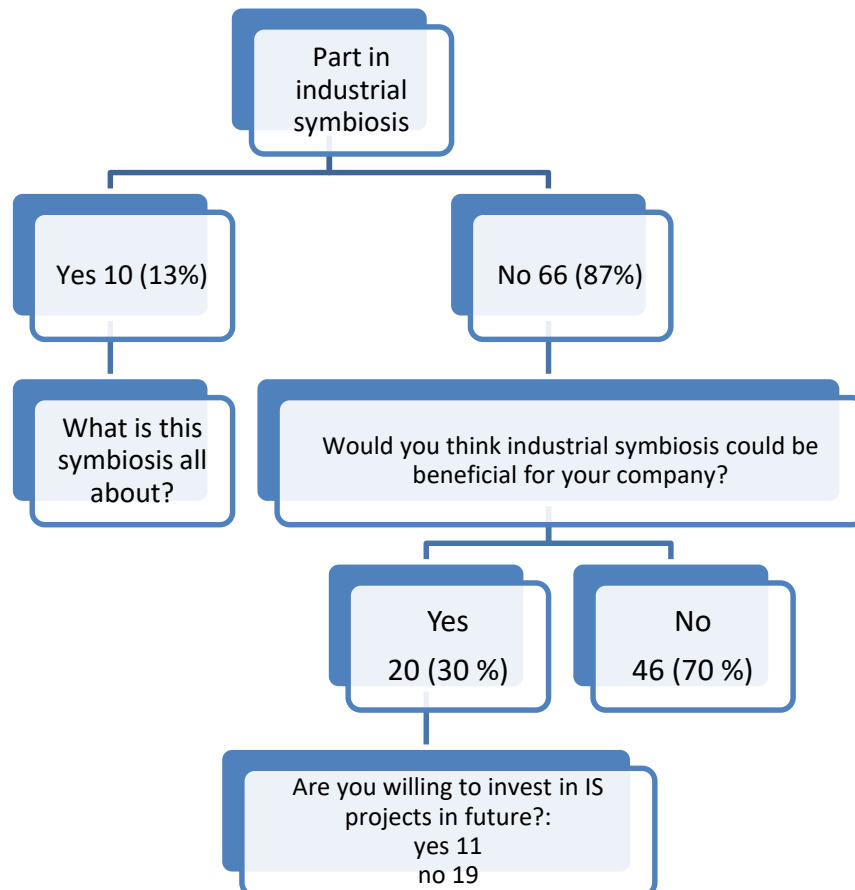


Figure 24. The distribution of the survey results from companies from Häme region

7.8.2 Public sector

As table 2 on page 15 shows, the survey was sent to 19 public sector organisations and six answers was received. Three of the respondents were municipal, one regional and two national organisations. Three of the public body organisations stated not being able to allot financial support for companies in creating industrial symbiosis and three stated having some ways of financing such projects:

- Allowance can be granted for investment that encourages export activity assuming that actions are commercially profitable. Allowance cannot be granted to business group or consortium.

- We have allot financial support for building up and coordinating FISS (Finnish Industrial Symbiosis System) operations model in several years as part of Motiva Ltd. Environmental ministry is also involved in FISU network (resource wise municipalities).
- We have a possibility to attend with municipal funding for actions that support municipal or region. Targeting of funding is not precisely defined.

The public sector also has many other ways of supporting companies in their activities among circular economy and/or industrial symbiosis investments:

- Business development services such as business analysis and consulting.
- We are active in promoting CE development in Riihimäki municipality with several measures. We offer suitable building sites, promote cooperation between municipal workshops and recycling centre and other actors (e.g. Ekokem, Pari-Materia, Suomen Kelapalautus, Salvation Army). We are searching for new complementary businesses to our CE network.
- Waste and environmental legislation, special funding for development and pilot projects.
- Funding of different development projects (no funding for companies).
- Expertise that can be used in common projects. Experience on applying funding. Experience in facilitation (e.g. HINKU project, The Carbon Neutral Municipalities project).
- Most relevant way of support relates to utilizing of different networks (regional, national and international). Option to reflect actions through different peer actors.

The public sector has several ways of giving finance to companies that bring profit to the region. In addition, many other ways of supporting companies in finding investment are present in the Häme region.

7.8.3 Investors and banks

The survey was sent to 18 investors and banks and five answers were received. Two of the respondents stated not having financing instruments to support industrial symbiosis and circular economy. Three of the organisations reported some traditional banking instruments that are particularly tailored for SME enterprises:

- Angel investments for start-up companies, especially on food industry
- In principle, all parties apply funding themselves. For example, Business Finland (the Finnish Funding Agency for Innovation) has funding for group projects. In addition, project-financing models can be suitable.
- Each credit decision is done considering company applying for funding, project, collateral available and financing in question. In

this way, also the best financing product is selected. The financing tool can be IOU financing, limit loan, investment or working capital loan, warranty or the combination of these.

7.8.4 SWOT analysis and conclusions

In general, especially the survey results from companies showed a lack of knowledge towards industrial symbiosis. Many companies operating in the field of services took part in the survey, which might distort the result, as they do not belong to the target group of the survey nor the project. In the Häme region, the organisations were sceptical towards the idea of starting cooperation with other companies and organisations. A fear of the operation being unequal and not finding a common will were present in the answers. In addition, the legislative obstacles and expensive investment costs were mentioned in several answers.

