FISSAC

FOSTERING INDUSTRIAL SYMBIOSIS FOR A SUSTAINABLE RESOURCE INTENSIVE INDUSTRY ACROSS THE EXTENDED CONSTRUCTION VALUE CHAIN

Social strategies for FISSAC: Strategies for social engagement and acceptance

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D1.7: Strategies for social engagement and acceptance
WP 1, T 1.5

Authors: Marion Courtois (ACR+)

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[1] PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

0. Summary

In this Deliverable, the first section describes the project context i.e. industrial symbiosis, the main foreseen outputs and the governance around social engagement and acceptance.

Industrial Symbiosis is an emerging concept with a multitude of benefits for companies, communities and the local environment. It can be a very powerful and important strategic approach to promoting sustainability in the European Union. For this reason, the FISSAC project is highly relevant, bringing together a wide range of partners and countries.

Industrial Symbiosis (IS) can be initiated by a public authority, private firm, or association. Research to date rarely focuses on the interactions between the highly predominant technical aspect of industrial symbiosis and the non-technical aspects (including social engagement and acceptance); despite this being a key element of success of an IS project.

Due to the low level of knowledge on social engagement and acceptance held by the majority of the partners of FISSAC, the Social Advisory Board plays a strategic role to orientate the integration of these aspects throughout the project.

Beyond the technical feasibility of the exchanges, social elements also play a crucial role in the development of IS networks (Domenech and Davies, 2009) and therefore understanding of such elements is essential for the further development of IS. Hence, the second section describes the stakeholder engagement strategy, which establishes the objectives of stakeholder engagement and indicates how the involvement of stakeholders will be achieved at each stage of the project. A Five-step approach is used:

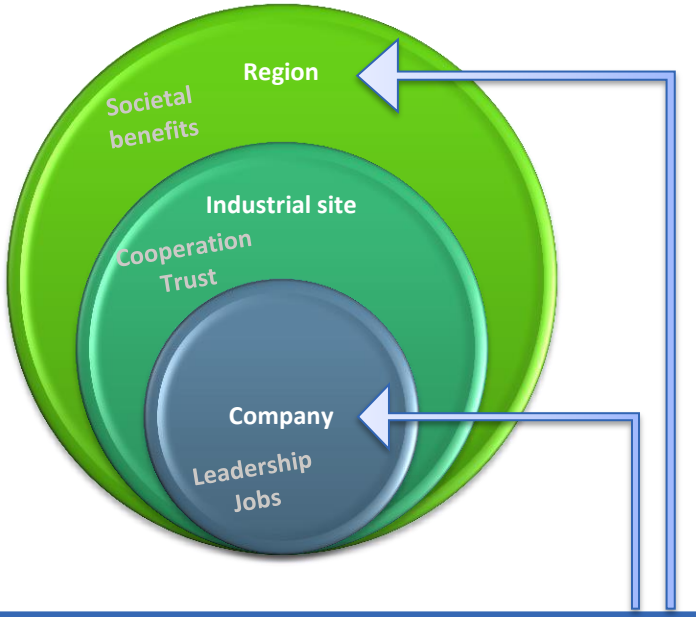
1. Develop a vision
2. Map stakeholders
3. Prepare for the engagement
4. Engage stakeholders
5. Monitoring and evaluation

The third section describes how we will define the next steps of the project and what are the actions already foreseen.

The diversity of the tasks and the wide range of countries and partners underline the need to clarify the responsibilities of each partner in the contribution of social engagement and acceptance. It is why this document summarises the implication of each partner.

The aim of this deliverable D1.7 is to highlight the importance of non-technical and social aspects of IS as a key for achieving successful Industrial Symbiosis projects. In line with FISSAC deliverables D1.1 “Stakeholders network set up”, D1.2 “Identification of best practices and lessons learnt in Industrial Symbiosis” and D1.4 “Social strategies for FISSAC: Definition of target social groups”, this report will prepare the deliverable D10.5 “Report of social engagement and acceptance” foreseen at the end of the project. The objectives of D10.5 **are to identify the main elements related to social engagement and acceptance in industrial symbiosis projects.**

Social acceptance levels



Final deliverable

with 3 foci

D10.5 Report of social engagement and acceptance

Companies | Public Authorities | End-users

FISSAC Actions to implement the stakeholders engagement

Information and resources

- 08/16 - Task 1.4 - Identification and development of IS indicators for quantifying the social dimension of IS initiatives
- 02/16 - Task 2.1 - Definition of technical requirements of secondary raw materials
- 02/16 - Task 2.4 - Overcoming non-technological barriers
- 02/17 - Task 3.1 - Evaluation of the proposed processes and value chain to ensure their environmental and economic sustainability
- 02/20 - Task 3.5 - Environmental Technology Verification
- 02/20 - Task 7.2 - Analysis of the condition of the various represented industries to detect technological and non-technological drivers and barriers
- 02/20 - Task 7.3 - Evaluation of the replicability of the model

Concrete actions with stakeholders

- 05/17 - Task 3.2 - Eco-design of cost-effective products
- 08/10 - Task 5.1 - Project Design of the constructive solutions
- 02/20 - Task 5.5 - Sustainability assessment of the solutions: LCA and LCC of real case studies
- 02/20 - Task 7.1 - Establishment of a Living Lab for replicating the FISSAC model
- 02/20 - Task 8.1 - Management of intellectual property rights
- 02/20 - Task 9.2 - Dissemination Plan deployment

Co-construction process

- 02/16 - Task 1.1 - Stakeholders network and analysis of 60 practical cases
- 02/17 - Task 1.6 - Paving the way to FISSAC Industrial Symbiosis Model: Methodology and Software Platform
- 02/20 - Task 6.3 - Monitoring and evaluation of results with the platform, including real-scale test and compilation of the FISSAC life-cycle inventory (LCI) Database
- 02/20 - Task 6.4 - Definition of the final version of FISSAC Industrial Symbiosis Methodology
- 02/20 - Task 6.5 - Definition and validation of FISSAC model
- 02/20 - Task 8.3 - New business models for industrial symbiosis towards a circular economy
- 02/20 - Task 8.4 - Business Plan outline

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Abbreviations and acronyms

BM	Business Model
CDW	Construction and Demolition Waste
CSR	Corporate Social Responsibility
D	Deliverable
ETV	Environmental Technology Verification
EU	European Union
FISSAC	Fostering Industrial Symbiosis for a Sustainable Resource Intensive Industry Across the Extended Construction Value Chain
FMP	Flanders' Materials Programme
IAP2	International Association for Public Participation
IBR	Iskenderun Bay region
ICT	Information and Communications Technology
IPR	Intellectual Property Rights
IS	Industrial Symbiosis
LCA	Life-Cycle Assessment
LCC	Life-Cycle Cost
LCI	Life-Cycle Inventory
LLs	Living Labs
MA	Manresa
NCP	National Contact Point
R&D	Research and Development
SDG	Sustainable Development Goals
SME	Small and Medium Enterprise
SNA	Social Network Analysis
SRM	Secondary Raw Materials
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TIS	Technological Innovations Systems
TM	Transition Management
UN	United Nations
WP	Work Package

1. Introduction to FISSAC

The structure of the sections is defined in boxes.
In this Section 1, the objective (1.1), industrial symbioses (1.2), expected output (1.3) and partners (1.4) of the FISSAC project are described.
Then, due to the subject of Deliverable D1.7, following sections focus on the Social Advisory Board (1.5), the definition of social engagement and acceptance (1.6) and the Sustainable Development goals (1.7) where the FISSAC project

1.1 Objective

The FISSAC project involves stakeholders at all levels of the construction and demolition value chain to develop a methodology and software platform to facilitate information exchange which can support Industrial Symbiosis networks and replicate pilot schemes at local and regional levels.

The model will be based on three sustainability pillars:

- environmental (with a lifecycle approach);
- economic;
- social (taking into consideration stakeholders engagement and impact on society).

Our ambition is that the model we create will be replicable in other regions and other value chain scenarios.
The project runs from September 2015 until February 2020.

1.2 Definition of Industrial Symbiosis

[Industrial Symbiosis] engages diverse organisations in a network to foster eco-innovation and long-term culture change. Creating and sharing knowledge through the network yields mutually profitable transactions for novel sourcing of required inputs, value-added destinations for non-product outputs and improved business and technical processes. (Lombardi and Laybourn, 2012)

The FISSAC project is working with various stakeholders across the extended construction value chain to understand these aspects and build a model and supporting systems that will endeavour to overcome the challenges associated with Industrial Symbiosis.

Figure 1 – Circular economy in the construction value chain

Industrial Symbiosis, as a transition of a well-established global production and operational model to a new innovative concept, can deliver a multitude of benefits to companies, communities living in the vicinity, and the local environment.
D1.4 - Social strategies for FISSAC: Definition of target social groups identified a number of benefits and savings, summarised in Table 1. In italic, some new benefits have been added. In addition, the separation in 3 columns is artificial due to the fact that improvement of the environment and creation of local business opportunities are generally goad for communities and local authorities.

Table 1 – Potential benefits of Industrial Symbiosis projects

Potential benefits of Industrial Symbiosis projects		
For communities and local authorities	**For the environment**	**For businesses**
Communities:	Improved air quality and reduced pollution	Cost savings
Improved health for citizens and workers	Ecosystems protection	Increased energy efficiency
Knowledge transfer and new skills	Avoided water use	New partnerships
Enhanced quality of life[2]	More efficient use of resources	Speed up innovations and invest in R&D
Higher quality job in these new activities	Waste reduction	New patents
Co-creation of business solutions with the consumers	Reduced carbon emissions and climate change mitigation	Additional sales and increased turnover
Social innovation	Raw material availability	*Controlled or stable raw material prices*
Local authorities:		Reduction of operation costs
Possibility of diversifying the economic fabric in intensive areas		Green profile, better public image
Reduced cost for waste disposal		Decrease carbon footprint
Improved aesthetics		Income from sale of by-products
Improved (local) environment		New business models
Boost local economy and growth[3]		Reduced business risk
Local business opportunities		Infrastructure sharing
		"Sense of community"[4]

1.3 Expected outcomes

FISSAC aims to demonstrate the effectiveness of the processes, services and products at different levels:

- **Manufacturing processes**
  - Demonstration of closed-loop recycling processes to transform waste into valuable and acceptable secondary raw materials;
  - Demonstration of the manufacturing processes of the novel products at industrial scale.

[2] *Health, work, education, frame and environment…*

[3] *Employment creation (new jobs in already existing occupations and new occupations), higher quality jobs (pre-existing ones), and economic and production activities' regeneration and diversification in local economic activities.*

[4] Developing a sense of community between the companies within a network will make them realise a multitude of resources to be shared (e.g. waste streams, water, energy, by-products, ideas, people) and gradually develop their willingness to collaborate.

- **Product validation**
  - Demonstration of the eco-design of eco-innovative construction products (new eco-cement and green concrete, innovative ceramic tiles and rubber-wood plastic composites) in pre-industrial processes, under a life-cycle approach;
  - Real-scale demonstration of the application and technical performance of eco-innovative construction products in a variety of case studies.
- **Industrial Symbiosis model**
  - Demonstration of the software platform;
  - Replicability assessment of the model through living lab concept (as a user-centred, open-innovation ecosystem, often operating in a territorial context).

The FISSAC project creates an innovation action for the improvement of products, processes and services, including demonstration activities for technologies and the FISSAC model, large-scale product manufacturing demonstration and market replicability of the FISSAC model, and technical developments. A methodology and a software platform will be developed in order to implement the innovative industrial symbiosis model in a feasible scenario of industrial symbiosis synergies between industries (steel, aluminium, natural stone, chemical, construction, and demolition sectors) and stakeholders in the extended construction value chain. […] The platform will then be used to quantify the expected benefits of symbiotic material flows.[5]

Social aspects are one of the main pieces for the successful results of the industrial symbiosis model. This is why a deliverable was dedicated to this subject. The FISSAC project, apart from its relevance and interest in technological innovation, implies a transformation of a well-established global production and operational model, and brings multiple changes that will affect the organisational culture, habits, labour and skills market, etc.

1.4 Partners

The FISSAC project is coordinated by Acciona Infrastructures (Spain). The consortium is composed of 26 partners from nine countries (8 EU Member States and Turkey) and includes:

- general contractor and engineering/construction companies;
- non-profit research organisations;
- SMEs in different sustainable business fields;
- public authorities;
- manufacturing and energy intensive industry organisations;
- standardisation and certification bodies;
- local and regional recycling / sustainable resource management organisations.

1.5 Social Advisory Board

The project counts on the insight and advice from experts on social issues, namely the Social Advisory Board. These experts are not members of the Consortium, but are regularly involved in the project. The partners will be more and more supported by members of the social advisory board specifically about the progress on social aspects of their tasks. Acciona is the point of contact to communicate the progress and any relevant project activities. ACR+ is in charge of coordinate, report and analyses the various tasks of FISSAC around social engagement and acceptance.

The members of the Social Advisory Board who have confirmed their participation are:

- Mr Fredrik Björk (Malmö University, Sweden)
- Ms Teresa Domenech (University College London, United Kingdom)
- Ms Elisabeth Ekener Petersen (KTH Royal Institute of Technology, Sweden)
- Ms Marta Zaragoza Domingo (Cresalida, Spain)

ACR+ and Acciona organised several conference calls (October 2015, January 2016, February 2016, and December 2016) with members of the Advisory Board in order to discuss the outline of the present paper as well as questions about Industrial Symbiosis and previous experiences and lessons learnt.

[5] Description of Work of FISSAC

1.6 Definition of social engagement and acceptance

Social engagement and acceptance are a key challenge for the deployment of an industrial symbiosis project and for the development of a market for secondary raw materials.

Social engagement refers to one's degree of participation in a community or society. Key elements of social engagement include activity (doing something), interaction (at least two people need to be involved in this activity), social exchange (the activity involves giving or receiving something from others), and lack of compulsion (there is no outside force forcing an individual to engage in the activity). (Prohaska an al., 2012).

A general definition of **social acceptance**, which could be adopted for the purpose of this report, is: "a favourable or positive response (including attitude, intention, behaviour and — where appropriate — use) relating to proposed or in situ technology or social technical system by members of a given social unit (country or region, community or town and household, organisation)" (Upham, 2015). Social acceptance can be **influenced by a very wide range of factors**, including project and product characteristics, perception of the distribution of costs and benefits, and degree of public participation.

Healey and al. (2003) propose that the capacity of actors to engage in collective action is determined by the qualities of their social relations (**relational resources**), the knowledge resources that flow around and are developed through these relations (**knowledge resources**), and the capability of actors to mobilize these resources for joint action (**mobilization capacity**).

Typically, **the social dimension** of industrial symbiosis refers to the **need for firms to interact more extensively** than is required for normal business practice (Spekkink, 2016). In his further elaboration of the concept, Gertler (1995) argues that "because industrial symbiosis requires interaction and trust among companies that goes well beyond normal business practice, such expanded collaboration is both a component and a necessary precursor of industrial ecosystem development" (Gertler 1995, p. 15).

Several scholars in the field of industrial symbiosis have applied the concept of **social embeddedness** to study the wider social context in which industrial symbiosis takes place, usually referring to the work of Uzzi (1997) and Granovetter (1985). The concept of social embeddedness expresses the view that economic activities are embedded in (and therefore strongly influenced by) **structures of social relationships**, which may differ across space and time (Granovetter 1985; Uzzi 1997).

Within the FISSAC project, an angle could be to focus on

- The **benefits** for the company, for industrial site members, and for society in general that can occur with an **industrial symbiosis** project. Chataigner and Jobert (2003) pointed out that it is generally "unacceptability" rather than "acceptance" that is actually the focus of interest.
- The concept of **social sustainability**, which is discussed in a wide range of literature with varying emphases: relating to multiple disciplines such as urban planning, international development and accountancy. The notion of social comprises numerous component parts or criteria, such as community cohesion, human wellbeing, effective dialogue, and the access that individuals and communities have to those that make important decisions on their behalf (Whitton et al., 2014).

1.7 Sustainable Development Goals

The 17 United Nations Sustainable Developments Goals (SDGs)[6] are a universal set of goals, targets and indicators that UN member states will be expected to use to shape the agendas and political policies over the next 15 years (2015 – 2030). This ambitious agenda for all of humanity seeks to finish what the Millennium Development Goals started, while adding its own elements. Industrial symbiosis projects are helping to meet the SDGs' target and are playing an essential role and acting as an important engine for innovation in many various sectors.

Figure 2 – United Nation Sustainable Developments Goals

Industrial symbiosis supports a number of the Goals (see below[7]), in particular:

- SDG 8 **Decent work and economic growth**: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all". The concept of industrial symbiosis is essential to the long-term development of global industry in all countries of the world. Developed and developing economies around the world can achieve a more sustainable industrial development trajectory and move their economies towards a circular model more rapidly by taking advantage of the opportunities inherent in this approach.
- SDG 9 **Industry, innovation and infrastructure**: "Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation". Innovation provides one of the keys to do more with less (increased productivity with fewer raw materials).
- SDG 12 **Sustainable consumption and production**: "ensure sustainable consumption and production patterns" through the sustainable management and efficient use of natural resources by 2030 (target 12.2), and substantially reduce waste generation through prevention, reduction, recycling and reuse (target 12.5). With the global population expected to reach 8 billion by 2025, the European industrial sector needs to recognise that a viable, sustainable future for all will depend on the ability to meet growing demand by more efficient use, and reuse of resources.
- SDG 13 **Climate action**: Climate mitigation and industrial symbiosis are strongly linked, both in terms of efforts and in terms of development. In a broader view, the quantification of the circular economy's potential for GHG emissions are found in a growing body of literature. For example:

[6] http://www.un.org/sustainabledevelopment/sustainable-development-goals/#

[7] http://www.international-synergies.com/wp-content/uploads/2015/10/G7-Arden_Clarke-10-Year-Framework-Programme-for-SCP.pdf and http://www.international-synergies.com/wp-content/uploads/2015/10/G7-Laybourn-International-Synergies.pdf

- The Deloitte Sustainability Study "Circular economy potential for climate change mitigation" (2016), which focused on how recycling and reuse could easily cut a third of the GHG emissions that are inherently embedded in our products.
- The Zero Waste Europe and ACR+ study "The Potential Contribution of Waste Management to a Low Carbon Economy" (2015), which focused on the need for a climate-friendly strategy regarding materials and waste.

