CORALIS

Creation Of new value chain Relations through novel Approaches facilitating Long-term Industrial Symbiosis

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Guideline 4.5: Industrial Symbiosis Readiness Level Matrix

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Working Package: WP10

Guideline for use of the Industrial Symbiosis Readiness Level Matrix (ISRL Matrix)

This is an introduction to the Industrial Symbiosis Readiness Level Matrix (ISRL Matrix) and instructions on how to use it as a tool to evaluate the readiness of an IS network or specific IS collaboration. The ISRL Matrix was first developed in WP2 in CORALIS and has continued to be developed within Task 9.1, with the objective to serve as a tool for the continuous evaluation of the demo sites' activities and progress throughout the project.

Why use the ISRL matrix?

The purpose of the ISRL Matrix is to evaluate and support the progress of the IS network. In the early initiating phase of establishing an IS network, the ISRL Matrix can be used as a tool for guidance, and when the IS network development is underway it can function as a tool for evaluation. By using the matrix as a guide, the user has the possibility to evaluate the readiness level (RL) of an existing, or potential, IS network or a specific resource exchange within an IS network. The evaluation is based on self-assessments done by each participating actor and covers different categories of perspectives that are relevant for successful deployment of symbiotic networks: **Technology and Integration (TIRL), Business (BRL), Organizational (ORL), Legal (LRL), Societal (SRL), and Environmental (ERL**). A further description of each category can be found at the end of this document. For each category there are nine ascending readiness levels (RL1-RL9), which each corresponds to sets of activities that can contribute to the progression of the IS network. The activities should be seen as a guidance of things worth to consider when forming or developing an IS network, not a definite "checklist".

Due to the complexity often associated with IS networks, ORL, SRL and ERL are evaluated based on the progress of the *entire* IS network (an example is depicted in Figure 1 below). TIRL, BRL, LRL, and ERL are evaluated based on *specific* collaborations within the IS network, e.g. a resource exchange where two actors are involved (see an example in Figure 2). In this manner, aspects that are important for the progress of the entire network are addressed by all actors, while aspects important to different specific collaborations within the network can be evaluated separately by the concerned actors. The category 'Environmental' is regarded as essential on different system levels, both for the network as a whole as well as for each specific collaboration, and therefore included in both assessments.

When each actor has evaluated the readiness of the IS network and/or a specific resource exchange with the ISRL matrix, it is possible to visualize and assess the total readiness of the IS network or the specific collaboration by combining the results from the assessments done by all actors involved. After completing the ISRL assessment, each participating actor will receive a graphic summary of the results like in the examples in Figure 1 and Figure 2 below.
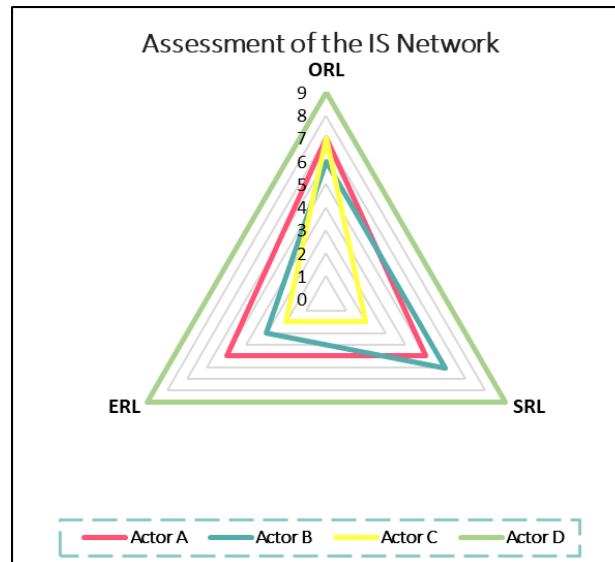
Figure 1. Example of results from assessing the readiness of an IS network consisting of four parties: Actors A – D. The assessment of the IS network entails assessing the networks' readiness from the Organizational, Societal and Environmental perspective (ORL, SRL and ERL).
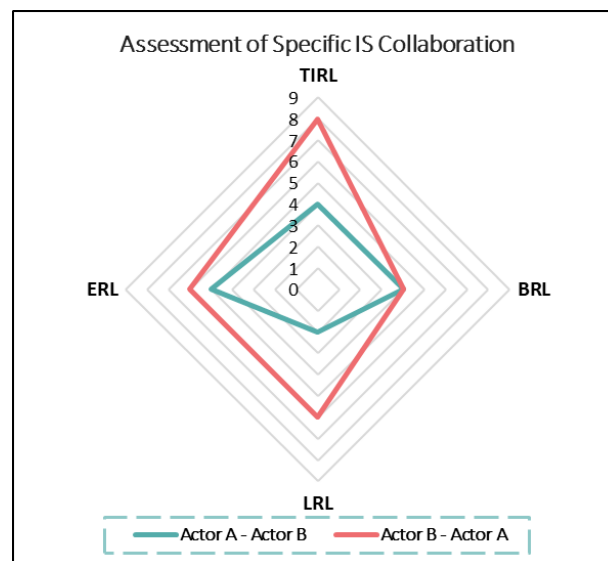