The public sector in Häme region seemed to be familiar with the two concepts, and in many cases is able to support CE and IS projects in some ways. However, none of the public sector organisations mentioned any budget information related to such projects. It seems that the role of public sector in supporting CE and IS mainly focuses on non-financing ways such as promoting and guiding. The funding from public sector seem to large extent be funding of projects.

Also in Finland, the financing sector can support CE and IS projects only by traditional banking instruments. Business Finland (the Finnish Funding Agency for Innovation) has funding for group projects, which is an important feature in funding industrial symbiosis between different companies.

<u>Strengths</u>	<u>Weaknesses</u>
<p>Companies:</p> <ul style="list-style-type: none"> - cooperation <p>Public sector:</p> <ul style="list-style-type: none"> - allowance can be granted for investment that encourages export activity assuming that actions are commercially profitable - also other ways of supporting companies in development among IS 	<p>Companies:</p> <ul style="list-style-type: none"> - lack of knowledge and networks - fear of competition - lack of partners and leaders - legislative obstacles and expensive investment costs - financing, coordination, time management (lack of vision) - locked attitude and lack of creative thinking

<p>and CE: business development services such as business analysis and consulting</p> <p>Investors and banks:</p> <ul style="list-style-type: none"> - many instruments for supporting IS and CE: angel investments for start-up companies, especially on food industry and funding for group projects 	<ul style="list-style-type: none"> - lack of cooperation and finding a common will, fear of inequality <p>Public sector:</p> <ul style="list-style-type: none"> - allowance cannot be granted to business group or consortium. <p>Investors and banks:</p> <ul style="list-style-type: none"> - no specific funding instruments for IS and CE - many companies have no instruments for supporting IS and CE
<p><u>Opportunities</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - interest and unutilized resources available <p>Public sector:</p> <ul style="list-style-type: none"> - rise awareness <p>Investors and banks:</p> <ul style="list-style-type: none"> - further develop funding instruments in amount and quality 	<p><u>Threats</u></p> <p>Companies:</p> <ul style="list-style-type: none"> - the term “symbiosis” is too difficult to comprehend - the fear of losing independency prevents the start of cooperation <p>Public sector:</p> <ul style="list-style-type: none"> - funding is too short term and not available for companies <p>Investors and banks:</p> <ul style="list-style-type: none"> - lack of interest prevents the development of funding instruments for IS and CE

Figure 25. SWOT analysis of the survey results from HAMK, Finland

8 CONCLUSIONS AND OUTLINE OF THE SURVEY RESULTS

Many of the partner-specific survey results entailed similarities. A common SWOT analysis can be made to summarise the results of the survey. The main critique that SWOT analysis faces is about it being too simple, just a “laundry list” put together under each of the four headings. SWOT indicates the aspects that affect the analysed matter from inside and out but does not tell what to do next and how exactly the outcome of this analysis can help the analyst in its development. For this purpose, an 8-fold SWOT has been created. The 8-fold matrix has four quadrants for the listing of strengths, weaknesses, opportunities and threats and in addition

to this, there are four quadrants for the actions that should be made based on the results. The 8-fold SWOT analysis can be found from the following page, figure 26.

In most of the cases reported in the survey, the industrial symbiosis is about the exchange of materials and especially waste. The variation between whether the material is biological or technical is distributed quite evenly. The reported investment information varied from zero to millions of euros with the payback time of one and a half years to ten years. The most common investment information varied from 10.000 to 500.000 euros with the payback time of 2-5 years. Different EU-financing mechanisms play a fundamental role in funding industrial symbiosis and circular economy projects in many of the partner countries.

Most of the results of the survey came from companies. A strong willingness to participate to such projects is notable even though the lack of knowledge is still hindering the activity. Results show that many companies invest in industrial symbiosis at the SYMBI partners' region especially in the field of sharing secondary resources. Based on the survey results, public body organisations can give finance to companies in certain conditions, which are determined by regional and national bureaucratic processes and financial status. Furthermore, public body organisations have other tools to direct companies to finance such as guiding them to specific EU-funding mechanisms and make the implementations of such projects more feasible by example organizing events to raise awareness or through affecting (waste and secondary aggregate) legislation and directives. The results show that investors and banks have a general lack of knowledge about the two aspects and lack of interest to participate in such surveys. However, many traditional investment tools can be used to finance industrial symbiosis and circular economy actions. In one case, financing instruments tailored to specifically facilitate cooperation between companies was found.

Internal

STRENGTHS

Companies:

- Different EU financial mechanisms utilized
- Reducing different types of costs, especially in waste management
- Reduction of waste
- Closing the material lifecycle, looking for new opportunities and development of new value chain and products
- Cooperation and the exchange of knowledge

Public sector:

- Many ways of giving finance
- Also other ways of supporting IS and CE (guiding to finance, awareness rising)

Investors and banks:

- Are able to finance IS and CE through traditional investment instruments
- Some trends of customising investment specifically for IS and CE

WEAKNESSES

Companies:

- Lack of knowledge and partners
- Cooperation difficulties: challenging to find right partners, equality, division of responsibilities,
- Legislation and expensive investment costs
- Regulatory requirements for transport and waste management increase admin burden
- Absence of secondary raw material market

Public sector:

- Lack of initiative in private sector (as a consequence, public sector is not aware of SMEs' needs and opportunities)
- Lack of capability affect organisations budget
- Very few direct funding instruments for IS and CE

Investors and banks

- Low level of respond
- Lack of knowledge about IS and CE
- Lack of tailor-made funding instruments to support cooperation

External

OPPORTUNITIES

Companies:

- Plans to invest in IS projects in the next 5 years
- A lot of potential in underutilized resources (waste, side streams, unutilized premises)

SO - STRATEGY

Maximise internal strengths to take advantage of opportunities

- More financing means more recognisability

WO - STRATEGY

Minimise internal weaknesses by taking advantage of opportunities:

- Utilize the good cases in raising awareness to overcome doubts

<ul style="list-style-type: none"> - Strong interest on the SMEs side to cooperate in the field of waste and by-product exchange <p>Public sector:</p> <ul style="list-style-type: none"> - There already is many cases of IS financing → with good promoting such cases can increase <p>Investors and banks:</p> <ul style="list-style-type: none"> - Low level of knowledge gives an opportunity to start fresh 	<ul style="list-style-type: none"> – Cooperation with the three stakeholder groups with a committed leader, clear responsibilities and aim – Create incentives to start investments (EU funding promoting, local financing) 	<ul style="list-style-type: none"> – Arrange education and training activities for employees, middle management and top management
<p style="text-align: center;">THREATS</p> <p>Companies:</p> <ul style="list-style-type: none"> - Not willing to take the first step and risk to start cooperation (fear of short-term profit losses) - Willingness to invest sensitive to the regulatory framework: landfill taxes, end-of-waste criteria; standardize - Secondary raw material markets are rare, poorly regulated and those existing highly volatile and still dependent on primary material markets <p>Public sector:</p> <ul style="list-style-type: none"> -Not enough knowledge to know all the ways the public sector can contribute towards giving finance to IS - Staff in public sector does not have appropriate knowledge in order to create a supportive environment for development of CE and IS <p>Investors and banks:</p> <ul style="list-style-type: none"> - Level of knowledge does not rise 	<p style="text-align: center;">ST - STRATEGY</p> <p>Utilize internal strengths to minimise threats:</p> <ul style="list-style-type: none"> – Utilize good cases in advancing confidence in starting up new industrial symbiosis activities – Name clear responsibilities among the cooperation organisations to boost the implementation of IS projects and cooperation 	<p style="text-align: center;">WT - STRATEGY</p> <p>Minimise weaknesses and prepare for threats. Use strengths to overcome external threats:</p> <ul style="list-style-type: none"> – Cost and payback times depending on the access to the market of secondary raw materials – Legal status of the secondary raw material has a significant effect on the market price

Figure 26. 8-fold SWOT analysis summarizes the survey results and actions to be made

A general strength reported in most of the survey results is the additional value that participating in industrial symbiosis brings. New business activities, products and cooperation are the main drivers for such projects. Savings and lowering environmental impacts through decreasing the amount of waste when it is utilized as material before entering the waste status also encourage taking part to such projects. Profits encourage investment.

Common weaknesses emerging from the survey results were the fear of taking the risk of forming partnership and starting cooperation and forming clear responsibilities between the organisations. Factors hindering participations and investment were the expensive investment cost and technical and administrative barriers. The probability to participate depends largely of the availability of incentives and legal and bureaucratic possibilities.

A general threat is that if the level of knowledge does not rise the situation might not advance. On the other hand, the level of knowledge acts as an opportunity as by increasing awareness and knowledge in any of the three categories it might have a positive effect to the other. Companies seeking funding for industrial symbiosis and circular economy projects give the investment sector encouragement to create instruments tailored to such action and the availability of funding encourages companies to get involved. The general interest towards such activities gives the public sector regional development possibilities.

In most cases there are still more weaknesses than any other three features of the SWOT analysis. The greatest opportunity is to overcome weaknesses and manage threats. All weaknesses can be tackled with promoting of good cases, easing the bureaucratic barriers with legislation and taxation medications and rising awareness through different channels suited for specific target groups.

9 DISCUSSION AND REFLECTION

The aim of the report was to map the investment potential in industrial symbiosis in SYMBI project partners' operation regions based on the results of the investment survey. The amount of survey results received varied largely among partner countries. Only the Finnish partner HAMK and the Slovenian partner SVRK sent the survey to random recipients in certain areas at a vast distribution. Other partners selected specific organisations which they already had some connections with or which they

knew was oriented towards IS and/or CE operation. The Finnish partner HAMK was the only partner who managed to reach the target number of answers in all of the three categories. Rest of the partners were not able to collect enough results from one or more of the categories. This causes a problem in the reliability of the results. The results are somewhat distorted when the sampling of the survey is in most cases chosen beforehand and in some cases not. In a situation as such the before picked organisations often represent the best-case scenario. The survey results that come from vast distribution and from random organisations, express better the realistic situation related to the matter. However, the comparison between results from the two types of conducting the survey may not reflect realistic results and therefore cause issues in reliability. In addition, the small amount of survey results causes a problem in reliability as the results can be biased when only few representatives answered the survey.

There is also contradiction in the generalization of results. At this stage, the results of the survey cannot be generalized to indicate the current situation related to the SYMBI partner countries investment potential in industrial symbiosis. Especially the results from investors and banks cannot be generalized, as the amount of answers was so low. From all of the partners the minimum amount of survey results would have been 40 but only 11 replies were received (see page 15 table 2). In the two other categories (companies and public sector), the minimum amounts were reached because of the high input from HAMK and SVRK (Table 2, p. 15). The amount of received budget information from any of the three categories was so little that generalization based on them should not be made.