- SDG 17 **Partnership for the goals**: "Strengthen the means of implementation and revitalise the global partnership for sustainable development". A successful sustainable development agenda requires partnerships between governments, the private sector and civil society. It is exactly the same for an industrial symbiosis project. Moreover, social innovations[8] can be developed and implemented in any sector of society [like industrial symbiosis] and may take any organizational form. It can serve as a starting point for a social enterprise, but just as well be a part of local government, such as a new and more participatory governance approach.

[8] Social innovations are innovations that are social in both their ends and their means.

2. Social engagement and acceptance: Five-Step approach

In this Section 2, the vision (2.1.1), the objectives (2.1.2), and types of stakeholders (2.2) considered in this deliverable D.1.7 are defined.
In section 2.3, the various tasks of the FISSAC project are summarised in Table 4, highlighting the links with social engagement and acceptance.
The necessity of the monitoring and evaluation is described in 2.5.

The social engagement and acceptance strategy of FISSAC is based on a Five-Step Approach[9]. By engaging early and often, the FISSAC project can create value for stakeholders as well as use the engagement process to inform business stakeholders. The five steps are:

1. Develop a vision: Set vision and level of ambition of future engagement. Determine the project's motivation for the engagement, and define objectives.
2. Map stakeholders: Define criteria for identifying and prioritizing stakeholders
3. Prepare for the engagement: Define short- and long-term goals, and set tactics and rules for the engagement.
4. Engage stakeholders: Conduct the engagement itself, ensuring equitable stakeholder contribution and mitigating tension while remaining focused on the issues
5. Establish updated action plans: Use stakeholder feedback to improve project results and tools, build trust with stakeholders, and identify opportunities and plan for future engagements.

2.1 Vision of social engagement and acceptance

2.1.1 Vision

The transition to new models like industrial symbiosis requires new approaches. Technological innovations are not sufficient to change the system of the economy and the relationships between market parties. It is important for public and private parties to seek possibilities to implement technological, social and system innovations from a shared vision and in partnership[10]. For industrial symbiosis projects, a sharing transition is needed. It is in the capacity of people and organizations to enable the sharing of data, resources and profit in order to become more collaborative, circular and cooperative.[11]

In the FISSAC project, the FISSAC platform will be used for the evaluation of the material, energy flow as well as evaluating the environmental impacts and cost of the studied flows. This innovation is largely based on a **technical approach**. However, social engagement and acceptance is an essential pillar of success for the implementation of industrial symbiosis. It is part of the **collaborative approach** of industrial symbiosis. This deliverable brings these 2 approaches – technological and collaborative – together. It looks at the **complementarities and tensions** between biophysics and socio-ecologic concerns.

The work for social engagement and acceptance is tackled at three levels: Company, industrial site and regional level.

At the **company level** (interactions inside the company), a long-term vision of the management team and a deep employee participation are key drivers to boosting innovation and collaborations outside of the company. This is where potentially new (transversal) competences[12] (leadership, teamwork, creativity, communication, vision, strategic…) are needed and new jobs created.

[9] https://www.bsr.org/reports/BSR_Five-Step_Guide_to_Stakeholder_Engagement.pdf

[10] A Circular Economy in the Netherlands by 2050

[11] http://sharify.be/category/news/

[12] See for example: http://fabbisogni.isfol.it

- The social aspects of Industrial Symbiosis projects should be considered in the internal social dimension of the companies. This dimension requires working with the organizational culture as a key element for the success of the proposed change. The organizational culture will affect the kind of strategic management, the staff management model and the organizational structure. For instance, in the phase of construction and project validation, social aspects and organizational non-economic relations (Corporate Social Responsibility or Human Resources policies) are key factors for the viability of any technological innovation or production model. In this regards, it is important to consider the new organizational forms, new models of leadership and staff management that put the hub of activity with people (develop knowledge, new skills, aptitudes and attitudes). Organizational strategy and performance-related goals should also motivate managers to evolve and have an open, flexible mind-set.
- These new models of leadership aim to strengthen key competences and new business models, such as creativity and innovation, teamwork, adaptability, communication, interpersonal relations… Furthermore, they foster social-oriented values in the organization, internal and external to the company, such as cooperation, transparency, innovation and equal opportunities. These values imply corporate competences that benefit from the fulfilment of duties and responsibilities of the team; also by promoting greater motivation and staff involvement. To this end, it would be useful for companies to identify the required professional profiles, skills and competences that need to be attracted. That is a key factor i.e. to keep on learning and improving new competences (corporate and specific) required for new business models and methodologies as in the case of Industrial Symbiosis models suggested in FISSAC (Zaragoza Domingo et al, 2015).
- It is also relevant to emphasize the importance of organisational culture as a factor (opportunity or threat) in the viability of the FISSAC project. Inside company activities, the new economy of knowledge is defined by two main concepts: e-Business and Net Company. Globalization, information and communication technology (ICT), and new demand are transforming company organization and strategy. These changes result in company activities being carried out by computer networks (e-Business) and the definition of a new organisational and strategic model based on business line decentralisation (Net Company) (Torrent et Al, 2008). This new model requires new values (cooperation, equal opportunities, transparency, creativity, solidarity, tolerance, etc.) and therefore, new corporative competences that are demanded to the whole company in the form of behaviours: communication, teamwork, innovation, adaptability, social abilities, stress and emotion management, willingness to learn, etc. These can only be guaranteed by a competence-based human resource model and participative management.

At the **industrial site level** (interactions between companies), where trust is one of the concepts that has been used to capture the social dimension of industrial symbiosis, seen as a key condition for the willingness of actors to share information, to do business together, and to cooperate and commit themselves to industrial symbiosis.

- Collaboration between industrial companies could be associated at a number of potential risks:
    - leakage of information;
    - loss of control or ownership;
    - divergent aims and objectives, resulting in conflict.

  No single form of collaboration is optimal in any generic sense. However, in practice technological and market characteristics will constrain options, and company culture and strategic considerations will determine what is possible and what is desirable.

- If there are existing alliances, new kinds of collaborations could occur but there is a necessity to align mission, vision and values between companies. Many bonds between companies with shared interests fail just because they do not have a clear view of the benefits of networking. Once they understand those benefits, cooperation improves (Zaragoza Domingo, 2017).

- Mutual trust is clearly a significant factor, when faced with the potential opportunistic behaviour of the partners; for example, failure to perform or the leakage of information. […] The following bases of trust in alliances have been identified:
    - Contractual – honouring the accepted or legal rules of exchange, but can also indicate the absence of other forms of trust;
    - Goodwill – mutual expectations of commitment beyond contractual requirements;
    - Institutional – trust based on formal structures;
    - Network – because of personal, family or ethnic/religious ties;
    - Competence – trust based on reputation for skills and know-how;
    - Commitment – mutual self-interest, committed to the same goals;

- Various factors contribute to the success of an alliance :
  - The alliance is perceived as important by all partners;
  - A collaboration 'champion' exists;
  - The existence of a facilitator;
  - A substantial degree of trust between partners exists;
  - Clear project planning and defined task milestones are established;
  - Frequent communication between partners, in particular between marketing and technical staff;
  - The collaborating parties contribute as expected;
  - Benefits are perceived to be equally distributed;
  - Acknowledgement by each company of the benefits of networking;
- Other factors could be:
  - Positive cost-benefit analysis: many companies do not want to establish an alliance as they imagine it will cost them much time and, to a lesser extent, money;
  - The members should have the competences required to network: teamwork, communication, adaptability, strategic vision, emotion management...
  - Aligning values of companies taking part in the project is important, and people within these organisations should have their values also aligned with their companies and finally, with the project;
  - Every worker must have his individual expectations of collaboration clear and they must be concrete;
  - "Emotional contract of alliance": Organisations are made up of people with their own factors; personal, frame and competence ones. Emotional support (or the emotional benefit that people obtain from working in networks or teamwork) that an alliance can offer is an important bond between members.

At the **regional level** (interactions with others stakeholders – public authorities, research centres, citizens...) where governmental organizations play an important role as bridging actors during various stages of the collaborative process through their simultaneous participation in many projects.

- As an industrial site is integrated into a larger geographical area within which there are interactions, it is necessary to work at macro-level, especially considering the role of regional economic policies as a driver for business transformation. A general recommendation to public organizations with the ambition to stimulate industrial symbiosis is that it is important to build on and harness the activities that private actors are already developing in their region, rather than attempt to develop industrial symbiosis in a strictly top-down fashion. This can be achieved by identifying the common ground of the various activities that occur in the region, and articulating this common ground in shared visions (Stekkink, 2016).

- In addition to this, policy instruments should take into consideration the educational system and future prospects so employability can be improved and new skilled personnel attracted.

2.1.2 Main objectives

The objective of this deliverable **D1.7** – Report on Strategies for social engagement and acceptance – is to **define the strategies** for social engagement and acceptance of the different target social groups and stakeholders of the FISSAC Industrial Symbiosis model. This report includes an action plan. The **results of these actions** around social engagement and acceptance will be highlighted in the deliverable **D10.5** – Report of social engagement and acceptance – foreseen at the end of the project. The objective of D10.5 is to identify the main elements related to social engagement and acceptance in industrial symbiosis projects.

2.2 Map stakeholders

Throughout the project duration, target groups of beneficiaries and influencers of the FISSAC model will be involved with the project in the short- and long-term. For example, to validate the FISSAC model, to participate in Living Labs and webinars, to test the replicability of the FISSAC model in new markets and regions, etc.
A first network of stakeholders relevant to FISSAC was identified and set up in Task 1.1. A total of one thousand five hundred direct contacts and more than nine hundred actors were identified, either as 'warm contacts' or contacts of indirect interest in the FISSAC project. The majority of them comes from industry (materials producers, managers, federations, construction companies) followed by research and innovation organisations, public authorities and consultancies.

In the Deliverable D1.4 – Social strategies for FISSAC: Definition of target social groups – a group of stakeholders to be considered in the project was defined:

- At the company level:
  - company CEOs and executive leaders;
  - workers[13];
- At the industrial site level:
  - consultancies and facilitators;
  - local communities;
- At the regional level:
  - local, regional and national policy makers;
  - industry federations;
  - research centres;
  - citizens' groups and consumers.

2.3 Prepare for engagement

2.3.1 Define short- and long-term goals

This section describes how the FISSAC project will reach the objectives of social engagement and acceptance strategy. It is less specific than the action plan of the next section, which focuses on the Who-What-When. An ethnographic approach is used by observing partners of the FISSAC project in their tasks. An immersion in the industrial symbiosis actions as an active participant allows for the recording of extensive field notes. Currently, there is no limiting of what will be observed and no concrete ending point to this kind of study.

The general idea of this strategy is to give an overall direction: to work on social engagement and acceptance, the project partners need to be aware of the impact of social acceptance on the success of an industrial project to provide content in order to create tools disseminated at the end of the project.

The main sub-goals will be:

- To **collect information** and provide resources to and from the project stakeholders around social engagement and acceptance.
  The following resources and assets exist and need to be gathered to help achieve the objectives:
  - Literature review;
  - Feedback from real cases lead by project partners;
  - Living labs in various countries where a variety of the available agents of change (industry, research, civil society organizations, public authorities, policy makers…) will co-creation IS solutions.

- To **implement concrete actions** by and between project partners. They will receive support, notably via interaction with the social advisory board, to help them in their social engagement.
  The technical partners of FISSAC could show resistance that could make it difficult to achieve our objectives due to the fact that the social acceptance project is not in their comfort zone. It is why support for and between them is necessary.
  A large set of techniques may be appropriated to use in the involvement of stakeholders: invitation letters, questionnaires and surveys, exhibitions and road shows, public meetings, use of the full range of the media,

[13] + Unions (representatives of workers' interests).

(semi-)structured interviews, forums, focus groups, advisory committees, workshops, round table discussions… Some of these techniques will be used by main FISSAC partners during the organisation of living labs and in particular by the task leader of the living lab (SP in Sweden). The living labs will be organised by British Glass in the UK, Ingenieurbüro Trinius in Germany, Hifab in Sweden, Fenix in the Czech Republic, Geonardo in Hungary, TCMA in Turkey, OVAM in Belgium (with the assistance of ACR+), SÍMBIOSY in Spain, and D'Appolonia in Italy.

- To **co-create tools** – such as guidelines to help stakeholders to remove barriers linked to social acceptance. FISSAC uses a rigorous bottom-up approach; building on stakeholders' experiences, with top-down conceptual dimensions. The application of a co-construction method demonstrates strengths in understanding stakeholders' perspectives and values, and provides an effective way to get to a shared representation of a complex system. It supports stakeholders' participation in a process that emphasizes empowerment, equity, trust, and learning. It allows an integration of lay (or at least non-technical), technical, and scientific knowledge by stressing the choice of clear and simple terms, and providing access to different ways of thinking about and representing a project of industrial symbiosis.

2.3.2 Set tactics for social engagement and acceptance aspects in FISSAC tasks

The FISSAC project needs to implement concrete actions in order to maintain social interest and minimise any risks and threats that FISSAC might create in the social milieu. The following aspects must be addressed:

- Economic and business aspects (corporate culture, corporate social responsibility (CSR) and human resources policies, innovation, strategic management, organisation, management model, consolidation, etc.);
- Entrepreneurship (new companies... role of social entrepreneurship in circular economies);
- Social aspects (consumer perception about new models affecting their purchases, present and future consumer habits, social welfare, etc.);
- Employability (job creation, quality of jobs, new transversal skills required, training needs…).

The Task on social aspects aims to highlight the importance and raise awareness about the social dimension as a key factor of Industrial Symbiosis model success. The idea is to integrate the social dimension in the work carried out through concrete actions. For this reason, during the third FISSAC general assembly (5-6 October 2016, Brussels), ACR+ formulated an exercise for all the attendees in order to identify the social engagement and acceptance in the different tasks and work packages (WPs) of FISSAC. The attendees used "Post-it" papers of different colours in order to identify the tasks with social engagement and acceptance. Additionally, in mid-November 2016, the project partners received a questionnaire which they completed by 10 January 2017 to give precision on their task in relation to social engagement and acceptance. The objective was to identify for each concerned action which activities will be done around social acceptance in order to increase the knowledge of this aspect.

The following Table 2 summarises the tasks where social aspects will be taken into account and from which the FISSAC project will draw conclusions. It establishes the objectives of stakeholder engagement through the project and indicates how the involvement of stakeholders will be achieved at each stage of the project and dissemination process. The FISSAC project uses a variety of techniques to maximise the participation of community members and stakeholders.

Careful consideration should be given to who will need to be engaged (see 2.2 Map stakeholders, page 17) and what engagement methods will be the most efficient and effective to successfully deliver the project. One tool for considering the appropriate engagement approach for a particular project is the spectrum developed by the International Association for Public Participation (IAP2)[14]. It identifies five approaches to engagement that result in varying levels of influence by the community and internal and external stakeholders: Inform, Consult, Involve, Collaborate, and Empower.

To specify more deeply the actions for the next period of the project, a meeting between each partner involved and with members of the Social Advisory board will be organised. The objective is to improve the stakeholder engagement in the FISSAC project.

[14] http://www.advertising.nsw.gov.au/sites/default/files/downloads/page/appendice_f.pdf

An analysis, at this stage, shows that:

- 21 actions are more concerned by social engagement and acceptance than the others and the two main partners are Acciona and SP.

Table 2 – Leaders of the tasks related to social engagement and acceptance

Leader	1.1	1.4	1.6	10.4	2.1	2.4	3.1	3.2	3.5	5.1	5.5	6.3	6.4	6.5	7.1	7.2	7.3	8.1	8.3	8.4	9.2	Total
ACCIONA			1		1	1				1			1									5
SP							1				1				1	1						4
FENIX																		1	1	1		3
ACR+	1			1																	1	3
D'Applonia														1			1					2
Ekodenge		1										1										2
RINA									1													1
Trinus								1														1
Total	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**21**

- The main categories of stakeholders to which actions are foreseen are:
  - Companies (16 tasks);
  - Consumers (11 tasks);
  - Public Authorities (10 tasks).

Table 3 – Main stakeholders concerned by the tasks related to social engagement and acceptance

Task		1.1	1.4	1.6	2.1	2.4	3.1	3.2	3.5	5.1	5.5	6.3	6.4	6.5	7.1	7.2	7.3	8.1	8.3	8.4	9.2	10.4
Companies	16	x		x	x	x	x	x	x		x	x	x		x	x		x	x	x	x	
Consumers	11			x		x	x		x		x		x	x	x			x	x		x	
Public authorities	10			x		x			x		x		x	x	x			x	x		x	
Others	4				x														x		x	x

- Few actions (4) directly concern industry federations, consultancies and facilitators, research centres and local communities. During the next period of the project, attention will be paid to increase the actions to target these categories of stakeholders.

The extent to which stakeholders are to become involved during the development of FISSAC (from full involvement of stakeholders to simply undertaking consultation/dissemination exercises) is described in the Table 4 below. This table also identifies if the task concerns actions inside a company, in interactions between companies or at the regional level. It is a work in progress that will be updated during the entire project duration and finalised at the end of the project. In fact, only 6 out of 21 tasks are already finished (Task 1.1, 1.4, 1.6, 2.1, 2.4, and 3.1).