However, there is a notable coherence in the results. Certain patterns or codes emerge from many results from different countries. The lack of interest from investment sector to participate in surveys and lack of knowledge from all three categories were present throughout the survey results. The interest towards the benefits of industrial symbiosis seemed to be vibrant among many companies but the lack of information hinders the real diffusion. Different EU funding instruments are utilised in IS and CE projects around partner regions and the role of public sector in most cases is supportive in non-monetary ways.

Further investigations are needed to back up the conclusions and results of the survey. However, the results and the survey can act as a base for further investigations and are relevant and valid enough to be compared to similar surveys or reports. The main source of information used in the thesis was the survey results from the SYMBI partner regions. References utilized focus mainly on the introduction paragraphs at the beginning of the report. Continuing the report with scientific desk research would also increase the reliability of the results.

The report and its preliminary results will be presented to the SYMBI project stakeholders and published at the projects websites. This report is one of the four main activities conducted during the project's operation time. Because of the activity, another SWOT analyzation will be made to summarize main conclusions from all of the four SYMBI reports. The improvement of the quality of the reports is one of the current agendas of the SYMBI project consortium. In addition, to summarise lessons learnt from the exchange of experience activities (A1 activities), within partners' organisations, and to a wider readership in EU Policy briefs will be made to ease the dissemination of information.

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The modified questionnaires for activity A1.2: FUNDEYT, SPAIN

QUESTIONNAIRE FOR COMPANIES

1. Basic information

Name of respondent
Company or organization
Country and region
Revenue
Number of staff
Type of company

Are you already involved in industrial symbiosis?

Answer question 2 or 3.

2. YES, we are already involved in industrial symbiosis

- Type of project
- How big were the investments and what were the estimated payback times for the investments? (Please describe as many cases as you feel appropriate)
- What is this symbiosis all about: giving/receiving materials, utilizing/sharing other resources?
- What kinds of objectives, obstacles or drivers are involved in industrial symbiosis according your experience?

3. NO, We are not already involved in industrial symbiosis

- Would you think industrial symbiosis could be beneficial for your company?
 - Could it be giving/receiving materials, utilizing/sharing other resources? If possible, explain what are these materials or resources.
 - Would you be willing to invest in industrial symbiosis, how much (€ and/or % of revenue)? What would be the expected time for payback?

QUESTIONNAIRE FOR MUNICIPALITIES AND CITIES, REGIONAL BUSINESS DEVELOPMENT AGENCIES, REGIONAL ADMINISTRATION AND COUNCILS, NATIONAL ADMINISTRATION AND MINISTRIES, NATIONAL INNOVATION AGENCIES

1. Basic information

Name of respondent

Company or organization

Country and region

Operation level

municipal

regional

national

2. Has your organization supported investments in circular economy / industrial symbiosis projects?
3. Are you able to allot financial support for companies in creating industrial symbiosis?
 - a. If yes, please explain
4. Do you have a budget for supporting circular economy and/or industrial symbiosis investments?
5. What is the budget per year and what are the conditions supporting your decision to invest? If the budget is not fixed, please explain.
6. What conditions are required from companies for getting the funds?
7. Do you have other way of supporting companies in their activities among circular economy and/or industrial symbiosis investments?

QUESTIONNAIRE FOR INVESTORS AND BANKS

1. Basic information

Name of respondent

Company or organization

Country and region

Operational level

 municipal regional national

2. Has your organization supported investments in circular economy / industrial symbiosis projects?
3. Are you able to allot financial support for companies in creating industrial symbiosis?
 - a. If yes, please explain
4. Do you have a budget for supporting circular economy and/or industrial symbiosis investments?
5. What is the budget per year and what are the conditions supporting your decision to invest? If the budget is not fixed, please explain.
6. What conditions are required from companies for getting the funds?
7. Do you have other way of supporting companies in their activities among circular economy and/or industrial symbiosis investments?

Appendix 2

The modified questionnaires for activity A1.2: SVRK Slovenia

INDUSTRIAL SYMBIOSIS – INVESTMENT POTENTIAL: COMPANIES

Survey short title: Industrial symbiosis: companies

Survey long title: Industrial symbiosis – investment potential: companies

Question number: 22

Survey is closed.

Active from: 12.12.2016

Active until: 12.03.2017

Author: marjana.dermelj

Edited: marjana.dermelj

Date: 24.11.2016

Date: 03.01.2017

Since 2016, the Government Office for Development and European Cohesion Policy has been involved in SYMBI project (Industrial symbiosis for regional sustainable growth and a resource efficient circular economy). Consortium consists of nine partner organisations from seven countries (Slovenia, Spain, Italy, Hungary, Poland, Greece and Finland). Its main objective is to raise the level of knowledge and implementation of industrial symbiosis and support the transition towards the circular economy, efficient resource management, setting up territorial synergies for waste management, exchange of energy surpluses and by-products as secondary raw materials. More information about the project can be found at the project website. With this short survey, taking place in seven partner regions, which will take you around 10 minutes, we wish to: identify priority sectors and cross-sectorial areas for encouraging investments and private-public partnerships; prepare the overview of investment potential for industrial symbiosis projects. Finnish partner, namely Häme University of Applied Sciences in region Häme, will make the analysis of investment potentials in the field of industrial symbiosis for SYMBI partner regions. Data will be used exclusively for the purpose of analysis and will not be used for any other purposes without prior approval. By answering this survey and sharing information you agree to being processed. All participants will be informed about the results upon their request. In order to produce credible, reliable and useful results, a relevant number of feedbacks are needed. The survey is open until 30 December 2016. Thank you very much in advance for taking your precious time. Marjana Dermelj, project manager

Q1 – Name of institution.

Q2 – Region, where your company has a seat

Pomurska

Podravska

- Koroška
- Savinjska
- Zasavska
- Jugovzhodna Slovenija
- Primorsko - notranjska
- Osrednjeslovenska
- Gorenjska
- Goriška
- Obalno - kraška
- Posavska

Q3 – Nubmer of employees:

- up to 10
- up to 50
- up to 250
- 250 and more
- Other

Q3 – Please state your institutional turnover in 2015

Q4 – Are you familiar with the concepts of circular economy and industrial symbiosis?

- YES
- NO

IF (1) Q5 = [2] (NO)

Q6 – What is industrial symbiosis? Very first example of industrial symbiosis dates back in 1961 in Kalundborg (Denmark). There are already many partners included in the project, among them Novo Nordisk company and municipality of Kalundborg. Industrial symbiosis is an industrial ecosystem where unused or residual resources of one company are used by another. This results in mutual economic, social and environmental benefits. It is a process involving several companies – firms that complement one another provide mutual added value through efficient use of raw materials, technology, services and energy. Joint development of industrial symbiosis provides an efficient way of thinking up, developing and testing product and service innovations. This, in turn, engenders new competencies, on which new business operations can be based. (Source: <http://www.sitra.fi/en/economy/industrial-symbiosis>).

Finnish cases of industrial symbiosis in the field of bio-materials:

The food processing factory HK Scan Finland is delivering stillage from a biorefinery to pig farms producing pork for food refining. Offal from the slaughterhouse is taken to Envor Group where it is used for biogas production. Digestate and ammonium sulfate are byproducts in that process. All stakeholders are benefitting:

- stillage is used as feed instead of dumping it somewhere
- pig farms are getting cheap feed

- offal is taken to biogas reactors instead of land fill
- Enviro Group is getting material for its biorefinery
- biowaste is refined to valuable soil improvement material and fertilizer which can be utilized by farmers
- biogas is used as fuel in cars and in industry
- one side product is electricity

Saint Gobain is using renewable biogas instead of fossil fuels, Uusioaines Ltd and Enviro Group are taken scrap glass to Saint Gobain Isover instead of paying for dumping the material and construction industry is benefitting of 'green raw material'. There is a win-win situation between the stakeholders:

- scrap glass from private households (via Enviro Group) and other sources (Uusioaines Ltd) is collected to Saint Gobain Isover Ltd;
- glass wool is benefitting Parma Ltd in producing concrete elements and other construction industry as isolation material as such;
- biogas from Enviro Group is used as energy production in Saint Gobain Isover Ltd.

IF (2) Q5 = [1]

Q7 – Is your company already a partner of an industrial symbiosis project?

- YES
 NO

IF (2) Q5 = [1]

IF (3) Q7 = [1] (YES)

Q8 - Please, name projects that you have supported so far:

IF (2) Q5 = [1]

IF (3) Q7 = [1] (YES)

Q9 – What type of industrial symbiosis was addressed by your projects?

Multiple answers are possible

- delivery/receiving of materials (e.g. exchange of materials, waste energy, water etc.)
 (co-)use of resources (e.g. joint finances, logistics, knowledge etc.)
 other:

IF (2) Q5 = [1]

IF (3) Q7 = [1] (YES)

Q10 – Why have you decided to join the industrial symbiosis projects?

IF (2) Q5 = [1]

IF (3) Q7 = [1] (YES)

Q11 – Which barriers did you face when implementing these projects?

IF (2) Q5 = [1]

IF (3) Q7 = [1] (YES)

Q12 - How much have you allocated in the last five years for industrial symbiosis projects? (in EUR)

IF (2) Q5 = [1]

IF (3) Q7 = [1] (YES)

Q13 - What was the average return period of your investment?

IF (2) Q5 = [1]

IF (3) Q7 = [1] (YES)

Q14 - Do you plan to financial support industrial symbiosis projects in the next five years?

YES

NO

IF (2) Q5 = [1]

IF (3) Q7 = [1] (YES)

IF (4) Q14 = [2] (NO)

Q15 – Why not?

IF (2) Q5 = [1]

IF (3) Q7 = [1] (YES)

IF (5) Q14 = [1] (YES)

Q19_2 – How much money do you plan to allocate for industrial symbiosis projects in the next five years (in EUR)?

IF (2) Q5 = [1]
IF (6) Q7 = [2] (NO)
Q16 – Why not?

IF (7) Q5 = [2]
Q17 – Now, when you are familiar with industrial symbiosis concept, do you think that this kind of project would be beneficial for your company and you would be willing to support it?

- YES
 NO

IF (7) Q5 = [2]
IF (8) Q17 = [1] (YES)
Q18 – If you decided for industrial symbiosis project, which areas would be interesting for your company? Multiple answers are possible

- delivery/receiving of materials (e.g. exchange of materials, waste energy, water etc.)
 (co-)use of resources (e.g. joint finances, logistics, knowledge etc.)
 other:

IF (7) Q5 = [2]
IF (8) Q17 = [1] (YES)
Q19 - How much money approximately would you be willing to allocate for such project or percentage of your turnover? (in EUR)

IF (7) Q5 = [2]
IF (9) Q17 = [2] (NO)
Q20 – Why not?

Q21 - E-mail of the person, who was in charge for this survey, where we can send the survey's results and ask for more information.

INDUSTRIAL SYMBIOSIS – INVESTMENT POTENTIAL: PUBLIC SECTOR

Survey short title: Industrial symbiosis: public sector

Survey long title: Industrial symbiosis – investment potential: public sector

Question number: 19

Survey is closed.