Table 4 – Tasks related to social engagement and acceptance

WPs and Tasks	WP & Task description			Who is organising the involvement
	Purpose of stakeholder involvement	Methods of achieving involvement	Stakeholders to be involved	Status of the action
WP1	FROM CURRENT MODELS OF INDUSTRIAL SYMBIOSIS TO A NEW MODEL			
Task 1.1	**Stakeholders network and analysis of IS model**			**ACR+**
In the ecosystem	Establishment of a stakeholder network (industries, civil society organizations, public authorities and policy makers) Evaluate drivers and barriers (qualitative) via analysis of 60 practical cases of IS Evaluation of replication in other regions	All project partners were requested to indicate a list of actors with whom they have regular collaborations, and who would be interested in FISSAC activities. Sixty best practices collected from FISSAC project partners with some semi-structured interviews with actors Literature review to evaluate drivers and barriers (qualitative)	Internal partners + Some industrial actors	09/15 - 02/16 Done
Task 1.4	**Identification and development of […] IS indicators for quantifying the environmental, economic and social dimension of IS initiatives** *To be able to bring a holistic approach to the indicator-based assessment in FISSAC project, indicators addressing environmental, economic and social issues were studied. The range of social indicators included in the proposed list are based on the possible social benefits of IS. Main criteria of selection was the ability to quantify these social aspects as the list of the indicators suggested in the "Deliverable 1.6: Industrial Symbiosis Indicators" are mainly limited to quantitative indicators to minimize subjectivity of analysing qualitative aspects.*			**Ekodenge**
Inside company	Indicators related to social responsibility, lifelong learning, Health and safety at work, innovation, and investment in R&D	Detailed literature review on existing social indicators used within the EU Feedback asked from FISSAC partners	Internal partners	03/16 - 08/16 Done
Between companies	Indicators related to creation of IS (number of liaisons, shared facilities)		Internal partners	
In the ecosystem	Indicators related to job creation and retention, rate of community participation, level of social acceptance, community development		Internal partners	
Task 1.6	**Paving the way to FISSAC Industrial Symbiosis Model: Methodology and Software Platform** *The aim of this task is to set up the baseline of FISSAC Industrial Symbiosis Model.*			**ACCIONA**
Inside company	Exploitation of services such as internal consulting services for applying the FISSAC model or/and applying the model directly	Internal stakeholder engagement: internal meetings (one-on-one or group meetings → Acciona Workshop in November 2016), email	Acciona employees	

	Acciona internal awareness of social aspects of a new model of Circular economy and acceptance of the new products/applications	or newsletter		
Between companies	Establishment of tentative synergies between industrial processes and actors To facilitate clustering to prevent by-products from becoming waste	During the Acciona Workshop, the FISSAC model was presented to different departments of Acciona, other members of the consortium, and companies outside the consortium Newsletters One-on-one and Group meetings inside Acciona, other members of the consortium, and companies outside the consortium	Companies involved in the construction sector, public authorities in particular at local or regional level, recyclers and materials federations, manufacturers of products and services that potentially can use secondary raw materials	09/15 - 02/17 Done
In the ecosystem	Networks of public authorities and consumers	Workshops Newsletters	Public authorities, consumers	
WP2	CLOSED-LOOP RECYCLING PROCESSES TO TRANSFORM WASTE INTO SECONDARY RAW MATERIALS			
Task 2.1	**Definition of technical requirements of secondary raw materials** *The main objective of this task is to define the technical requirements of the secondary raw materials used in the sectors where the industrial tests will be carried out.*			**ACCIONA**
Inside company	Importance of internal organisation for the definition of technical requirements of secondary raw materials for green products	Internal stakeholders engagement Meeting, interviews and newsletters	Acciona employees	
Between companies	Importance of the definition of technical requirements of secondary raw materials for green products	FISSAC partners and industrial stakeholders Meeting, interviews and newsletters	Large companies SMEs Public/private research Centres Universities Non-profit associations	09/15 - 02/16 Done
In the ecosystem	Definition of technical issues of secondary raw materials, feedback from public authorities and consumers	Workshops Newsletters	Public Authorities Consumers	
Task 2.4	**Overcoming non-technological barriers: [..] to identify and analyse the main non-technological barriers**[15]			**ACCIONA**
Inside company	Barriers related to leaders and workers in the company	Dissemination activities of the demonstration activities	Acciona employees	95/15 - 02/17 Done

[15] Economic, legislative/regulatory, organisational, social/cultural [...]

		Face-to-face meeting Phone meeting Group meeting		
Between companies	Barriers related, among others, to truth between companies	Face-to-face meeting Phone meeting Group meeting	Consortium Companies	
In the ecosystem	Barriers related to interactions with public authorities and consumers	Face-to-face meeting Phone meeting Group meeting	Public authorities Consumers	
WP3	PRODUCT ECO-DESIGN AND CERTIFICATION			
Task 3.1	**Evaluation of the proposed processes and value chain from a life cycle perspective in order to ensure their environmental and economic sustainability** *Task 3.1 and 5.5 aim at evaluating the environmental and economic consequences of the transition to IS. In order for these kinds of assessments to be performed and have an impact, it is important that the participating industries have both knowledge and trust to collect and share the data needed. The output of these assessments can be important to boost the understanding and acceptance for the FISSAC IS and its products, among customers and the society.*			**SP**
Inside company	Social aspect related to internal data collection will be analysed Contact with companies for data collection, for Life-Cycle Assessment (LCA)[16] and Life-Cycle Cost (LCC)[17].		Companies	
Between companies	Companies need to share economic and environmental data in order to evaluate IS effects and to collaborate on improvements of the IS for LCA and LCC (The information requested from the suppliers must also be produced in a standardized manner to enable comparative study). Data collection and preliminary results in 3.1. Focus on communication and acceptance for data collection among partners and actors in the value chain. Acceptance among the partners in sharing data are crucial for our assessments to be made, and the results may contribute to social acceptance of the IS and its products		Companies	02/16 - 02/17 Done

[16] Life-Cycle Assessment is a methodology to assess the environmental aspects and potential impacts associated with a product, process, or service considering a "cradle-to-grave" approach, which begins with the gathering of raw materials from the earth to create the product and ends at the point when all materials are returned to the earth (including stages such as manufacture, transport, use, maintenance and final disposal).

[17] Life-Cycle Cost is the sum of all costs for fulfilling a specific function encompassing all relevant aspects of products and services needed, from (raw material) acquisition until disposal or recycling

In the ecosystem	Output of the LCA study can be used to communicate and disseminate the environmental consequences of the IS to end-users and authorities		Customers and society	
Task 3.2	**Eco-design of cost-effective products** *The Task is to optimize the products from an Eco-design perspective. It will consider technical, environmental, social, and economic factors and cover the whole life cycle of the product. By communicating with the producers, we will improve their understanding of eco-design. The aim is to guide towards a balanced optimization of production, use and end-of-life of the product. Additional aspects of concern lie beyond the immediate product scope, including recycling and recyclability, integrated systems and synergies, so that broader perspectives are properly and proactively considered.*			**TRI**
Inside company	Improve the awareness of social aspects in Eco-design Establish the list of eco-design items covering social aspects like health & safety of the product with the objective of integrating selected feasible social aspects in the eco-design indicators.	1 Run brainstorming sessions about eco-design aspects with involved companies 2 Explain the eco-design concept and process during meetings with other project partners (LCC and LCA conductors) 3 Distribute our in-house developed eco-design matrix among the project partners to let them have better understanding of eco-design. 4 Contribute to developing a list of items (information requested from manufacturers for LCC/LCA/eco-design) by integrating the eco-design aspects. Communicate with the manufacturers and LCA/LCC conductor about various aspects of eco-design to enable fluent eco-design process (information requested for eco-design, information format etc.)	Companies Internal partners	11/16 - 05/17
Between companies	With eco-design, producers could be influenced to consider various aspects of a product to optimise it and the related production process.		Companies - manufacturers / product producers	
In the ecosystem	Achieve wider influence among the manufacturers through the superior performance and positive market prospects of the eco-designed products.		Companies - manufacturers / product producers	
Task 3.5	**Environmental Technology Verification (ETV)** *RINA will perform the ETV eligibility assessment of the technologies / products developed. At this stage, designers and manufacturers of the technologies/products are expected to share with RINA information related to the technology's environmental performance. This activity will allow to have a deeper view and increase awareness of what are the major positive and negative environmental aspects of the technologies/products.*			**RINA**
Inside company	Workers can have, trough Environmental Technology Verification (ETV), a higher awareness of the environmental performance and impacts of their activities.	Preliminary environmental performance information can be shared within the organization.	Workers	03/17 - 02/20
Between	At the end of the ETV process, technology purchasers	Publication of the Statement of Verification	Companies - Technology	

companies	(public or private) will benefit from it, being able to select the performing eco-technologies fitting their needs. ETV will provide information on which they can base their purchasing decisions.	on the public website	purchasers	
In the ecosystem	Citizens, regulators and decision-makers will benefit from ETV process with solid information on the level of performance achievable by new environmental technologies ready for the market.	Publication of the Statement of Verification on the public website	Consumers, regulators and decision-makers	
WP5	INDUSTRIAL PRODUCTION & REAL-SCALE DEMONSTRATION			
Task 5.1	**Project Design of the constructive solutions** *In this task, the design of the constructive applications of the new products will be carried out. The design documents will be developed into comprehensive construction drawings and specifications (calculation, dimension and configurations) which will be used as the basis for the construction solutions of the case studies to be developed in Task 5.3. The design will define all physical components and constructive solutions to be demonstrated in specific case studies*			**ACCIONA + AKG**
Inside company	Internal awareness of social aspects			02/18 - 08/18
In the ecosystem	Public administration acceptance of the new products/applications			
Task 5.5	**Sustainability assessment of the solutions: LCA and LCC of real case studies** *See 3.1*			**SP + TCM**
Inside company	Analysis of the acceptance from material producer (cement etc.) leaders in terms of decision about green materials (such as calcium sulfoaluminate cement) Analysis of acceptance from waste producers by supplying waste in the required properties. Contact with companies for data collection, for LCA and LCC.		Leaders of industrial companies Companies - waste producers	02/19 - 02/20
Between companies	Companies need to share economic and environmental data in order to evaluate IS effects and to collaborate on improvements of the IS.		Involved companies	
In the ecosystem	Interaction between companies and universities around new research areas Interaction between companies and public authorities around new regulation Engagement of stakeholders		End-users public authorities	

	Output of the LCA study can be used to communicate and disseminate the environmental consequences of the IS to end-users and public authorities			
WP6	FISSAC MODEL FOR INDUSTRIAL SYMBIOSIS			
Task 6.3	**Monitoring and evaluation of results with the platform, including real-scale test and compilation of the FISSAC life-cycle inventory (LCI)[18] Database** *The FISSAC Software Platform aims to go beyond the existing platforms by integrating capabilities of EPESUS and GEO-CLUSTERING software and adding network analysis functionalities to assess the roles of partners within the industrial symbiosis network and evaluate the success of overall operation using social network analysis (SNA) methodologies. The mathematical quantification background of the "Networking" feature of the ICT Platform relies on graph theory which is widely used for social network analyses (SNA). The SNA-related aspects have been found directly applicable to Industrial Symbiosis analyses.* *IS distance and cooperation potential index scores; clustering and benefits evaluations; impact on possible stakeholders and society. Additionally, novel network analyses based on SNA capabilities and especially visual representation of the network will help to assess indicators with a social dimension such as:* • *Reciprocity, which assures collaboration is beneficial for all participants* • *Centrality, which is indicative of a company's position in the network (direct centrality) and a measure of its influence and ability to pass on information (betweenness centrality).*			**Ekodenge**
Inside company	Reciprocity[19] will be evaluated		Companies	03/18 - 02/20
Between companies	Centrality[20] will be evaluated. Through the Software Platform, IS networks can be studied in terms of knowledge networks.		Companies	
In the ecosystem	Social acceptance will be evaluated when the FISSAC platform will be made available to stakeholders.			
Task 6.4	**Definition of the final version of FISSAC Industrial Symbiosis Methodology** *In this task, the final version of FISSAC methodology will be defined. FISSAC final scenario will be a feasible demonstrator of industrial*			**ACCIONA**

[18] LCI is the life-cycle inventory, which is the data collection portion of Life-cycle assessment. LCI is the straightforward accounting of everything involved in the "system" of interest. It consists of detailed tracking of all the flows in and out of the product system, including raw resources or materials, energy by type, water, and emissions to air, water and land by specific substance.

[19] IS literature has emphasised that companies in IS networks are engaged in mutually beneficial exchanges (reciprocity). However, when analysing concrete IS dyads, cooperative links also seem to occur when no direct payback is attached to them, analysed on a single transaction basis. In this last case, the rationale of the behaviour has to be linked to more subtle and inter-temporal frameworks than the one presented above, taking into account generalised reciprocity and network balancing. A distinction should be made between symmetric (non-directive) relationships and asymmetric relationships.

[20] Centrality is an indicator of the position of different nodes in the network and the relevance of the role played by each of them. Simply put, it serves as a measure of how many connections one node has to other nodes.

	symbiosis synergies between industries (steel, non-ferrous metal, mineral, chemical, and construction & demolition sectors) and stakeholders in the extended construction value chain.			
Inside company	Definition of FISSAC scenario Synergies between sectors Non-technical barriers to replicate industrial symbiosis	During the Acciona Workshop, the FISSAC model was presented to different departments of Acciona, other members of the consortium and companies outside the consortium, emails or newsletters	Acciona employees	03/17 - 02/20
Between companies	Establishment of tentative synergies between industrial processes and actors To facilitate clustering to prevent by-products from becoming wastes It will guide how to overcome non-technical barriers (social/cultural…)	During the Acciona Workshop, the FISSAC model was presented to Acciona (different departments), other members of the consortium and companies outside the consortium Newsletter One-on-one and Group meetings between ACCIONA, other members of the consortium, and companies outside the consortium	Companies involved in the construction sector, public authorities in particular at local or regional level, recyclers and materials federations, manufacturers of products and services that potentially can use secondary raw materials	
In the ecosystem	It will guide how to overcome non-technical barriers (legislative/regulatory…) Evaluation[21] of replication in other regions and of the impact generated on society.	Workshop Newsletter	Public authorities and consumers	
Task 6.5	**Definition and validation of FISSAC model** *Social aspects related to the defined FISSAC model will be studied through social network analysis[22] and eco-innovation/industrial symbiosis indicators. This assessment will not only be performed for the cases handled in FISSAC project, since the ambition of the model is to be replicated in other regions and other value chains symbiosis scenarios. Moreover, the validation will take into account the establishment of cooperation and communication patterns between network participants.*			**D'Applonia**
Inside company	Indicators related to social responsibility, lifelong learning, Health and safety at work, innovation and investment in R&D will be analysed.			03/17 - 02/20
Between companies	Indicators related to creation of IS (Number liaisons, shared facilities) will be analysed			

[21] "One of the partial objectives set in Task 6.4 is to evaluate the impact generated on society. However, in the description of the project, no activity or methodology, method or model of social impact assessment which achieves this objective is envisaged, neither during construction phase nor in the operational and replication in other regions phase." 31 August 2015, report of one member of the Social Advisory Committee, Marta Zaragoza Domingo.

[22] See for example: Structure and morphology of industrial symbiosis networks: The case of Kalundborg (Domenecha, T., Daviesa, M., 2011)

	Establishing cooperation and communication between symbiosis network participants will be of question.			
In the ecosystem	Indicators related to social network analysis (SNA), job creation and retention, rate of community participation, level of social acceptance, and community development will be analysed. An attention will be brought to the understanding of user needs. The idea of extending involvement goes far beyond customers and end-users. (Open) innovation requires building such relationships including suppliers, collaborators, competitors, regulators and multiple other players.		Customers, end-users, suppliers, collaborators, competitors, regulators and multiple other players.	
WP7	INDUSTRIAL SYMBIOSIS REPLICABILITY AND SOCIAL ISSUES			
Task 7.1	**Establishment of a Living Lab for replicating the FISSAC model** *Task 7.1 will develop Living Labs (LLs) for where construction sector stakeholders will co-design and test solutions (technologies, processes, policies, etc.) relevant to a transition towards circular business models in a country context. Social aspects at all three levels will be relevant in the LLs.*			**SP**
Inside company	The Living Lab[23] will evaluate how manufacturing companies tend to orient themselves around products and technologies (changes in organizational principles, policies, structures and processes which are new for the manufacturer). The living lab is a lot about learning the actual working of an organisation. To understand not how you should do things but how an organisation actually works. This learning can be very hard to accept, because you realise you are doing many things "wrong". Companies will 'test' their own internal assumptions and behaviours in the context of IS collaborations. However it is not certain that multiple representatives from a given company will participate in the LL.	Through M18, the focus is on developing the LLs as a tool for IS, using Sweden as a test case. Relation to social aspects will become more specified once some findings are available. After that, task leaders will collect and summarise the social aspect learnings for the various living labs	Companies	09/16 - 02/20
Between companies	The LL is a forum for interactions between the companies. The social aspect represents much of what is being tested.		Companies	

[23] Living Lab: a user-centric platform based on every day practices and experiences and research. It facilitates user influence in an open and collaborative innovation process engaging all pertinent stakeholders in real life context, aiming to create validated and sustainable values and often operating in a territorial context.

	The living lab will analyse the way to create circular economy relationships among industries. The necessary changes have to be identified and we need to define a transition step-by-step process.			
In the ecosystem	This platform of Living lab can be employed as part of a Transition Management (TM)[24] strategy. Representation from the public sector and possibly third sector/civil society will be included in the LLs if possible. Role and interests will vary by lab context. Citizens and consumers could be brought into a development process and need to understand how their input may be used (not as command, but as recommendations).		Public authorities, Possibly third sector/civil society Citizens and consumers	
Task 7.2	**Analysis of the condition of the various represented industries to detect technological and non-technological drivers and barriers for the purpose of creating industrial symbiosis and circular economy** *Task 7.2 will study innovation system and transition dynamics related to IS for the construction sector, including but not limited to the solutions being tested in the LLs. Depending on the findings different social aspects at all three levels may be relevant.*			**SP**
Inside company	The analysis may look at organisation-level needs to the extent that these are generic and not project-specific. E.g. human resource and knowledge development needs at the firm level may be of relevance. Weight given to these issues will depend on the findings.			03/18 - 02/20
Between companies	The analysis may look at intra-firm issues to the extent that these are generic and not project-specific, for example barriers and drivers for co-investment. Weight given to these issues will depend on the findings.	Inclusion of social aspects in the analysis based on a structured set of interviews with stakeholders from the different industries.	Stakeholders from the different industries.	
In the ecosystem	The analysis will consider social acceptance at the contextual level (in the TIS[25] framework this is often looked at as part of technological 'legitimation'). Weight given to these issues will depend on the findings.			
Task 7.3	**Evaluation of the replicability of the model**			**D'Applonia**

[24] Transtition Management ™ is a strategy or governance tool to facilitate transitions from a current socio-technical regime to a new one, and is frequently applied in relation to the transition to more sustainable social, economic, or industrial arrangements.