Active from: 12.12.2016

Active until: 12.03.2017

Author: marjana.dermelj

Edited: marjana.dermelj

Date: 29.11.2016

Date: 03.01.2017

Since 2016, the Government Office for Development and European Cohesion Policy has been involved in SYMBI project (Industrial symbiosis for regional sustainable growth and a resource efficient circular economy). Consortium consists of nine partner organisations from seven countries (Slovenia, Spain, Italy, Hungary, Poland, Greece and Finland). Its main objective is to raise the level of knowledge and implementation of industrial symbiosis and support the transition towards the circular economy, efficient resource management, setting up territorial synergies for waste management, exchange of energy surpluses and by-products as secondary raw materials. More information about the project can be found at the project website. With this short survey, taking place in seven partner regions, which will take you around 10 minutes, we wish to: identify priority sectors and cross-sectorial areas for encouraging investments and private-public partnerships; prepare the overview of investment potential for industrial symbiosis projects. Finnish partner, namely Häme University of Applied Sciences in region Häme, will make the analysis of investment potentials in the field of industrial symbiosis for SMYBI partner regions. Data will be used exclusively for the purpose of analysis and will not be used for any other purposes without prior approval. By answering this survey and sharing information you agree to being processed. All participants will be informed about the results upon their request. In order to produce credible, reliable and useful results, a relevant number of feedbacks are needed. The survey is open until 30 December 2016. Thank you very much in advance for taking you precious time. Marjana Dermelj, project manager

Q1 – Name of institution.

Q8 – Your institution supports projects at

Multiple answers are possible

- National level
- Regional level (NUTS3)
- Local level
- Other (please explain)

Q2 - Please, select the region, where your institution has a seat.

- Pomurska
- Podravska
- Posavska
- Koroška
- Savinjska
- Zasavska
- Jugovzhodna Slovenija
- Primorsko - notranjska
- Osrednjeslovenska
- Obalno - kraška
- Goriška
- Gorenjska

Q3 – Are you familiar with the concepts of circular economy and industrial symbiosis?

- YES, we know them both
- PARTIALLY we know both concepts
- NO, we are not familiar with these concepts
- other, please explain

IF (1) Q3 = [1] (YES, we know them both)

Q4 – Do you support circular economy and/or industrial symbiosis projects?

- YES
- NO
- other

IF (1) Q3 = [1] (YES, we know them both)

IF (2) Q4 = [1] (YES)

Q5 – How do you support industrial symbiosis / circular economy projects?

Multiple answers are possible

- direct financial support to companies
- tax relief
- exemption from tax paying
- setting standards
- education and awareness raising
- support environment/counselling
- other:

IF (1) Q3 = [1] (YES, we know them both)

IF (2) Q4 = [1] (YES)

Q6 – Please, list the key criteria, based on which your support depends on.

IF (1) Q3 = [1] (YES, we know them both)

IF (2) Q4 = [1] (YES)

Q7 – How much money approximately have you allocated on yearly basis for this kind of projects in the last five years? (in EUR, you can also valorise the work of employees)

IF (1) Q3 = [1] (YES, we know them both)

IF (2) Q4 = [1] (YES)

Q9 – Will you continue supporting circular economy / industrial symbiosis projects also in the coming five years?

- YES
 NO
 I do not know
 Other

IF (1) Q3 = [1] (YES, we know them both)

IF (2) Q4 = [1] (YES)

IF (3) Q9 = [2] (NO)

Q14_3 – Why not?

IF (1) Q3 = [1] (YES, we know them both)

IF (2) Q4 = [1] (YES)

IF (4) Q9 = [1] (YES)

Q14_2 – How much money do you plan to allocate for this area in the next five years (or in the next one, if you cannot state your mid-term plan)? (in EUR, you can also valorise the work of employees)

IF (1) Q3 = [1] (YES, we know them both)

IF (5) Q4 = [2] (YES)

Q10 – Please, state reasons, why you do not support circular economy and/or industrial symbiosis projects?

Multiple answers are possible

- we do not have enough financial resources
 there is no interest for such projects
 we do not have enough human resources
 other:

IF (6) Q3 = [2, 3]

Q11 - What is circular economy? Current economic development model is based on linear production process: "take, make, use, dispose" and is driven by huge quantities of cheap, easy accessible primary raw materials and energy. This model has started overshooting the capability of our planet. Transition towards circular economy is thus focused in different product design, its use, refurbishment and at the end the recycling of already existing materials and products. It is based on use of renewable energy and resources, waiving the use of dangerous chemicals, reduce the use of raw materials and through design (in the way that it allows materials to circulate and preserve their value as long as possible) prevent the waste. Products thus remain in (circular) economy even after they reach their end of the lifetime. Circular economy is attractive and feasible alternative, being already explored by certain companies. For better illustration, you are invited to have a look at the [Circular Economy System Diagram](#).

IF (6) Q3 = [2, 3]

Q12 - What is industrial symbiosis? Very first example of industrial symbiosis dates back in 1961 in Kalundborg (Denmark). There are already many partners included in the project, among them Novo Nordisk company and municipality of Kalundborg. Industrial symbiosis is an industrial ecosystem where unused or residual resources of one company are used by another. This results in mutual economic, social and environmental benefits. It is a process involving several companies – firms that complement one another provide mutual added value through efficient use of raw materials, technology, services and energy. Joint development of industrial symbiosis provides an efficient way of thinking up, developing and testing product and service innovations. This, in turn, engenders new competencies, on which new business operations can be based. (Source: <http://www.sitra.fi/en/economy/industrial-symbiosis>).