[25] The Technological innovations systems (TIS) methodology allows stakeholders to understand their regional innovation clusters' performance in particular technology and knowledge domains, looking at so-called "structures" and "dynamics of technological innovation systems".

	Within this task, the possibility to extend social acceptance of FISSAC Model in other regions and other value chains symbiosis scenarios will be assessed through the definition of replicability criteria and evaluation protocols as well as through SWOT analysis addressing social aspects and barriers. *Replicability aspects will be tackled considering technical and non-technical barriers in a broad context, with particular reference to the social and cultural aspects that can be at the basis of the real industrial uptake of an innovative technology and approach.*			
Inside company	Indicators related to social responsibility, lifelong learning, health and safety at work, innovation, and investment in R&D will be analysed from the replicability point of view.	Starting from the data collected within previous WPs, related to the quantification of social benefits associated to FISSAC Industrial symbiosis methodology, the impact of FISSAC Model in terms of social acceptance within each of the value chains addressed will be evaluated. The analysis will focus on the following aspects: • Social responsibility, lifelong learning, Health and safety at work, innovation and investment in R&D • Creation of IS (Number liaisons, shared facilities) • Job creation and retention, rate of community participation, level of social acceptance, community development, lifestyles change and consumption behaviours.		03/18 - 02/20
Between companies	Indicators related to the creation of IS (number of liaisons, shared facilities) will be analysed from the replicability point of view. Data collected in the previous WPs, identifying the quantified social benefits associated to the FISSAC Industrial symbiosis methodology, will be analysed with the final aim to evaluate the impact in terms of social acceptance within each of the value chains addressed.			
In the ecosystem	Indicators related to job creation and retention, rate of community participation, level of social acceptance, community development, lifestyles change, and consumption behaviours will be analysed from the replicability point of view. Influence of the public authorities/ association, sectorial associations, policy makers… for the replicability of the model		Community, Consumers, Sectorial associations, Public authorities/policy makers	
WP8	EXPLOITATION AND BUSINESS MODELS FOR INDUSTRIAL SYMBIOSIS			
Task 8.1	**Management of intellectual property rights** *This task aims to ensure the assessment of the intellectual property rights (IPR) protection of all results and proposition of the most suitable form of IPR protection. IPR protection is not always required and it is the aim of the IPR management task to ensure that the interest of all involved partners is taken into consideration when assessing the adequate form of IPR protection of results in connection with the interest of stakeholders. The main barrier is the lack of understanding of the importance of IPR and the high bureaucracy that makes the procedures related to IPR protection too long.*			**FENIX**
Inside company	Promote awareness of IPR importance and boost the implementation of IPR.	Analysis and assessment of project results from the perspective of IPR and assessment of the adequate forms of its protection. Engagement of involved partners and key stakeholders in order to assess the best	Companies – management and workers	09/15 - 02/20
Between companies	Increase awareness of benefits of IPR protection and properly handled joint ownership of IPR.		Companies, entrepreneurs	

In the ecosystem	Empower the commercial viability of the results and influence its strategic positioning inside the broader ecosystem. Support to entrepreneurs to develop solutions which can be adopted reliably by customers and/or end-users.	measures of IPR protection. Workshop and conference organisation for partners and stakeholders in order to a) broaden awareness of IPR importance b) highlight the benefits of IPR c) inform about the up-to-date status of IPR management and measures taken.	Industry, research, civil society organizations, public authorities and policy makers.	
Task 8.3	**New business models for industrial symbiosis towards a circular economy** *The aim is to develop business models to commercialize project results. Social aspects are a critical element of business models and should be in line with the value proposition and project purpose. New business models of industrial symbiosis towards a circular economy should integrate, among others: social innovation (such as new sustainable lifestyles, consumption behaviour, household and community penetration), gender equality aspects, regional and national industrial symbiosis programmes and best practices, ample coordination of all stakeholders such as industry, research, civil society organizations, public authorities and policy makers; policies, legislation, and standardisation; and verification of processes, products, and/or services. It will be a target of the business model task to design such a solution addressing non-technological aspects such as social, legal, regulatory or cultural. Integrating social engagement aspects, along with the exploitation plan and replication strategy, it should provide new widely accepted solutions. The critical success factors will be tested and validation of the business models will be done by end-users.*			**FENIX**
Inside company	Business model (BM) management analysis. Delivering message of benefits of new business models for IS. Analysis of individual needs and preferences about construction & demolition waste (CDW) management, and consequently reflect them in the BM creation	Mapping business model environment Analysis of end-user needs and preferences to define widely accepted BMs Engagement of individuals and companies in BMs Engagement of other stakeholders in BMs Widely accepted functional business models which enhance industrial symbiosis and circular economy. Business models which can be employed by various groups of companies and stakeholders across Europe.	Companies	03/18 - 02/20
Between companies	New BMs will be developed to address the barriers which have so far prevented regionally or locally adapted solutions with an emphasis on non-technological aspects. Combination of products, processes and services that each stakeholder may benefit from. Business model networking analysis. Engagement of companies in business model creation so that it can be replicated across various companies. Adaptation of new BM leading to sustainable development.		Companies	
In the ecosystem	Support to entrepreneurs to develop solutions which can be adopted reliably by customers and/or end-users. Ample coordination of all stakeholders such as industry, research, civil society organizations, public authorities, and policy makers. Business model environmental mapping.		Customers, end-users Industry, research, civil society organizations, public authorities and policy makers.	

	Cooperation with other stakeholders and integration their offers into the BM, looking for possible synergies with national programmes.			
Task 8.4	**Business Plan outline** *The aim is to write business plans arguing that new business models for industrial symbiosis lead to a sustainable future through circular economy. Sustainable solutions are essential for prosperous society and future development. The business plan should support the business models and explain the steps needed to achieve the goals of each model. It will be developed as a sustainability strategy, outlining what will happen to FISSAC outputs at the end of the project, and exploring how they can be sustained.* *Social issues are seen as an important way to increase profitability and attract customers, employees and investors. Social engagement is critical for future success of the FISSAC model and competitiveness. Testing, validation and communication with potential users can create new business opportunities and ways to the market.* *Thus, along with the Exploitation Plan results, defined business models, market assessments and other analysis, social aspects will be integrated in the business plan to ensure successful implementation of industrial symbiosis models.*			**FENIX**
Inside company	Business plans tailored to different stakeholder groups. Business cases for individual companies.	Communication with individuals and companies to design the best business cases. Business plans communicating benefit of IS to wide public and various social layers	Companies	03/18 - 02/20
Between companies	Communicate new BM with companies customers/end-users. Proof that adaptation of new BMs lead to sustainable development. Demonstration of economic benefits for company through viable business model (cost reduction, environmental consciousness and alignment, future growth)		Companies	
In the ecosystem	Engagement of other stakeholders to the business plan definition.	Communicating the results of economic (impact) analysis on broad society and other stakeholders.		
WP9	DISSEMINATION *WP9 Dissemination aims to make stakeholders aware of the project and to disseminate the project results towards its future exploitation. To reach this objective, ACR+ created a dissemination plan which will be deployed and updated throughout the project lifetime.* *The FISSAC Dissemination strategy and its deployment throughout the project is key to social engagement and acceptance of the project, as it is the means by which we communicate on the project, it plans and gives advice on how to bridge the gap between the consortium and the outside world. The development of a well-formed brand increases recognition and trust in the project mostly but on a broader scale it can also be used to increase the social acceptance of Industrial Symbiosis.*			ACR+
Inside	Education of construction and demolition supply chain on	**Design of a project visual identity**	Companies involved in	09/15 - 02/20

company	the need to recycle materials (glass, concrete, steel, …) and how to do so Increase capacity of employees regarding topics covered by the webinars and newsletter special reports	The objectives of the project identity are to: a) Develop a design structure that would accommodate standard project identity elements, a variable visual identity in various uses, and be able to convey thematic information when needed. b) Allow an immediate recognition of the FISSAC project thanks to standardized communication templates meant for external audiences. Following and respecting the project visual identity allows to maximise the impact on the audience. c) Develop specific guidelines and structures related to the templates such as a specific set of colours and/or typography. This is linked to social aspects in the sense that a recognisable visual identity gives immediate recognition of the project, helping external audiences associate a message with the overall project and therefore facilitating mental links to industrial symbiosis. Having visually appealing communication material also reinforces the professional appearance of a project, thus favouring trust stakeholders will have in our work. **Project website** The website was designed by a subcontractor in accordance with the FISSAC visual identity and is managed by ACR+. It aims to be dynamic and interactive in order to ensure a clear communication and wide dissemination of project news, activities and results. The website is of primary importance due to the expected impact on the target audiences. The website is the primary communication	the construction and demolition sector	
Between companies	Increase awareness of the need of trust between companies		Companies involved in the construction and	

	Increase awareness of benefits of Industrial Symbiosis Increase awareness of pilot projects taking place on Industrial Symbiosis	channel of the project and therefore must be updated regularly with clear and concise information to encourage social acceptance of the project. Furthermore, it has been translated in the languages of the project partners and includes a contact form to allow dialogue with external audiences. The availability of the website in multiple languages further emphasises the holistic nature of Industrial Symbiosis and will help facilitate the cooperation between different companies. Other Communication channels include **trainings and webinars** 1st one on February 23th on tools for Industrial Symbiosis and Social acceptance. The next ones will be around M25, M37, M49), social media, newsletters, press releases, events and conferences, living labs, and videos. Guidelines creation for sustainable construction with social engagement and acceptance section to reach a high success rate in their industrial symbiosis projects	demolition sector; Environmental companies collecting and storing waste streams Recyclers; Material federations; Product manufacturers using secondary raw materials from the construction and demolition sector; Consultancies and facilitators;	
In the ecosystem	Increase of awareness of multi-stakeholder process. Collect information and provide resources to and from the project stakeholders Increase knowledge and capacity regarding industrial symbiosis, sustainable construction, and circular economy with the highlighting of social aspects.		Public authorities in particular at local or regional level; Research centres; Certification institutions Members of European platforms (e.g. Climate KIC), Public authorities - European, national and regional policy makers; A wide European Industrial Symbiosis research community; Network of national contact points (NCPs) for the climate and environment	

			programme; Consumers and citizens groups	
WP10	MANAGEMENT			
Task 10.4	**Social engagement and acceptance** *Social engagement and acceptance will be tackled in the project considering inputs from members of the Advisory Board on Social issues. The social impact point of view of key industrial partners (SMEs, large industries), research organizations, associations and public authorities will be summarised in this report*			**ACR+**
Inside company	Assess business culture (organisation structure, leadership models) Summarise results of tasks described in this table	Semi-structured interviews will be conducted with project leaders and stakeholders. The lead questions will be developed by the support of the Social Advisory board and first interview will be conducted during the General Assembly in March 2017 Report	Companies: project managers Companies	09/15 - 02/20
Between companies	Summarise results of tasks described in this table	Report	Companies	
In the ecosystem	Capture benefits and risks for all sorts of stakeholders via SWOT analysis of the 3 cases and deep questionnaires: Flanders Materials Programme (BE), Manresa (ES), Iskenderun Bay (TR) Highlight the social dimension in practice for the transactions of the 3 analysed cases. Summarise results of tasks described in this table	Questionnaires has been answered by the partner responsible of the 3 cases Site visits will be organised in Belgium and in Spain (not in Turkey due to the fact that the project is finished) Report	Internal partners: OVAM, Símbiosy, Ekodenge Companies, public authorities, consultants as facilitator Every type of stakeholders	

2.4 Engage stakeholders: Conduct the engagement itself

The action plan in the previous table describe the way the FISSAC project will meet its objectives through detailed action steps that describe how and when these steps will be taken. Some actions were realised between Month 0 and Month 17 and a larger set of actions will be implemented from Month 18 to Month 54.

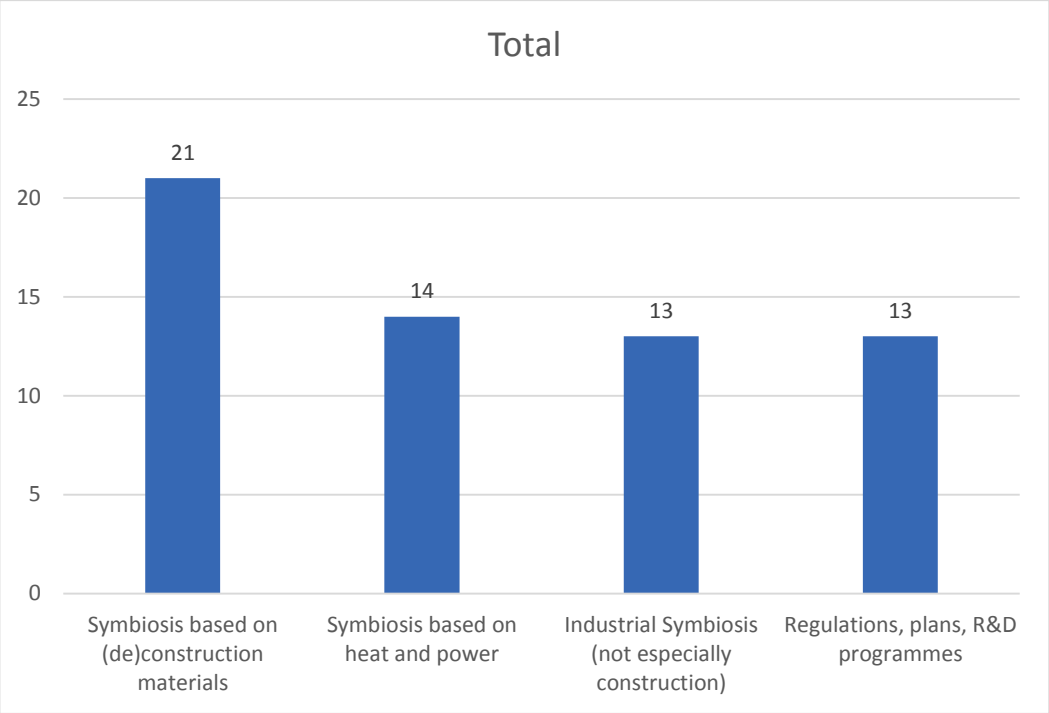
2.4.1 Stakeholders network and analysis of 60 practical industrial symbiosis cases (Task 1.1)

Who: ACR+
When: From 09/15 to 02/16

In Deliverable D1.4. – Social strategies for FISSAC: Definition of target social groups – the collected cases were analysed for the opportunities and benefits created by Industrial Symbiosis projects. The FISSAC project partners compiled over **sixty cases** from across Europe and the world as part of Task 1.1 'From current models of Industrial Symbiosis to a new model'. Based on the information collected, we have identified four types of projects:

- Symbiosis based on heat and power;
- Industrial Symbiosis for various materials;
- Symbiosis based on (de)construction materials;
- Regulations, plans and R&D programmes related to industrial symbiosis.

Figure 3 – Repartition of 4 types of the analysed IS cases



Some conclusions related to social engagement and acceptance of D1.2. are the following:

- At company level:
  - Non-secretive leadership style and management profile of high-level executives in a company has proven to be inspirational for employees. In some cases, a passionate and committed CEO[26] has initiated and driven such projects by solving a number of problems.
  - The team can be motivated from the transformation of business, serving as a new source of inspiration.
  - Investing in Industrial Symbiosis can often be associated with a 'green' and sustainable profile that a company wants to promote.

[26] If managers have the key competences; mainly transversal ones (communication, adaptability, emotion management) hence, are leaders, that will be the best warranty to motivate workers.

- At industrial site level:
  - Promoting a culture of cooperation – building transparency and open communication and trust is critical for synergistic projects. On the other hand, having companies engaged in Industrial Symbiosis projects is a way of initiating the process of building trust.
  - Developing a sense of community between the companies within a network will make them realise a multitude of resources to be shared (e.g. waste streams, water, energy, by-products, ideas, people) and gradually develop their willingness to collaborate.
  - Having different firms collaborating at the very first stages of the project (idea, partnership, and concept) is important.
- At the regional level:
  - Stability and long-term vision provided by local and regional policy makers will provide a favourable environment for investing in Industrial Symbiosis.

Hereunder, a brief summary of what we can learn with a **literature review** of the social aspects of industrial symbiosis.

Industrial symbiosis (IS) has emerged as a body of exchange structures to progress to a more eco-efficient industrial system, by establishing a collaborative web of knowledge, material and energy exchanges among different organizational units. [...] The effective operation of such networks relies heavily on aspects such as trust and general reciprocity, aspects insufficiently covered in the IS literature (Doménech, Davies, 2010).

Initially, most of the contributions focused on the engineering and technical feasibility of the exchanges, whereas social elements remained mostly unaddressed. […] IS exchanges cannot be considered in isolation of the social context in which they take place and the understanding of this context is crucial for the design of policy action to promote IS. Behind the flow of materials in the industrial system there is a complex network of actors, with different and sometimes conflicting, interests, interacting with each other and which are, in fact, defining the actual realisation of the physical flows (Doménech, T., 2010).

Industrial symbiosis is not only about technical knowledge or inter-industry relationships. In fact, besides functional flows, social relationships between different forms of organizations, which constitute the nodes of the network, are important too. (Schiller et al, 2014).

When scientific publications address the social dimension of industrial symbiosis, a variety of concepts is used (Spekkink, 2016):

- One of the concepts that have been used to capture the social dimension of industrial symbiosis is that of **trust**, which is seen as a key condition for the willingness of public and private actors to share information, to do business together, and to cooperate and commit themselves to industrial symbiosis.
- Industrial symbiosis also relates to (social) **learning and innovation**. For some, learning processes and innovation are inherent parts of industrial symbiosis.
- Several scholars in the field of industrial symbiosis have applied the concept of **social embeddedness** to study the wider social context in which industrial symbiosis takes place […]. The concept of social embeddedness expresses the view that economic activities are embedded in (and therefore strongly influenced by) structures of social relationships, which may differ across time and space.
- The role of **coordinating bodies** in industrial symbiosis has also been discussed.
  These may, for example, take the form of "anchor tenants," which are large firms that provide the critical mass for industrial symbiosis to commence. The role of coordinating body may also be performed by governmental agencies or business associations.
  Various activities of coordinating bodies in industrial symbiosis are also discussed, such as providing informational support, the creation of a supporting institutional setting, providing guidance on actions that are required to achieve long-term environmental sustainability, enhancing and intensifying communication among potential partners, informing them about potential symbiotic exchanges.

From the literature, in the following paragraphs main factors that play a crucial role in implementation of Industrial Symbiosis are extracted (Deshpande, S.S., 2015). The focus is on behavioural and managerial Factors. Among others, main factors are:

- **Attitude towards Waste**

Social attitude towards waste and by-products have to be changed. They no longer have to be seen as a burden but rather a business opportunity. […] Attitudinal changes will lead to higher pro-activeness (Roberts, 2004).

- **Awareness**

The study of Eco-Industrial Parks conducted by Gibbs & Deutz (2005) indicates that most of their respondents had only a vague idea what industrial synergies are. Moreover, everyone believed that correct promotion of these ideas is a key to success.

- **Negligence**

Waste has a long history of being neglected and its impact being ignored. This made it difficult to integrate these issues into company's strategic processes. Therefore there is a need to change the mind-set if the entire value chain of the production of a company has to be optimized. (Ehrenfeld & Gertler, 1997).

- **Long-term vision**

Industrial Symbiosis takes years to grow therefore, a long-term approach is necessary to nurture and develop key elements of infrastructure. To do this a long-term vision is necessary (Roberts, 2004).

- **Trust and Cooperation**

These two factors help to reduce the mental distance between the companies (Gibbs & Deutz, 2007). Issues of trust were found critical while raising funds for IS projects. Pre-existing links were crucial during these fund raisings as already some type of interaction existed. Trust and co-operation need to be developed between firms before they are prepared to link their processes and involve in a IS network. Inter-firm trust is essential to establish alliances or contract among participants (Ehrenfeld & Gertler, 1997).

- **Willingness to participate**

Greater willingness to participate makes it very easy to start the interaction between the companies. This interaction may not be about the waste exchanges but openness and willingness set the stage for such talks (Sterr & Ott, 2004).

- **Information flow and Communication among the firms**

There must be sufficient information flow to develop waste exchanges to enable companies to involve in community business interactions (Gibbs & Deutz, 2005). Unfortunately, it is difficult to obtain. Data about inputs and outputs of surrounding companies is costly to obtain. Countries such US where there is a strong sense of privacy, data sharing is difficult (Ehrenfeld & Gertler, 1997). Information sharing on the industrial wastes, products among the industries and development of industrial database will help to discover benefits of colocation (Lowe, 1997).

Based on the cases reviewed, the following transactions within an IS network have been identified:

Table 5 – Transactions within an Industrial Symbiosis network

Flows	Actors	Interactions
Energy and materials	Supplier/ purchaser	Supplies/purchases
Waste	Regulator	Legal contracts
Water	Facilitator	Moderation
Knowledge	Initiator	
Technology and innovation	Practitioner	
Payments	Managers/employees (white collar)	
Non-financial exchanges	Workers	
Logistics		
Infrastructure sharing		
Space		

The transactions and key players within an IS network will be evaluated and closely monitored throughout the various actions in FISSAC.

2.4.2 Identification and development of IS indicators for quantifying social dimension of IS initiatives (Task 1.4)

Who: Ekodenge
When: From 03/16 to 08/16

Deliverable D.1.6 is prepared as an output of FISSAC Task 1.4: Identification and development of ecoinnovation, waste and IS indicators. The list was compiled after a detailed literature review of existing indicators used within the EU and available indicators in peer-reviewed articles. Following the compilation of a preliminary indicator list based on the literature review, the proposed list was finalized with the contributions of all participants of the task. The indicator list proposed so far should be regarded as a compilation of possible relevant metrics, which will be used and evaluated through the course of the Project, in particular in life cycle assessment, eco-design and ETV tasks.

Industrial symbiosis practices provide social benefits for industries as well as their neighbouring communities. These benefits include human capital achieved through employment, shared health and safety practices, lower staff turnover, and more innovative industrial practices. Furthermore, IS initiatives are expected to boost local economy and growth, create new business opportunities, help transfer knowledge and new skills, and contribute to the sense of community. Social indicators identified as relevant to the FISSAC Project are provided in Table 6 below.

Table 6 – Industrial Symbiosis Indicators of Deliverable 1.6

Indicator titles	Specific indicators
Job creation and retention	Number of new jobs Average duration of number of years of employment at the same company
Creation of IS	Number of liaisons (number of connection between companies) Extent of shared facilities
Social responsibility	Size of the union (Share of union membership among the workers) Number of focus groups or records from local focus groups
Lifelong learning	Number of trainings provided Total hours of trainings per employee Share of training in total workable hours Cost of training and education programmes per employee
Health and safety at work	Number of accidents per year Average number of days without an accident
Rate of community participation	Number of projects funded
Level of social acceptance	% of the local public in support of the IS initiative % of key local stakeholders and decision makers in support of the IS Numbers of articles published creating positive and negative publicity
Community development	Share of profits dedicated for charity
Innovation and investment in R&D	Number of patents Number of technologies transferred Expenditure of resource related R&D Number of environmental certificates obtained

The main selection criteria was the ability to quantify these social aspects, as the list of the indicators suggested in this deliverable are mainly limited to quantitative indicators to minimize subjectivity of analysing qualitative aspects.

2.4.3 Paving the way to the FISSAC Industrial Symbiosis Model: Methodology and Software Platform (Task 1.6)

Who: Acciona
When: From 09/15 to 02/17

The FISSAC Methodology and Software Platform tool will be developed in order to implement the innovative industrial symbiosis model in a feasible scenario of industrial symbiosis synergies between industries (steel, aluminium, natural stone, chemical, and construction and demolition sectors) and stakeholders in the extended construction value chain. It will guide how to overcome technical barriers (transformations and adaptations of industrial and recycling processes) and non-technical barriers (social and cultural, legislative/regulatory, economic, organizational) as well as standardisation concerns to implement and replicate industrial symbiosis in a local/regional dimension.

Task 1.6.set up the baseline of the FISSAC Industrial Symbiosis Model. The innovative model will be applied based on the three sustainability pillars:

- Environmental
- Economic (with a life-cycle approach)
- Social (taking into consideration stakeholder engagement and impact on society).

The Baseline for FISSAC methodology is structured on 3 levels:

- Stakeholder networks, social engagement
- Processes, products and services: indicators
- FISSAC Model demonstration and replicability

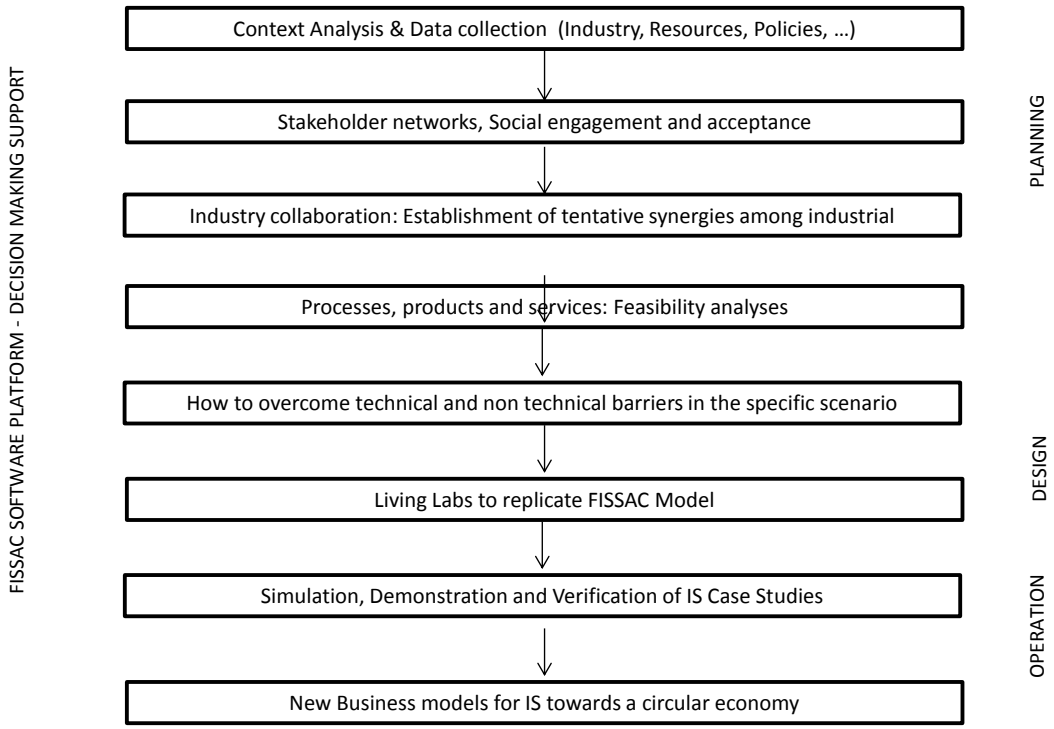
The aim is to replicate the model in other regions and other value-chain symbiosis scenarios. The FISSAC methodology was developed after the analyses of existing Industrial Symbiosis cases (Task 1.1) from Europe/International.

The framework of the FISSAC methodology includes system boundaries, incorporated indicators, rating and evaluation schemes, weighting factors, the software platform and replication model.

The new model will be applied in a feasible scenario as a demonstrator of industrial symbiosis synergies between industries (steel, aluminium, natural stone, chemical, and construction sectors) and stakeholders in the extended construction value chain.
The starting point for the definition FISSAC system boundaries is based primarily on the industrial sectors that are involved in the project. Seven (of the eight) SPIRE industrial sectors are represented in the project.

The following figure helps visualize an approach to methodology process through a basic flow chart. The sequence of steps and relationships show how the FISSAC model could be deployed and helps for the replicability of FISSAC scenario in other value chains.

Figure 4 – Methodology flow Chart for FISSAC Model replication



The following steps in the FISSAC project are shown below:

- *Planning*: Task 1.6 was considered as an important step within the FISSAC Project since the outcomes set up the baseline of the FISSAC Industrial Symbiosis Model.
- *Design*: WP6 aims to develop the final version of the FISSAC model for IS.
- *Operation*: the main objective of WP7 is to demonstrate the replication of the FISSC model.

The FISSAC project was presented in an International Workshop organised by Acciona with the aim to disseminate objectives, to achieve stakeholder engagement, and to discuss possible synergies with other projects.
The International Workshop took place on 22 November 2016 at the ACCIONA Infrastructure S.A. Headquarters. It was divided into three different session. The 3rd session was entitled "Towards a circular economy model in the construction sector". The workshop included a visit to the Acciona's Demopark, where diverse prototypes are located.

Acciona, as coordinator, along with Spanish FISSAC partners Tecnalia, Symbiosi, ICV, FAB, and Keraben, presented and attended the workshop to introduce the project progress and to contribute to social engagement.

Figure 5 – Session 3 Agenda: Towards a circular economy model in the construction sector

Session 3: Towards a circular economy model in the construction sector

- **Circular economy and industrial simbiosis: Setting the scene**

By Verónica Kuchinow, SIMBIOSY

- **The SESBE products – Sustainability towards future requirements**

By Urs Mueller, Nadia Al-Aish, CBI/RISE

- **Fostering Industrial Symbiosis in the contruction Sector: FISSAC project and successful stories (alternative solution for soil stabilization. Highway A-14, Lleida-Roselló).**

By Blanca Juez and Juan José Cepriá, ACCIONA Infraestructuras

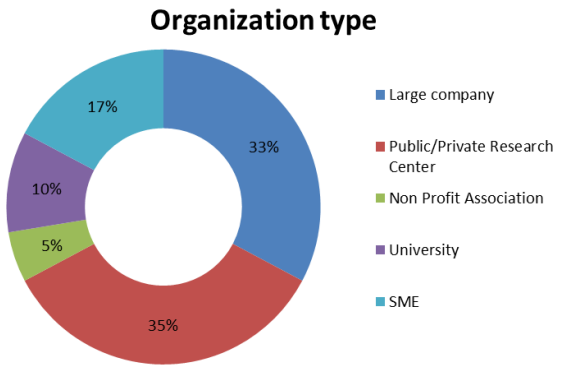
- **Industrial Symbiosis best practices examples and its Regional development in Basque Country.**

By Iñigo Vegas, TECNALIA

The attendance figures are detailed below, inFigure 6. A total of 58 people attended the workshop and 15 visited the Demopark. A good balance among types of organizations was obtained, covering the whole value chain of stakeholders: 33% were large companies, 17% SMEs, 35% public/private research centres, 10% universities, and 5% non-profit associations.

Figure 6 – Type of participants and pictures of the Acciona International Workshop, November 2016

Organization type	Number	Percentage
Large company	19	33%
Public/Private Research Centre	20	34%
Non-Profit Association	3	5%
University	6	10%
SME	10	17%



2.4.4 Definition of technical requirements of secondary raw materials (Task 2.1)

Who: Acciona
When: From 09/15 to 02/16

The main objective of this task is to define the technical requirements of the secondary raw materials used in the sectors where the industrial test will be carried out.

The report (Deliverable D2.1) focuses on selected construction products and compiles all technical requirements of raw materials for them, including when existing, secondary raw materials (SRM), to provide a general view of what is currently needed. Secondary raw materials should fulfil the basic industry needs as raw materials do, so that they will be taken as reference and will be the first step to develop quality standards.

In this sense, those needs will be called "technical requirements"[27]. They also include issues in connection with **technical and environmental regulations** (general quality standards, emissions to the soil, air or water), or with the optimal operation of production plants, such as the occurrence of specific chemicals. For instance, in most cases technical requirements for SRMs will be the same as traditional raw materials. In other situations, however, some differences could be acceptable as long as the construction industry changes some procedures to gain competitiveness, or whether the recycling sector adapts their processes to the needs of the industry, as the extractive industry did it previously.

Consequently, the first stage for this target is to compile the technical requirements for each demonstration sub-sector (concrete, cement, ceramic tiles and wood-plastic composites) at European level, identifying as far as possible national variations, and compare them with technical properties of proposed SRMs[28] aiming to identify current gaps and barriers.

These technical requirements must take industrial constraints, **recognised in standards (or lack of them) and regulatory framework** into account. These requirements are usually defined to guarantee the proper technical performance of the final product. As much as possible, new SRMs should be tested to proof that they comply with these standards, justify that there is no need to comply with them, or propose complementary treatments or industry process' changes to adapt their properties to the established requirements.

Furthermore, other identified requirements have to do with the **environmental regulatory framework**. Some activities such as those of the cement or ceramic industry have important restrictions regarding emissions. The use of SRMs may increase the emission of some components, consequently, it is very important to analyse these compounds to offer security and guarantee that the use of SRMs is not going to compromise their environmental approval. In other cases, it is necessary to guarantee that SRMs do not contain harmful or dangerous substances, radioactivity or may release prejudicial elements.

Finally, industries (cement, concrete, ceramic, WPCs) have their processes adapted to original raw materials and the way that they are usually supplied (moisture content, grading, hardness,…). The industry may change some specific processes, but this could be a **barrier for the acceptance of SRMs**. Physical and chemical properties required by the industry should be also tested to proof the feasibility of handling these alternative materials instead of the original ones and, if necessary, to define what kind of changes or treatments would be needed.

The methodology of work is based on the following steps:

- Collection of available documentation from specialized literature and standards.
- FISSAC partners and stakeholders inputs

[27] Technical requirements cover diverse fields of performance: physical, chemical & mineralogical properties such as composition, way of supplying the product (grading, moisture content), physical stability (volumetric stability, hardness, fire resistance, water proofing,…).

[28] An especial attention is paid on SRMs which are currently being used in an extensive way in the construction sector, and on regulations and standards governing their use. Among others: pulverised fly ash (PFA), silica fume or ground granulated blast furnace slag (GGBF Slag). On the basis of such standardized by-products, connections with SRMs will be set by associating similar properties and performance.

2.4.5 Overcoming non-technological barriers (Task 2.4)

Who: Acciona
When: From 09/15 to 02/17

The identification of possible barriers and their mitigation measures was based on the methodology proposed in the report "The efficient functioning of waste markets in the European Union - Legislative and Policy options". The main steps include:

- Collection of available documentation regarding barriers and drivers from specialized literature on Circular Economy and Industrial Symbiosis through literature research;
- Identification of real and perceived barriers among the FISSAC partners and stakeholders without including any evaluation, by means of personal interviews and conversations;
- Assessment of the impact of these barriers on the industrial symbiosis models for each case study and potential drivers and tools to minimize it.

Literature research:
Various documentation, including peer-reviewed research papers, reports from previous studies, and projects at different levels about policy and legislation, as well as other data sources on the topic, were compiled in order to obtain an overview of situations where circular economy is hampered by constraints of any nature.

The literature research was firstly focused on proposing a classification of the different types of barriers and the general characteristics of all of them. Then, the most common non-technological barriers were identified within the previously defined groups. After that, a more specific compilation was performed for the case studies included in the FISSAC project.

Stakeholder interviews:
Once the barriers structure was clearly categorized and the general constraints were identified, different personal interviews were conducted among the industrial FISSAC partners and final users. Then, the personal interviews were extended to other stakeholders covering the whole value chain of the different circular economy models, including waste generators, waste managers and final users. The objective was to identify the constraints along the value chain, trying to allocate the barriers in their corresponding position.

The interviews were conducted following a previously defined script, but only as a reference, trying to keep an informal and close interview where the caller could feel comfortable and feel free to express their concerns about the topic. This method also allowed us to adapt the questions to each caller according to their activity and position within the value chain as well as to include more questions as the interview was going on. The general questions included as a basis for all interviews were:

1. Dou you have – or did you have – any experience in recovering waste or recycled materials in your product portfolio? Which was the reason to start?
2. What is your impression from the commercial point of view?
3. And from the commercial point of view, did they bring the market up?
4. What kind of economic drawbacks did you get by using recycled/waste materials? (Supply reliability, productivity losses, increased transportation costs, increased management costs…)
5. How could these economic problems be sorted out?
6. From the legal point of view, was it easy to implement the new product line? What type of barriers did you find?
7. Regarding your internal organisation, was it easy to implement the use of waste/recycled materials within your organisation? Did you perceive resistance, scepticism…? Did you need to change many production processes or management structures?
8. Did you have any kind of support from outside your organisation (economic, finance, technical, legal, public awareness, public procurement)?