Finnish cases of industrial symbiosis in the field of bio-materials:

- The food processing factory HK Scan Finland is delivering stillage from a biorefinery to pig farms producing pork for food refining. Offal from the slaughterhouse is taken to Enviro Group where it is used for biogas production. Digestate and ammonium sulfate are byproducts in that process. All stakeholders are benefitting:
 - stillage is used as feed instead of dumping it somewhere
 - pig farms are getting cheap feed
 - offal is taken to biogas reactors instead of land fill
 - Enviro Group is getting material for its biorefinery
 - biowaste is refined to valuable soil improvement material and fertilizer which can be utilized by farmers
 - biogas is used as fuel in cars and in industry
 - one side product is electricity

- Saint Gobain is using renewable biogas instead of fossil fuels, Uusioaines Ltd and Enviro Group are taken scrap glass to Saint Gobain Isover instead of paying for dumping the material and construction industry is benefitting of 'green raw material'. There is a win-win situation between the stakeholders:
 - scrap glass from private households (via Enviro Group) and other sources (Uusioaines Ltd) is collected to Saint Gobain Isover Ltd;
 - glass wool is benefitting Parma Ltd in producing concrete elements and other construction industry as isolation material as such;
 - biogas from Enviro Group is used as energy production in Saint Gobain Isover Ltd.

IF (6) Q3 = [2, 3]

Q13 - You are now informed about the circular economy and industrial symbiosis concepts. Would you be willing to financially support such projects in the next five years?

- YES
 NO
 other

IF (6) Q3 = [2, 3]

IF (7) Q13 = [1] (YES)

Q14 – What kind of projects would you be willing to support in the next five years?

Multiple answers are possible

- direct financial support to companies
 tax relief
 exemption from tax paying
 setting standards
 education and awareness raising
 support environment/counselling
 other:

IF (6) Q3 = [2, 3]

IF (7) Q13 = [1] (YES)

Q15 – How much money would you be willing to allocate for this area in the next five years (or in the next one, if you cannot state your mid-term plan)? (in EUR, you can also valorise the work of employees)

IF (6) Q3 = [2, 3]

IF (8) Q13 = [2] (NO)

Q16 – Why not?

Q17 - E-mail of the person, who was in charge for this survey, where we can send the survey's results and ask for more information.

INDUSTRIAL SYMBIOSIS – INVESTMENT POTENTIAL: INVESTORS AND FINANCIAL INSTITUTIONS

Survey short title: Industrial symbiosis – investors

Survey long title: industrial symbiosis – investment potential: investors and financial institutions

Question number: 20

Survey is closed.

Active from: 27.02.2017

Author: marjana.dermelj

Date: 28.11.2016

Active until: 27.05.2017

Edited: marjana.dermelj

Date: 14.03.2017

Since 2016, the Government Office for Development and European Cohesion Policy has been involved in SYMBI project (Industrial symbiosis for regional sustainable growth and a resource efficient circular economy). Consortium consists of nine partner organisations from seven countries (Slovenia, Spain, Italy, Hungary, Poland, Greece and Finland). Its main objective is to raise the level of knowledge and implementation of industrial symbiosis and support the transition towards the circular economy, efficient resource management, setting up territorial synergies for waste management, exchange of energy surpluses and by-products as secondary raw materials. More information about the project can be found at the project website. With this short survey, taking place in seven partner regions, which will take you around 10 minutes, we wish to: identify priority sectors and cross-sectorial areas for encouraging investments and private-public partnerships; prepare the overview of investment potential for industrial symbiosis projects. Finnish partner, namely Häme University of Applied Sciences in region Häme, will make the analysis of investment potentials in the field of industrial symbiosis for SMYBI partner regions. Data will be used exclusively for the purpose of analysis and will not be used for any other purposes without prior approval. By answering this survey and sharing information you agree to being processed. All participants will be informed about the results upon their request. In order to produce credible, reliable and useful results, a relevant number of feedbacks are needed. The survey is open until 3 March 2017. Thank you very much in advance for taking you precious time. Dejan Hribar, project officer

Q1 – Name of institution.

Q2 – Region, where your company has a seat

- Pomurska
- Podravska
- Posavska
- Koroška
- Savinjska

- Zasavska
- Osrednjeslovenska
- Jugovzhodna Slovenija
- Primorsko - notranjska
- Gorenjska
- Goriška
- Obalno - kraška

Q3 – Please state your institutional turnover in 2015

Q4 – Are you familiar with the concepts of circular economy and industrial symbiosis?

- YES, we know them both**
- PARTIALLY we know both concepts**
- NO, we are not familiar with these concepts**
- other, please explain**

IF (1) Q4 = [2, 3]

Q5 – What is circular economy? Current economic development model is based on linear production process: "take, make, use, dispose" and is driven by huge quantities of cheap, easy accessible primary raw materials and energy. This model has started overshooting the capability of our planet. Transition towards circular economy is thus focused in different product design, its use, refurbishment and at the end the recycling of already existing materials and products. It is based on use of renewable energy and resources, waiving the use of dangerous chemicals, reduce the use of raw materials and through design (in the way that it allows materials to circulate and preserve their value as long as possible) prevent the waste. Products thus remain in (circular) economy even after they reach their end of the lifetime. Circular economy is attractive and feasible alternative, being already explored by certain companies. For better illustration, you are invited to have a look at the [Circular Economy System Diagram](#).

IF (1) Q4 = [2, 3].

Q6 – What is industrial symbiosis? Very first example of industrial symbiosis dates back in 1961 in Kalundborg (Denmark). There are already many partners included in the project, among them Novo Nordisk company and municipality of Kalundborg. Industrial symbiosis is an industrial ecosystem where unused or residual resources of one company are used by another. This results in mutual economic, social and environmental benefits. It is a process involving several companies – firms that complement one another provide mutual added value through efficient use of raw materials, technology, services and energy. Joint development of industrial symbiosis provides an efficient way of thinking up, developing and testing product and service innovations. This, in turn, engenders new competencies, on which new business operations can be based. (Source: <http://www.sitra.fi/en/economy/industrial-symbiosis>).

Finnish cases of industrial symbiosis in the field of bio-materials:

The food processing factory HK Scan Finland is delivering stillage from a biorefinery to pig farms producing pork for food refining. Offal from the slaughterhouse is taken to Envor Group where it is used for biogas production. Digestate and ammonium sulfate are byproducts in that process. All stakeholders are benefitting:

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- pig farms are getting cheap feed
- offal is taken to biogas reactors instead of land fill
- Envor Group is getting material for its biorefinery
- biowaste is refined to valuable soil improvement material and fertilizer which can be utilized by farmers
- biogas is used as fuel in cars and in industry
- one side product is electricity

Saint Gobain is using renewable biogas instead of fossil fuels, Uusioaines Ltd and Envor Group are taken scrap glass to Saint Gobain Isover instead of paying for dumping the material and construction industry is benefitting of 'green raw material'. There is a win-win situation between the stakeholders:

- scrap glass from private households (via Envor Group) and other sources (Uusioaines Ltd) is collected to Saint Gobain Isover Ltd;
- glass wool is benefitting Parma Ltd in producing concrete elements and other construction industry as isolation material as such;
- biogas from Envor Group is used as energy production in Saint Gobain Isover Ltd.

IF (1) Q4 = [2, 3]

Q14_2 – You are now informed about the circular economy and industrial symbiosis concepts.

Would you be willing to financially support such projects in the next five years?

- YES
- NO
- other, please explain

IF (1) Q4 = [2, 3]

IF (2) Q14_2 = [2] (NO)

Q7 – What is the reason that you do not wish to support the circular economy / industrial symbiosis projects?

Multiple answers are possible

- we do not the topic
- revenues are not profitable/enough defined
- risk is too high
- other financial sources are available for this purpose
- other, please explain

IF (1) Q4 = [2, 3]

IF (3) Q14_2 = [1] (YES)

Q8 – Under what conditions you would be willing to invest in circular economy / industrial symbiosis projects?

Multiple answers are possible

- high rate on return
- medium rate on return
- low rate on return
- environmental benefits/better environmental conditions
- other, please explain

IF (1) Q4 = [2, 3]

IF (3) Q14_2 = [1] (YES)

Q9 – Which instruments would you be willing to use in order to support circular economy / industrial symbiosis projects?

Multiple answers are possible

- guarantees
- favourable loans
- venture capital
- equity capital
- quasi equity capital
- other:

IF (1) Q4 = [2, 3]

IF (3) Q14_2 = [1] (YES)

Q10 – How much money approximately would you be willing to allocate for such projects in the next five years (cumulative)?

IF (4) Q4 = [1] (YES, we know them both)

Q15_2 - Do you already support the projects in the field of circular economy and industrial symbiosis?

- YES
- NO

IF (4) Q4 = [1] (YES, we know them both)

IF (5) Q15_2 = [2] (NO)

Q11 – Why you do not support projects in the field of circular economy and industrial symbiosis?

Multiple answers are possible

- we do not the topic
- revenues are not profitable/enough defined
- risk is too high
- other financial sources are available for this purpose
- we do not have human resources
- other, please explain

IF (4) Q4 = [1] (YES, we know them both)

IF (6) Q15_2 = [1] (YES)

Q12 – What financial instruments you use to support circular economy / industrial symbiosis projects?

Multiple answers are possible

- guarantees
- favourable loans
- venture capital
- equity capital
- quasi equity capital
- other:

IF (4) Q4 = [1] (YES, we know them both)

IF (6) Q15_2 = [1] (YES)

Q13 – What are criteria, based on which you make the project selection?

Multiple answers are possible

- rate of return
- low level of risk
- environmental benefits
- other:

IF (4) Q4 = [1] (YES, we know them both)

IF (6) Q15_2 = [1] (YES)

Q14 – How much have you allocated in the last five years for this kind of projects? (in EUR)

IF (4) Q4 = [1] (YES, we know them both)

IF (6) Q15_2 = [1] (YES)

Q15 – Do you plan the financial support for circular economy / industrial symbiosis projects in the next five years?

- YES
- NO
- other, please explain:

IF (4) Q4 = [1] (YES, we know them both)

IF (6) Q15_2 = [1] (YES)

IF (7) Q15 = [2] (NO)

Q16 – Why not?

IF (4) Q4 = [1] (YES, we know them both)

IF (6) Q15_2 = [1] (YES)

IF (8) Q15 = [1] (YES)

Q17 – Please, state the rough estimation of financial resources by which you plan to support the circular economy / industrial symbiosis projects in the next five years. (in EUR)

Q18 – E-mail of the person, who was in charge for this survey, where we can send the survey's results and ask for more information.