Assessment of barriers' impact and potential mitigation measures:
Once the barriers were structured according to the previously defined classification and the most common ones were described along the value chain, these barriers were analysed according to a risk matrix where the frequency and impact was assessed. This exercise was carried out for each waste stream and for each FISSAC IS scenario.

Data obtained from the interviews played a relevant role to assess the importance of each barrier and the impact that this barrier represented for each IS model.
After that, some potential mitigation measures were proposed for each constraint according to both data from interviews and bibliographic references.

The outputs from this task will serve as the baseline for Task 7.2 (Analysis of the condition of the various represented industries to detect technological and non-technological drivers and barriers for creating industrial symbiosis and circular economy) and assessment methodology, web and model.

Consequently, this study also includes the analysis of non-technical barriers to identify the most appropriate drivers to overcome the constraints and facilitate the establishment of the new model.

FISSAC uses the construction sector as an effective case study to demonstrate this circular economy scenario. The targeted framework for this assessment is focused on the selected SPIRE industries as SRM feedstock for the construction manufacturing sector (cement, concrete, ceramics and wood-plastic composites), consequently, the identified and assessed barriers, as well as the proposed drivers are oriented to these sectors. As many of the non-technological barriers are common for many value chains, this scenario could be easily replicable.

2.4.6 Evaluation of the proposed processes and value chain from a life-cycle perspective in order to ensure their environmental and economic sustainability (Task 3.1.)

Who: SP
When: From 02/16 to 02/17

Life-cycle assessment (LCA) and Life-cycle costing (LCC) are highly inclusive by nature in that the overall aim and system to be assessed (goal and scope) is discussed and set in collaboration with the involved companies. Once an assessment framework is in place, data is collected (inventory analysis) from and with the assistance of the involved company or companies. Inventory analysis and goal and scope definition is often an iterative process, driven by interim findings along the way. The process of performing environmental and economic sustainability assessments often yields as much insight into the companies' processes and products as the final results of the study.

The main stakeholder interactions have been with the companies whose products were assessed and with industry associations through meetings, both direct and teleconference, and e-mail correspondence. We have engaged with environmental, product, and process experts at these companies to assess the environmental and economic sustainability of the proposed value chains.

2.4.7 Eco-design of cost-effective products (Task 3.2)

Who: Trinus
When: From 11/16 to 05/17

The expected results of this task are:

- To select feasible social aspects and to integrate them in the eco-design indicators of FISSAC;
- To increase the understanding of manufacturers of the concept and process of eco-design and to increase their willingness to integrate eco-design into their product development consequently addressing a broad array of design criteria, including social aspects.

So far, to reach these results, various actions have been implemented:

- To run brainstorming sessions about eco-design aspects with involved companies
  The following companies have been involved: SP, Ekodenge.
  The main subjects were: LCA and eco-design indicators

- To explain the eco-design concept and process during meetings with other project partners (LCC and LCA conductors)
  The meetings were held on 09.11.2016, 17.01.2017 and 20.01.2017 with SP and Ekodenge.

- To distribute our eco-design matrix, developed in-house, among the project partners to let them have better understanding of eco-design.
- To contribute to the development of a list of items (information requested from manufacturers for LCC/LCA/Eco-design) by integrating the eco-design aspects.

2.4.8 Highlight the social dimension in practice for the transactions of the 3 analysed cases (included in Task 10.4)

Who: ACR+, OVAM, Ekodenge, Símbiosy
When: From 09/15 to 02/20

Following the analysis of best practices and lessons learnt in Industrial Symbiosis (D1.2), three case studies were selected as candidate projects to assess their social dimension, key actors, transactions and engagement strategies. These projects were selected because of their strong social element: cultural, organisational or educational highlights, which have made the projects successful and ensured long-term operation.

They are located in different countries, represent different symbiosis concepts and are at various stages of project maturity. The proposed projects to be evaluated are the following ones:

1. Manresa – Símbiosy (Spain)
2. Flanders Materials Programme – OVAM (Belgium)
3. Iskenderun Bay – Ekodenge (Turkey)

Cooperation: "Manresa" case (Spain) - Industrial Symbiosis with various materials

The first industrial symbiosis project in Catalonia is being implemented in Manresa, a municipality specially designed to be the promoter of the action. The objective is to demonstrate the viability of a methodology and a digital tool to be replicated elsewhere. It is a cooperative approach to exchange resources supported by a trusted third party.

- Municipalities seem to be good promoters of IS in the territory;
- Benefits for both companies and municipalities are high;
- Help companies to visualize how to maximize resource efficiency reducing costs;
- Promotion of innovation and industrial competitiveness;
- Creation of new companies and jobs - social benefits;
- Promotion of circular economy and industrial symbiosis concepts;
- Strengthening Manresa's industrial network.
- http://www.simbiosy.com

Platform for governance: "Flanders' Materials Programme (VMP)" case (Belgium)- Regulations, plans and R&D programmes

Flanders' Materials Programme is a public-private initiative run by OVAM, the public waste & materials agency in the Flanders region of Belgium. It combines ambitious long-term vision development, experimental pilot projects, policy-relevant research and concrete priority actions on the basis of an iterative road mapping process in order to accelerate the transition to a circular economy.

- Long-term vision development, experimental pilot projects, policy-relevant research and concrete priority actions towards circular economy.
- It is a 'network of networks', comprising the frontrunners within government, industry, universities and research centres, and non-governmental organizations.
- Extensive experience in sustainable materials management, able to identify drivers and barriers to materials management, opportunities for circular economy via innovation, international logistics, new jobs and skills creation, the redesigning of economic policy instruments, consumer behaviour and circular public procurement;
- Educational and management tools to prevent value escaping the material flows
- http://www.vlaamsmaterialenprogramma.be/fmp

Leadership: "Iskenderun bay" case (Turkey) – Industrial Symbiosis with various materials.

The concept was to carry out an IS approach with both economic and environmental returns by establishing collaboration between companies in the Iskenderun Bay region.

With the experience gained from this local application, it was considered as the basis of the development of a national IS programme by increasing resource efficiency rendering low-carbon economy and sustainability policies.

- Collaborations between companies in the Iskenderun Bay region with both economic and environmental returns.
- The aims of the project are to increase the competitiveness, to create new market opportunities and to reduce in naturally occurred raw material usage.
- A passionate, determined, and competent person drove the process and managed to solve a number of problems.
- http://www.ttgv.org.tr/en/industrial-symbiosis-cooperation-networks-for-environmental-and-economic-benefits

During the 3rd FISSAC general assembly (5-6 October 2016, Brussels), ACR+ organised a side meeting with the three cases to better understand them. Moreover, ACR+ sent a questionnaire proposal on 20 October 2016. After the feedback from the partners, ACR+ sent the final version on 27 October. The deadline was fixed on 27 November to collect the first result. The questionnaire contents include the following sections:

1. General information
2. Description of Instruments and Actions implemented
3. Results
4. Social engagement and social acceptance
5. SWOT
6. Contacts

The analysis covers three very different cases: Manresa (MA) has just started, Flanders' Materials Programme (FMP) is at the end of a large first period (FMP enters a new phase to adjust to the new 'Vision 2050' on circular economy of the Flanders government), Iskenderun Bay region (IBR) is finished due to a lack of financing.

Hereunder is the result of the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis.

Company level

Industrial Symbiosis (IS) projects are an opportunity for companies to become **more competitive** and to uphold their productivity by implementing an efficient resource management (MA, FMP). At first, it is a concrete way to promote circular economy **awareness** in business as well as in society (MA, IBR).

The implementation of an IS project could be easier if **large companies** are involved (MA). Moreover, the IS concept is difficult to introduce in **small SMEs** (MA, FMP). SMEs are the ones with strongest barriers: they could experiment patriarchal and authoritarian culture, little innovative, vertical communication and a human resource management based on functions and not competences makes them move away from the net and cooperative work. Considering all of that, the work with these companies must be based in dynamics that not only focus on technics goals, but also try to make them aware of new approaches, values, behaviours, and competences needed to participate in this kind of project. This will help them be competitive in the new economic and social paradigm.

Every company **involved in the project** needs to participate in the workshops to identify possible synergies (MA, FMP). A vision in the **top management** of the companies helps to accelerate the implication of the company (IBR).

Industrial site level

Industrial network can be strengthened thanks to the IS project oriented by a highly motivated (MA) **Advisory/Steering committee** which watches out for the complementarity between the pillars (FMP).
The number and **diversity of sectors** involved (IBR) increase the effectiveness of the IS network. However, difficulties can occur when they act as autonomous bodies, guided by needs, demands and priorities within their sector (FMP).
Trust (in other companies, in technical experts…) is key (IBR), especially for the collection of data from industries/businesses (MA).
Finance for the participatory process and for the implementation of synergies is necessary (IBR).
The need for innovation sometimes comes at the expense of **up-scaling** (FMP).

Regional level

Thanks to IS projects, great potential for a **cross-sectorial cooperation** could be realised in large industrial region (IBR, FMP) and some external **investments** could be attracted (IBR). One objective is that the economic activity generated also has further **social benefits** with the creation of new businesses and (retention of) **jobs** (MA, IBR). A consequence could be the improvement of working conditions and public health (IBR)
Strong **public authorities' commitment** is a strength (MA, FMP). Public authority is not merely perceived as a governmental institute, whose main objectives are to regulate or to control, but also as a partner and facilitator (FMP). National strategies/policies supporting IS measures (ISB) and collaboration between politicians from different bodies (MA) facilitate the implementation of IS project for companies.
IS is generally a public-private cooperation. For the continuation of the IS programme, it is essential that **the financial means** (public and private) meet its ambition (FMP, IBR).
The **multistakeholder approach** is essential – a meeting place for policy makers, researchers and entrepreneurs (FMP) – with high benefits for both, companies and public authority (MA). Administrative capacity (MA) creates the pre-condition for making innovation happen in the public sector and thus to play a role of bridging actor.
A **multi-disciplinary approach** (FMP) gives a broad insight into obstacles and enablers in all fields: legislation, practices, business and finances… This approach requires intensive time investment that should not be underestimated (FMP). Bringing shared responsibility into practice remains a difficult exercise (FMP).
Public pressure on the companies to take concrete measures on resource/waste management/raw materials saving is an incentive to implement concrete actions due to obvious local environmental problems (IBR).
However, as **the social innovation**, necessary to realise the transition to circular economy, is less visible, it is not easy to implicate consumers and civil society organisations (FMP). **Raising awareness** and disseminating information on circular economy should involve civil society organisation, consumers, schools, professional associations (FMP)...
Concerns about **climate change** and sustainable development mobilise a broad movement of civil society organisation and concerned citizens. The concept of **circular economy** is born out of a similar concern. Linking both issues could boost the interest for circular economy and at the same time reinforce the social aspects linked to it.

The SWOT Analysis are the following:

SWOT for Manresa

Strengths

Strong central government commitment

Motivated Advisory committee

Benefits for both, companies and Municipality, are high

Contributes to the promotion of innovation and industrial competitiveness

Strengthening of Manresa's industrial network.

Weaknesses

Municipality motivation and capabilities

No big company involved in the project. The concept is difficult to introduce in small SMEs

Collection of data from industries/business is very difficult

Making companies get really involved in the project and get to participate in the workshops to work for their synergies opportunities

Making politicians and public entities from different bodies work together

Opportunities

Companies transition towards more resource efficiency and so, more competitiveness

Investment attraction

New companies and job creation/retention

Big social benefits

Promotes circular economy awareness in business as well as in society

Threats

The cultural relationships heritage between industries and municipality is a barrier that goes in front of everything...

IS concept is not an easy concept for SME manufacturer companies → messages to companies needed to be reviewed and specially oriented

Cultural change is needed in industrial SMEs → necessity to share! To learn, to be open…

SWOT for Flanders' Materials Programme (1/2)

Strengths

Flanders' materials Programme is a unique meeting place for policy makers, researchers and entrepreneurs supporting the transition towards a circular economy. Its high level representation with prominent and influential stakeholder from different sectors, combined with a pragmatic approach focusing as well on short-term projects as on experiments, contributes to the creation of a broad network, covering many and diverse industrial sectors.

The continued efforts of the initiator/coordinator (OVAM) to stimulate the network is essential for the further development and continuation of the programme. OVAM maintains an open and transparent approach, based on an open dialogue, a willingness to cooperate and an efficient organization. The interaction between SuMMA, Plan C and Agenda 2020 creates confidence in the programme as an innovative initiative. OVAM is not merely perceived as a governmental institute, whose main objectives are to regulate or to control, but also as a partner and facilitator.

The shared methodology, based on co-responsibility, the development of roadmaps and concrete actions, brings overview and focus to each approach. The multi-disciplinary approach gives a broad insight in obstacles and enablers in all fields: legislation, practices, business and finances…

Weaknesses

Although the different pillars of Flanders' Materials Programme share a common vision and objectives on circular economy, they act as autonomous bodies, guided by needs, demands and priorities within their sector. The Steering Committees of the Programme watch over the complementarity between the pillars, however in practice it remains difficult to attune agendas. The Programme would benefit from a more concerted and mutually reinforcing approach.

Within the network the main focus goes to industry and technology. This affects both the representation and interest of consumers and civil society organisations to participate in the network. Social innovation, necessary to realise the transition to circular economy, is less visible. Hence also a lesser commitment of those organisations to be actively involved in the network.

The Programme relies on a shared responsibility of stakeholders, since this is considered an essential condition for co-creation and co-ownership. Taking the lead and steering a multi-stakeholders project to concrete results requires an intensive time investment that should not be underestimated. Where it is obvious to take up a steering role for projects related to one's core business, it is less evident for others. Bringing shared responsibility into practice remains a difficult exercise, often for practical reasons such as time constraints. Flanders' Materials Programme succeeded in its objective to create a broad network, involving different stakeholders from different sectors. While the roll-out of Agenda 2020, its different levers and numerous actions succeeded to engage many, there was also a feeling of missed opportunities:

- Too many actions, scattered over different sectors, lead to a diversion of efforts and a loss of overview and shared understanding.
- Some actions, inspired by a pragmatic approach and aiming for a quick result were not always perceived as innovative.
- The need for innovation sometimes came at the expense of up-scaling.

Although there is a shared vision on the importance of circular economy and the need for an inter-disciplinary approach, it remains challenging to deepen the cooperation over specific sectors and clusters. For the Programme to be more than a meeting place to identify opportunities for a better and efficient resource management within each sector, a far going engagement is essential.

SWOT for Flanders' Materials Programme (2/2)

Opportunities

Both at a European and at a Flemish level, there is an increasing political awareness that sustainable materials management is essential to safeguard our current level of wellbeing and prosperity. New policy instrument favour circular economy, create opportunities and support for innovative and cooperative initiatives. To realise Flanders' 'Vision 2050' a cross-sectorial cooperation is essential.
The increasing scarcity of resources and materials, the impact of geopolitics on price setting of raw materials and Flanders' and Europe's dependency of import, also creates a sense of urgency for business and industry to look for new and creative solutions to uphold their productivity.

Concern about climate change and sustainable development mobilise a broad movement of civil society organisation and concerned citizens. The concept of circular economy is born out of a similar concern. Linking both issues could boost the interest for circular economy and at the same time reinforce the social aspects linked to it. For the climate debate, it could be equally beneficial to close the gap with the economic world.

Threats

While business and industry are key stakeholders to further the concept of circular economy, it is important to reach out to other stakeholders and sectors. Social aspect related to the transition from a linear to a circular economy should be taken into account from the start, stakeholders representing civil society and social organisations taken aboard. Raising awareness and disseminating information on circular economy should involve civil society organisation, consumers, schools, professional associations...

The Flanders' Materials Programme is a public-private cooperation. This is reflected in its composition and working methods. However for its funding the programme is entirely dependent on the contribution of the Flemish Government. The financial means are provided by the departments Environment, Nature and Energy and Economy, Science and Innovation. The private sector mainly contributes in terms of expertise and work force. For the continuation of the Programme it is essential that the financial means meet its' ambition. For a genuine transition to circular economy, additional means should be considered for trial project and to market products.

SWOT for Iskenderun Bay region

Strengths

Number and diversity of the sectors involved

Need of urgent action due to obvious local environmental problems

Public pressure on the companies to take concrete measures on resource/waste management

Interest and active involvement of R&D institutions

Current national strategies/policies supporting IS measures

Weaknesses

Tedious regulatory procedures and lack of legislation

Lack of confidence (to other companies, to technical experts etc.)

Lack of vision in the top management of the companies

Lack of finance

Opportunities

As a huge industrial region in Turkey, there is a great potential for collaboration

Raw materials saving

Waste reduction

Improvement of working conditions and public health

Increase in stakeholder awareness on IS

Threats

Local commitment for sustaining IS activities

Change of current regional/local strategies favouring IS measures (it may change with the vision of each new politician)

Change in economic stability (e.g. economic downturns)

Deeper analysis of the 3 cases thanks to a questionnaire

To go deeper in the analysis of the 3 cases, the partners have answered at a range of questions (see below). The responds have been consolidated:

At the company level

A charismatic visionary leader is not always present (ISB, FMP, MA) even if the **manager and the management team** play an important role in the transition towards a circular economy. More complex management is essential with higher flexibility and knowledge sharing (FMP).

The routines/structural organisation of the company could need to be slightly modified due to the implementation of industrial symbiosis synergies (ISB). However, it is mainly a question of "**Culture**". Transition to a circular economy requires an acceptance and adoption of the circular economy principles throughout the entire company (FMP). It necessitates a change of attitude on different levels:

- Strategic: the need for cooperation with external partners necessitates an openness to participate in a multi-stakeholders approach, flexibility and creativity to function in a complex context.
- Financial: new funding opportunities might need to be created to finance new business models and innovative project.

- Legal: new business models and cooperation agreements might ask for a different legal approach and a flexibility to overcome legal barriers.[29]
- Commercial: engaging in circular economy offers companies new selling opportunities: they do no longer sell a product but a concept/service.

Some new **skills/competences** could be needed and mobilized to implement the synergies related to IS. Specific skills related to symbiosis projects very much depend on the sector and the cooperation over different phases of the value chain (FMP). However, some key competences surface at all levels.

- Openness for information sharing: internal and external, connecting different phases of the value chain
- Co-creation and cooperation: need to involve different stakeholders of the value chain, including consumers
- Knowledge on the composition and development of products: to develop innovative products based on the use of secondary raw materials, residual waste or recycled materials.
- Managing a diversity of tasks: tasks will become more complex and not exclusively linked to one phase in the value chain
- Applying innovative management tools to make the transition to circular economy

Additional qualities related to new symbiosis projects are out of the box-thinking, ability to work autonomous, perseverance (FMP). Internal expert in resource efficiency do not seem to exist in the 3 cases analysed even if a shared external resource managers could facilitate the implementation of synergies (MA).

In most of the industrial symbiosis implementations, an intermediate waste/resource processing (or treatment) step is needed. The addition of that step required more labour force which in turn **increased employment** (ISB). Cooperation between sectors and over different phases of the value chain will have an impact on existing jobs. They will become more complex, involve more cooperation and co-creation (FMP). New jobs are to be expected in:

- Design: increased attention for the entire life-cycle of resources, including repair, refurbishment and remanufacturing;
- Innovation and product development: considering the entire value chain;
- Disassembling: far-reaching knowledge of composition of products;
- Administrative handling of new service contracts;
- Resource scout;
- Information manager: linking producers and stakeholders in other phases of the value chain, e.g. dismantling and recycling;
- …

At the industrial site level

An IS project needs to be coordinated. An **implementing agency/facilitator/Independent matchmaking institute** is often a key actor for coordinating the implementation of possible synergies (MA, FMP,ISB). It could be either public or private but the facilitator needs to provide the necessary guarantees to act autonomous and independent (FMP). In the long-run, it should evolve to a private-public funding mechanism.

Various **methods to identify possible synergies** are used:

- Site/company visits to companies for collecting information to be used for matchmaking purposes (ISB, FMP)
- “Synergy Workshops” which gather various companies for creating synergies (MA, FMP, ISB)
- Use of INEX IT platform (MA). A web platform that georeferences all site’s companies and incorporates their data regarding wastes and raw materials as well as pre-identifies possible synergies between them.
- Online template and database: register and list the available and requested material streams (FMP)
- On demand of a specific sector: address specific questions hindering symbiosis (FMP)

The culture of **industrial secrecy** is an important barrier in most of the cases. Sometimes competitor companies come together in order to discuss possible synergies among other companies (ISB). Companies are not used to share information and it is challenging to make them understand the benefits of such a thing (MA).
As every type of project, some reasons can delay an IS project. Particularly:

- Regulatory issues (MA, FMP, ISB)
- Lack of confidence (in other companies, in technical experts etc.) (ISB) and trust among companies (FMP)

[29] See, for example, EU Innovation Deals (IDs) that allow innovators to swiftly address legislative obstacles, shortening the time between moment of inspiration and market uptake. Innovation Deals take the form of voluntary cooperation between the EU, innovators, and national, regional and local authorities.

- Lack of information about industries and the difficulties to collect them (quality data) (MA, FMP).
- Lack of vision in the top management of the companies (ISB)
- Lack of interest or commitment of the companies (MA)
- Lack of finance (ISB) / funding mechanism (FMP)
- Access to public tenders for secondary raw materials, residual waste or recycled materials (FMP)
- External product standards do not always take in to account the possible use of secondary raw materials, residual waste or recycled materials (FMP)
- Costumer behaviour: trust in new products (FMP)
- Need for (new) technological solutions for side stream valorisation: more research is required for high value material valorisation (FMP)

Partners of IS projects do not often discuss the **social benefits and gender issues**, for example, during workshops around synergies. Economic and environmental benefits are underlined primarily (ISB). For the industry, the main drivers for symbiosis are sustainability, cost reduction and economic competition. When promoting industrial symbiosis, emphasis is also put on environmental impact and to a lesser degree on potential job opportunities/creation (FMP).

To evaluate the various impacts of an IS project, facilitators could implement a **dashboard** of industrial symbiosis (at-a-glance views of Key Performance Indicators relevant to the industrial symbiosis project). Here are some examples of indicators.

- Environmental:
  - Waste (tonnes/year)
  - Water saving (m^3/year)
  - Natural resource substitution
  - Land reclamation (m^2)
  - Labour force saving (person day/year)
  - Energy saving (kWh/year)
  - CO_2 reduction (tCO_2/year)
  - Amount of waste from landfill (t)
  - Quantity of raw materials saved (t)
  - Number of GHG avoided (t)
  - Number of eco-products (No.)
  - Total environmental certificates obtained (No.)
- Economic:
  - New product types
  - New enterprises
  - Total investment in project / total profits for the period
  - Savings (€)
- Social:
  - New employment (person)
  - Participated companies/institutions
  - Universities having contribution
  - Business Networks (formal and informal) created or expanded (No.)
  - Number of courses taught
  - Level of awareness, social acceptance (web page visitors, e-mails demanding information...)

At the regional site level

Public authorities could take the lead or not, participate or not. However, their presence in the project events (synergy workshops, dissemination events, trainings…) motivates the companies (ISB). In some cases, the municipality offers to the companies in its territory the service to identify synergies between other companies improving, at the same time, internal competitiveness through circular economy concepts. Central Government and supra-municipal public entities could also help finance the project (MA). The public sector is also an essential actor as policy maker., creating a long-term vision for the transition to a circular economy, guaranteeing that different policy instruments point in the same direction, and creating a legal framework and (financial) incentives supportive of a transition to circular economy (FMP).

From the point of view of a **multi-stakeholder approach**, **communication** is the key action of an IS project. It has to be done from the beginning, before contacting companies. Furthermore, it has to be coordinated (different

dissemination actors involved) in order to maximize repercussion in companies (MA). The stakeholders could also be reached via face-to-face meetings before and during the project. For example, R&D institutions need to take part in IS measures between firms. Governmental institutions need to support implementation with regulatory measures (ISB). The project team could approach each stakeholder showing the potential benefits of the project to the individual stakeholder (MA, ISB).

An **Advisory Committee** is a common practice to engage various types of stakeholders. It could include a ministry, development agency, the chamber of commerce, universities, technological centres, and civil society.

No **power games or local conflicts** were identified in the 3 analysed cases.

No clear evidence exists that **consumers** are ready to buy products made of secondary materials (ISB). The procurement policy of the government can have a favourable effect on the use of new products and its market (FMP).

The following questions have been chosen after analysis of the literature, after interviews of the representatives of the cases and after the analysis of 60 cases of industrial symbiosis (D1.2).

At the company level – interactions inside the company

1. Is there a "leader" (a charismatic visionary) inside the company (or inside the groups of companies) who leads the project? Could you specify this person's impact on the project?
2. Do you need to modify the organization and activities inside the company due to new collaborations with others companies? Did you experience any reluctance towards this within the company?
3. Is there a culture of industrial secrecy and of competition inside the company when in contact with others companies?
4. If the IS project was delayed, which were the main reasons behind this (e.g. lack of financing, lack of interest or commitment of the companies, lack of availability of industrials, regulatory issues…)?
5. Have the companies identified new skills/competences needed to implement the synergies related to IS?
6. Do resource managers (operational manager of material resources) exist in any of the companies implicated in the project? What is their impact?
7. Have you analysed the impact on jobs (lost and won)? What are the results of the analysis?

At the industrial site level – interactions between companies

1. What method did you use to identify possible synergies (use of a database identifying the flows, confidentiality clauses signed between partners, information around economic benefits...)?
2. What are the limitations to IS projects (data sharing (confidentiality), technical, logistics, regulatory, economic…)?
3. Who are the key actors to coordinate the implementation of possible synergies?
4. What is done to increase awareness about the social benefits of Industrial Symbiosis?
5. Does a dashboard of industrial symbiosis in your area (at-a-glance views of Key Performance Indicators relevant to the industrial symbiosis project) exist ? Which are the indicators that measure environmental, economic, social impacts?
6. To what extend does your project ensure a system change rather than system optimization?

At the regional level – interactions with others stakeholders (public authorities, research centres, citizens...)

1. Approximately, how many stakeholders are implicated in the project (how many private companies, how many citizens and how many others actors)? Is the number of stakeholders (too many, not enough, diversity...) an issue for the consultation/collaboration process?
2. What role the public sector has in your project and/or should have in fostering Industrial Symbiosis (up scaling the implementation of synergies related to IS)?
3. What means of communication have been implemented towards stakeholders (that are not companies)? Were the stakeholders consulted before the start of the project's implementation? If yes, what was the subject of the consultation?
4. What is the composition of the Advisory Committee (if any)?
5. What role do IS experts (consultancies, academia) play in your Industrial Symbiosis network?
6. Are there power games or local conflicts between the stakeholders of your project?
7. How do you encourage stakeholders to embrace and be involved in IS?
8. Is or has the issue of gender been mentioned in your project? If yes, how?

9. Does the economic market exist for the new product (with secondary material)? Do the consumers accept this kind of product? Have you noted changes in the consumers' perceptions about IS models affecting their purchase?
10. Does the project have a planned end? What is the process to anchoring the industrial symbiosis project?

2.4.9 Capture information from the various Living labs (Task 7.1)

Who: SP
When: From 09/16 to 02/20

The FISSAC model will be demonstrated and validated in Spain, the UK and Turkey and will be replicated in all FISSAC countries through Living Labs (LL) (a user-centred, open-innovation ecosystem, often operating in a territorial context). The results and knowledge gathered from other WPs will be used for the purposes of the LL. The LL concept will be set up in Task 7.1 and implemented between months 9 and 54.

LL concepts will gather various stakeholders (civil society, policy makers, producers and researchers) to define common goals, share knowledge, develop prototypes, facilitate innovation, and encourage more sustainable behaviour across the sector. The aim is to establish a pilot living lab in Sweden in order to start an early learning process and identify key opportunities and challenges before the living lab concept can be replicated at full scale in other FISSAC countries. Parallel to the pilot, SP will analyse which key actors should be involved in some countries in the Living lab. A list of additional relevant actors should be identified from different sectors. A pilot case in Sweden, where a large number of actors from different sectors are already identified, can act as a pioneer and lead the way for the work in the other countries and help the project partners understand what kind of support is needed in the other countries.

Hifab organised the first living lab in October 2016. ACR+ sent them the questionnaire in order to answer the questions throughout the various sessions of their LL. It was to been seen has a sample of what could be caught with the future living labs.

At the company level – interactions inside the company

1. Is there a “leader” (a charismatic visionary) inside the company (or inside the groups of companies) who leads the project? Could you specify this person’s impact on the project?
    - Often there are “driven” people hired in bigger companies that work with sustainability and environment question. It also seems that they have the management group´s support. However it remains unclear how much influence they have in the decision-making process and if they can actually change the routines of the organization.
    - In case of small companies ”driven by change makers” the impact differs significantly as the “leaders” are also decision makers and in some cases already the business idea is guided by sustainability principles.
2. Do you need to modify the organization and activities inside the company due to new collaborations with others companies? Did you experience any reluctance towards this within the company?
    This is a good question to be discussed during one of the following living-lab meeting
3. Is there a culture of industrial secrecy and of competition inside the company when in contact with others companies?
    So far, no
4. If the IS project was delayed which were the main reasons behind this (e.g. lack of financing, lack of interest or commitment of the companies, lack of availability of industrials, regulatory issues…)?
    - Regulations and standards do present a challenge. As an example a concrete producer that recycles their own spill in production, would like to do that in a greater extent, but is not allowed to do so, because of a standard on how the concrete should be produced (not on a quality of the final product);
    - There is a lack of knowledge on business cases & business models that would inspire to initiate the change of today’s routines;
    - Dual problem with the market: the marketplace is missing therefore there is no products on the market and vice versa;
    - Lack of independent assessment of the quality of the recycled products;
    - Time gap problem. It takes a long time from the planning phase till actual construction. And if any changes were to be made to the projects before the construction, the process of getting confirmations and permits lengthens the time spent in the “planning phase” even more. Which means that even if new materials are available today, they will not be used as decisions were made

in some cases years ago. – So some flexibility in the framework of planning-engineering and building is a big issue.

5. Have the companies identified new skills/competences needed to implement the synergies related to IS?
   One of the main conclusions drawn from the first Living lab meeting was that there is a general lack of knowledge which is the biggest barrier in creating possible material flows.
   - Lack of knowledge on materials
   - Lack of knowledge on possible business models – why should we work with circular economy and symbiosis
6. Do resource managers (operational manager of material resources) exist in any of the companies implicated in the project? What is their impact?
   /
7. Have you analysed the impact on jobs (lost and won)? What are the results of the analysis?
   Hifab has carried out analysis for a local symbiosis project that is though not connected to the building sector. Information can be available, if there is interest

At the industrial site level – interactions between companies

1. What method did you use to identify possible synergies (use of a database identifying the flows, confidentiality clauses signed between partners, information around economic benefits...)?
2. What are the limitations to IS projects (data sharing (confidentiality), technical, logistics, regulatory, economic.)?
   - There is a lack of open information flow between the actors in the industry
   - Standards and regulations pose a barrier
   - There is currently no efficient marketplace for products from rebuilding or demolition projects
   - There is also a barrier in potentially coordinating building site logistics as different actors have their own partnerships and framework contracts with different service providers and suppliers.
3. Who are the key actors to coordinate the implementation of possible synergies?
   This could be a question to discuss in the coming living labs as well as to confirm or revoke that such interest exists at all
4. What is done to increase awareness about the social benefits of Industrial Symbiosis?
   - FISSAC Living labs work with that question
   - Other local events, seminars and workshops (on similar projects) also help with this cause
   - Published reports and info materials that circulate in the industry
5. Does a dashboard of industrial symbiosis in your area (at-a-glance views of Key Performance Indicators relevant to the industrial symbiosis project) exist? Which are the indicators that measure environmental, economic, social impacts?
   No
6. To what extend does your project ensure a system change rather than system optimization?
   - This is a focus area in FISSAC living labs - transition management.
   - Smaller actors want to see societal change, bigger actors are hesitant as they have a much bigger and more difficult readjustment to implement.

2.4.10 Dissemination strategy

Who: ACR+
When: From 09/15 to 02/20

The dissemination strategy has been designed by ACR+ to help project partners define dissemination goals and use the right communication tools to achieve them over the project duration. Knowing the target audience of project communications is essential to tailor messages and to attract the interest of those who could benefit from the project's work. The report of the Deliverable D9.1 summarises the dissemination plan. Hereunder some information on the implementation so far can be found.

Design of a project visual identity

The objectives of the project visual identity are to:

a) Develop a design structure that would accommodate standard project identity elements, a variable visual identity in various uses, and be able to convey thematic information when needed.

b) Allow an immediate recognition of the FISSAC project thanks to standardized communication templates meant for external audiences. Following and respecting the project visual identity allows to maximise the impact on the audience.
c) Develop specific guidelines and structures related to such template such as a definite set of colours and/or typographic.
This is linked to social aspects in the sense that a recognisable visual identity gives immediate recognition of the project, helping external audiences associate a message with the overall project and therefore facilitating mental links to industrial symbiosis. Having visually appealing communication material also reinforces the professional appearance of a project, thus favouring trust stakeholders will have in our work.

Project website
The website - http://fissacproject.eu - was designed by a subcontractor in accordance with the FISSAC visual identity and is managed by ACR+. It aims to be dynamic and interactive in order to ensure a clear communication and wide dissemination of project news, activities and results. The website is of primary importance due to the expected impact on the target audiences.
The website is the primary communication channel of the project and therefore must be updated regularly with clear and concise information to encourage social acceptance of the project. Furthermore, it has been translated in the languages of the project partners and includes a contact form to allow dialogue with external audiences. The availability of the website in multiple languages further emphasises the holistic nature of Industrial Symbiosis and will help facilitate the cooperation between different companies.

Other Communication channels include trainings and webinars 1st one on February 23th on "Industrial Symbiosis Tools and Best Practices". To reinforce the understanding and knowledge of these concepts, the FISSAC project hasl host a webinar presenting industrial symbiosis and best practices surrounding the tools used. Within this framework, the speakers have introduced the FISSAC tool, currently under development. The programme was:
1. Introduction to Industrial Symbiosis (ACCIONA and SIMBIOSY)
2. Best practices – Industrial Symbiosis tools (OVAM; Geonardo; HIFAB)
3. Introduction to the FISSAC tool (EKODENGE and D'Appolonia)
4. Social Acceptance and Engagement (ACR+, UCL)

The next webinars will be around M25, M37, M49.

The others communication channels are social media/networks, newsletters, press releases, events and conferences, living labs, and videos.

2.5 Establish updated action plans: Monitor and evaluation of the actions

At the end of the FISSAC project, the objective is to demonstrate how social acceptance has been included in the FISSAC project in various tasks. All the conclusions will be summarised in the final deliverables (D10.4). However, monitoring and evaluation should be an integral part of (and therefore affect) all stages of the project cycle. Monitoring is about assessing whether the project's activities are going as intended. Therefore, if the plan of action is clear, it will be much easier to monitor whether the project is on the right track. Evaluating is about assessing whether the project achieved what the project wanted to achieve. Consequently, if the objectives are clearly and appropriately set, it will be much easier to assess whether the project has been more or less successful.

The tasks around social acceptance and engagement are concrete useful tasks due to the fact that is not the speciality of the majority of the project's partners and that is an important aspect of industrial symbiosis. However, it is also a challenge to tackle this aspect. For the next period of the project, discussions will be organised between the task leaders and the Social Advisory Committee in order to improve the integration of this aspect of the project. With the results of these discussions, the above table will be completed to have a global view of the actions related to the social engagement and acceptance.

Before end 2017, a timeline will be finalized to plan the evaluation of the actions and their outputs as part of an ongoing cycle throughout the project. The reason for doing this is not only to understand what worked - and why - but also to be able to respond flexibly to events as they unfold. This is often one of the most important keys to success, as no matter how well an engagement is planned there will always be elements that are difficult or impossible to predict. The evaluation of the engagement process and outputs considers elements such as:

- Involvement of stakeholders in the design of the actions

- Maintenance of key stakeholder commitment
- Number and diversity of participants attending events and activities
- Completion of tasks on schedule
- Completion of tasks on budget

For each of these elements, it asks the questions:

- What aspects contributed to successful outputs?
- What aspects could be improved upon?

Additional elements which may help evaluate the engagement process and outputs immediately after the last phase of engagement activity include:

- Provision of feedback to community and stakeholders on how their input impacted the project outcomes
- Community and stakeholder perceptions of their opportunities to contribute to the project
- Impact of community and stakeholder contributions on key project deliverables
- Alignment of engagement and project milestones

The most effective and appropriate techniques for the evaluation of an engagement process and outcomes are not always highly formalised. They may include a project team brainstorm, typically undertaken as a debriefing at the end of a project phase, and ongoing monitoring of media, online forum responses, interviews. Checking in with project champions and key members of advisory groups can often also assist in understanding how an engagement processes is travelling and where refinements or improvements can be made.[30]

[30] http://www.advertising.nsw.gov.au/node/650

3. Partners' actions for the next period of the project

In Section 3, the governance (3.1) to tackle actions related to social engagement and acceptance after February 2017 is presented. Then, when it is already available, the actions of the tasks are evoked (3.2). Deeper interactions with the Social Advisory Board and trainings will help to define and improve these aspects in order to strongly take into account the social aspect in the FISSAC project.

3.1. Governance of social engagement and acceptance in FISSAC

At the end of the project, the result of the Task 10.04, will be summarised in a report on Social engagement and acceptance.

The partners of FISSAC will continue to increase their awareness of the social engagement and acceptance thanks to the training tasks and thanks to the discussions that they will have with members of the social advisory board. Remote meetings will be planned between the **Social Advisory Board and every leader of tasks concerned by social aspects**. The objective is to help task leaders to identify the right actions in order to deeply take into account the social engagement and acceptance in their tasks. In particular, discussions will focus, among others:

- For all partners (during the general assembly of March 2017): on the learning ciommunity
- For Acciona: on the general vision of the this aspect as they are project leader and leader of various tasks. FISSAC leader needs to identify the stakeholders expectations; what do they expect about participating in FISSAC's project in order to increase their participation.
- For Ekodegen: on the social indicators as social advisory board can contribute to the improvement of the selection and the implementation for FISSAC
- For SP: on the inclusion of this aspect in the living labs where social engagement and acceptance is a key element
- For ACR+: on the inclusion of social aspects in the webinars and in the sustainable construction guidelines.

ACR+ will organise an annual follow-up and a final summarised in a report.

3.2. Engage stakeholders: from March 2017 to the end of the project

3.2.1. Identification and development of IS indicators for quantifying the social dimension of IS initiatives (Task 1.4)

Who: Ekodenge
When: From 03/16 to 08/16

The indicator list proposed in Task 1.4. will be used and evaluated throughout the course of the Project, in particular in life-cycle assessment, eco-design and ETV tasks.

After comments of the social advisory board, 2 main elements for the future evaluation can be already added:

- The link with the Sustainable Development goals (SDGs): See 1.7Sustainable Development Goals
- A lack of indicators related to the Management model based on competences and to the level of participation of workers in the strategy. More participation in decision-making implies directly more motivation and better working environment. Anyway, innovation capacity and application of competences are also boosted.

Here are some examples of indicators that can be added:

- Fit level of working people's professional profiles and the professional profile demanded
- Competencies improvement while working for the company through actions and plans
- Fit between working place and professional project (working objective) of workers (it will impact employee's quality of life and, indirectly, its motivation)
- Employees' careers projection (career plan inside the company)

3.2.2. Dissemination Strategy and Dissemination Plan deployment (Task 9.1 and 9.2)

Who: ACR+
When: From 09/15 to 02/20

Overall dissemination strategy covers

- the awareness on the project and its expected results,
- the identification and segmentation of main stakeholders and the dissemination targets,
- the database of stakeholders contacts,
- the communication EU/National/Regional level,
- the guidelines for the implementation of dissemination actions (messages to convey, internal reporting rules, tracking of distribution of dissemination tools, etc.),
- the tools needed to implement successful dissemination activities,
- the share of dissemination activities among partners,
- the responsibilities/roles attributed to each partner and finally the training Plan and calendar of dissemination activities.

In the future, attention will be paid to also communicate for non-expert people.

3.2.2.1. Plan for the dissemination from March 2017 is the following:

Project website

The project website will be further developed to include sections on the living labs and on each of the material streams. This will be of particular interest for professionals working with those specific materials and for stakeholders interested in joining the living labs.
For the non-Expert public, less technical informations could be add to facilitate the comprehension of the project and the social engagement.

Other Communication channels

- The next webinars will be around M25, M37, M49 – furthermore, each webinar will be recorded
- social media will be used at an increased frequency and project-specific accounts will be created and maintained regularly to build up a follower base but also to benefit from information sources available on social media
- newsletters: published each semester, the newsletters provide a summary of the project progress and they allow to focus on specific material streams. Each newsletter boosts the project's follower base.
- press releases
- events and conferences
- videos
- Living labs (see the section dedicated at the living labs)

Sites visits

- Manresa visit is planned in May 2017. The Flanders visit will be planned in function of the living labs.

3.2.2.2. Concrete deliverable: sustainable construction guidelines

It will include an important section on social acceptance and engagement with 2 main audiences:

- **Businesses**
  - Internal governance (leaders and workers)
  - Interactions with local businesses or organisations
  - Interactions with consultancies, research centres, industrial federations…

- **Publics authorities**
  - Role of (co-)initiators and bridging actors
  - Upscaling of synergies

With focuses

- on **social acceptance and engagement of consumers**
- on co-creation process
- on conflicts of interest (some people loses, some people win)
- on creation of jobs, needs of training…

Specifically, in the social acceptance section, the guidelines will give some answers to the following questions:

- At the company level (interactions inside the company)
  - How to benefit of the source of creativity and innovation in industrial companies that can be found amongst the very people within the organisation, and in the ability to create communities of people focused on the company as an element of sustainable human development
  - Why competency development requires a firm to have an explicit policy or intent to use collaboration as an opportunity to learn rather than minimize costs?
- At the industrial level (interactions between companies)
  - How to increase awareness of producer responsibility for waste production, which is essential in consideration of the central role of business in the economic and societal transformation
- At the regional level (interactions with others stakeholders - public authorities, research centres, citizens...)
  - How to maximize the coordination for industrial symbiosis synergies between stakeholders (industry, research, civil society organizations, public authorities and policy makers)
  - How the opportunities for social innovation, encouraging more sustainable consumption behaviour and lifestyle change, and involving civil society, should be considered, with appropriate attention to gender dimension and to the barrier to raising awareness of eco-innovative solutions and their market, household and community penetration
  - How could stakeholders increase the adoption of more sustainable consumption behaviours and lifestyles in the mid-term (Supporting, where relevant also from a gender perspective)?
  - How eco-innovative solutions, products and services and their uptake will be facilitated by new lifestyles and consumption behaviours;

3.2.2.3. Learning community FISSAC

With Marta Zaragoza Domingo, member of the social advisory board, the implementation of a learning community for FISSAC is being explored. The proposal is based on the design and development of an information and knowledge management tool, based on a Website. This web could stimulate the involvement and cooperation of all direct and indirect beneficiaries of the FISSAC project.

The goals are, among others, to

- Promote participation from all involved actors, internal and external, and their alignment with the project's Mission.
- Raise the awareness about Circular Economy and its related problems
- Disseminate FISSAC Project's results

It is an opportunity to create a new dynamics for commitment and loyalty to the project from stakeholders, mainly citizens, with the institutions or corporations promoting the project.

The proposal is based on the theoretical and methodological framework of Learning Community Models[31], founded on a set of educational initiatives aimed to social and education change.

There are four steps to create a Learning Community:

- Conceptualization
- Communication Plan
- Microsite creation
- Microsite's dynamization

[31] http://utopiadream.info/ca/presentacion/definicion/

This learning Community could have a great added-value for the project FISSAC and actually for every industrial symbiosis project. The budget for this is between €75,000 and €100,000. ACR+ and Cresalida have discussed the possibility to implement a learning community[32] for the FISSAC project, to streamline and enhance the active participation of stakeholders. So far, no budget has been foreseen for that. This is why ACR+ has demanded a precise budget from Cresalida to evaluate the possibility of implementation. The idea, as a participation strategy for achieving greater commitment and engagement, is to include some workshops where the community can participate. The concept is based on the educational model of a learning community. In this case, the FISSAC Learning Community could count on the participation, cooperation, and collaboration of the direct beneficiaries, in addition to the indirect beneficiaries who are expected to be affected by the project development. This could ensure their contribution to the three sustainability pillars of FISSAC. To make this possible, the community could actively participate in a ''virtual space'' and be able to feed their contributions during the project duration. During the next General Assembly in March, the concept will be presented to the partners to identify the opportunities for the project and the financial feasability

3.2.3. Management of the intellectual property rights (Task 8.1)

Who: Fenix
When: From 09/15 to 02/20

Management of intellectual property rights (IPR) comprises of creation, protection and exploitation of intellectual property rights such as patents or copyrights, which play a critical role in the development of intensive industries. Intellectual property rights provide significant benefits as they can ensure the competitive advantage of their owners by being sold or licensed and form foundation for making, using, and selling products and processes. Protection and exploitation of IPR establishes proprietary market advantage in terms of developing leading products, enhancing market share and leading to greater competitiveness on the market.

The importance of obtaining valid IPR and its commercialization is crucial in order to provide sufficient assurance to the stakeholders on their investments. However, the successful commercialization of results can still be influenced by the lack of understanding of the importance of intellectual property rights. It is necessary to develop activities to support awareness among industry and in particular levels of stakeholders of benefits of IPR and boost the implementation of IPR across all sectors.

Engagement of stakeholders within the management of intellectual property rights:

- At the company level:
  - Analyse company needs in order to assess the adequate IPR protection
  - Inform and consult with companies and their management on the importance of careful determination of inventors, ownership, and appropriate rewarding of employees for assigning IPR to their employers
  - Organize seminars with potential users of the platform to inform them about the investment opportunities and emphasize the benefits of IPR
- At the industrial site level:
  - Involvement of potential industrial players and their knowledge and experience in the area of IPR
  - Examine opportunities currently available on the market
- At the regional level:
  - Mapping options and possibilities to protect IP within particular national and regional authorities
- At the individual level:
  - Engage and consult with potential end-users on their needs and expectations regarding IPR attached to the final results

[32] A tool for knowledge management and information between stakeholders, mainly external.

3.2.4. Establishment of a Living Lab for replicating FISSAC model (Task 7.1)

Who: SP
When: From 09/16 to 02/20

The Living Lab is a forum for interaction between stakeholders in the construction value chain, including company management and specialists, consultancies and facilitators, industry associations, research institutes, and representatives from local authorities. For all of these stakeholders the involvement/collaboration is inherent in the task, as they are the participants who are executing the living lab.

The living labs will deal with organizational needs such as knowledge about internal processes and capacities; and intra-company issues such as increased comfort with new forms of collaboration, for example in information-sharing through building materials inventories, planning and strategy for construction projects, etc. Social issues related to citizen groups, public acceptance may become relevant but have not yet been identified during stakeholder interaction. The primary format of the Living Lab so far is that of an interactive workshop.

Social aspects at the level of "Inside the Company" and "Between Companies" will be core findings of the living labs. The workshop format of the lab is designed to help participants identify and discuss these organisational and inter-organisational challenges related to the technical and commercial challenges that are the focus of the lab. At the level of "The Ecosystem," social aspects will not necessarily be inherent to every Living Lab process. Guidance from SP on methodology will be included to help the regional Living Labs address these concerns where they do not naturally arise as a result of the Lab process.

It is important to work with the belief system of participants in these activities, identifying their cosmovision and its impact in every key aspect of the project and the circular economy. If the belief system is identified, it will be easier to shape in benefit of social impact.

3.2.5. Definition of the final version of the FISSAC Industrial Symbiosis Methodology (Task 6.4)

Who: Acciona
When: From 03/17 to 02/20

The final version of the FISSAC methodology will be defined in this task. The final FISSAC scenario will be a feasible demonstrator of industrial symbiosis synergies between industries (steel, non-ferrous metal, mineral, chemical, and construction and demolition sectors) and **stakeholders in the extended construction value chain**. It will advise how to overcome technical (transformations and adaptations of industrial and recycling processes) and **non technical barriers (social and cultural, legislative/regulatory, economic, organizational)** to implement and replicate industrial symbiosis in a local/regional dimension.
The final version of the FISSAC methodology will consist in the procedure to implement the IS model which will be applied in the construction value chain scenario:

- Establish tentative synergies between industrial processes to minimize, reduce and recycle waste as a whole.
- Determine steps to follow for the definition of an industrial commercial framework.
- Identify best techniques and solutions (processes, products and services) to define closed-loop flows.
- Identify other technical barriers and their weight in the specific scenario.
- Tackle **non-technical barriers** which could emerge from each case study.
- Carry out and validate eco-design in specific final products.
- Evaluate replication in other regions.
- **Evaluate the generated impact on society**

3.2.6. New business models for industrial symbiosis towards a circular economy and business plans outline (Task 8.3 and Task 8.4)

Who: FENIX
When: From 03/18 to 02/20

Stakeholders are an essential element of functional business models for industrial symbiosis. As industrial symbioses and principles of circular economy are based on engagement of various groups of stakeholders on different societal levels (such as industrial companies, local communities, regional and national policies and authorities). Successful deployment of the FISSAC business model is conditioned by social acceptance and interest to engage in the industrial symbiosis practices. To achieve this, business model creation should be in line with different stakeholders' needs and expectations. Similarly, the business plan should serve as a good tool to communicate economic impacts on different stakeholder groups. As a business plan can be disturbed by social unacceptance, the social aspect must be taken into account while designing the business plan for the FISSAC project. The plan, through the thorough examination of the market, will draft expected relations between several stakeholders such as suppliers, key partners, but also competition and end-users.

Functional business models communicated through business plans, supported by demo sites results and living labs concept, and dissemination activities should enhance the replicability potential of the model.

Engagement of stakeholders in the FISSAC business model:

- At company level:
  - Analyse company needs and current practices to target potential end-users for the platform (online studies, surveys, questionnaires, briefings with executives).
  - Analyse companies' potential for FISSAC industrial symbioses model participation, as well as use of different business cases to analyse economic viability of potential employment.
  - Inform and consult with companies' CEOs and executives the benefits and impacts of FISSAC model. The business plans could serve as communication/demonstration tools. Likewise results of living labs in different conditions providing a proof of the concept.
  - Organize seminars with potential users of the platform to inform them about the investment opportunities
- At industrial site level:
  - Involvement of potential industrial players
  - Examine supplier opportunities currently available on the market
  - Evaluate a need for key partners such as transportation companies
- At a regional level:
  - Mapping national options and possible synergies with national programmes, contacting national ministries
  - Possibilities for product certification
- At the individual level
  - Engage potential end-users (identify their wishes concerning specific products (cement, concrete, tiles)
  - Examine what are the customers' priority from an environmental perspective

Implications for the stakeholders:

- At the company level – cost reductions, environmental consciousness, engagement in eco-friendly projects
- At the industrial site level – benefits of industrial symbiosis and circular economy practices, sustainable growth of industries
- At the regional level – increasing levels of living, decreasing emissions, sustainable future
- At the individual level – cost reduction, environmental consciousness

3.2.7. Eco-design of cost-effective products (Task 3.2)

Who: Trinus
When: From 11/16 to 05/17

To be defined further

3.2.8. Environmental Technology Verification (Task 3.5)

Who: Rina
When: From 03/17 to 02/20

To be defined further

3.2.9. Definition and validation of FISSAC model (Task 6.5)

Who: D'appolonia
When: From 03/17 to 02/20

To be defined further

3.2.10. Monitoring and evaluation of results with the platform, including real-scale test and compilation of the FISSAC life-cycle inventory (Task 6.3)

Who: Ekodenge
When: From 03/18 to 02/20

To be defined further

3.2.11. Analysis of the condition of the various represented industries to detect technological and non-technological drivers and barriers for the purpose of creating IS (Task 7.2)

Who: SP
When: From 03/18 to 02/20

To be defined further

3.2.12. Evaluation of the replicability of the model (Task 7.3)

Who: D'appolonia
When: From 03/18 to 02/20

To be defined further

3.2.13. Sustainability assessment of the solutions: LCA and LCC of real case studies (Task 5.5)

Who: SP
When: From 02/19 to 02/20

To be defined further

4. Conclusions

Industrial Symbiosis can be a very powerful and important strategic approach to promote sustainability. The work in the FISSAC project is highly relevant in the field of the construction sector and more in general in Industrial Symbiosis. The methodology developed by the FISSAC Partners could be replicated in other sectors. In every Industrial Symbiosis project, the social aspects need to be taken into account. Initiatives aiming at promoting sustainability more widely must take social aspects into consideration and integrate them, in different ways, in their approaches.

In the FISSAC project, the FISSAC platform will be used for the evaluation of the material, energy flow as well as evaluating the environmental impacts and cost of the studied flows. This innovation is largely based on a technical approach. However, social engagement and acceptance is an essential pillar of success for the implementation of industrial symbiosis. It is part of the collaborative approach of industrial symbiosis. This deliverable gathers these 2 approaches – technological and collaborative.

Concretely, a five-step approach is used to establish the objectives of stakeholder engagement and indicates how the involvement of stakeholders can be achieved at each stage of the project. In this deliverable,

1. A vision for the social engagement and acceptance has been developed;
2. The Map stakeholders described in the Deliverable D1.4 – Social strategies for FISSAC: Definition of target social groups – is summarised;
3. A large table describes the various tasks with a social aspect in order to identify the FISSAC partners that will implement the social engagement and acceptance;
4. From March 2017, actions will be implemented thanks to the support of the Social Advisory board;
5. Indicators will be selected in order to monitor and evaluate the social aspect when it is possible.

FISSAC will contribute to increase the awareness of the importance of the social aspects for the implementation of Industrial Symbiosis project. The dissemination of the results will be supported by a final report (Deliverable 10.5) and by guidelines on sustainable construction and will highlight the link with the UN Sustainable Development goals.

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