Figure 2. Example of results from assessing the readiness of a collaboration within an IS network between Actor A and Actor B. The assessment of a specific IS collaboration entails assessing its readiness from the following perspectives: Technology & Integration, Business, Legal and Environmental (TIRL, BRL, LRL and ERL).

The results from the ISRL-assessments can then be used to identify in what area(s) the symbiosis is strong, i.e., on a high readiness level, and in what area(s) it is less developed, i.e., on a low readiness level. The matrix can also indicate whether partners in the IS are aligned or whether there are discrepancies in readiness between partners that might affect the progression of the symbiosis. As such, the purpose of the exercise is not to generate an

absolute measure, but to help evaluate the overall readiness of the IS network or specific collaborations, to identify in which areas actions are needed to favour further development and to shed light on where potential risks may lay ahead due to differences in readiness.

The main value lies in the joint discussions of the results between the IS partners, which may facilitate and contribute to creating a shared mental model of the IS' current state as well as the road ahead for its future development. This process can then be iterated throughout the IS network development, as depicted in Figure 3.
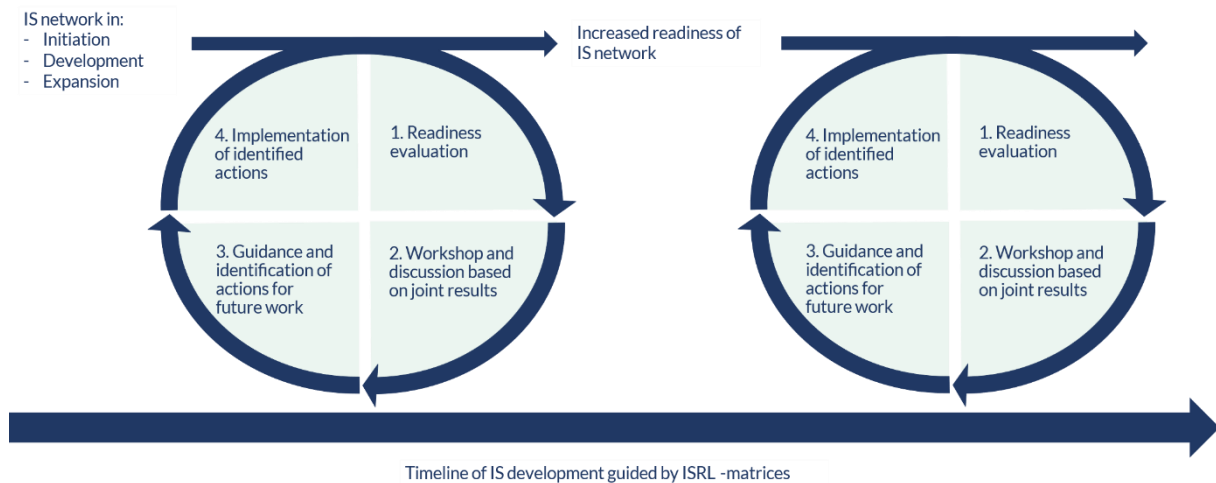

Figure 3. The suggested process for working with the ISRL Matrix as a tool for guidance early on and later evaluation during the development of an IS network.

Who is it designed for?

The intended users of the ISRL Matrix are, e.g., the (potential) supplier of a residual resource, the (potential) user of a residual resource and/or the facilitator of an IS network.

When assessing the whole IS network, each actor contributes with its view on the network's readiness within each category, and when assessing a specific resource exchange, each actor assesses it own readiness to participate in that specific symbiotic collaboration.

The ISRL Matrix can be used in the same manner independent of the actor's role in the IS network. However, all RL perspectives are not necessarily relevant for all actors and can thus be excluded if considered not applicable.

How to use the ISRL Matrix

Step 1 – Conducting self-assessments

Preparation: Read through this guideline document and decide which IS collaboration to assess besides the overall IS network. The ISRL Matrix is accessed in the Excel-file that accompanied this document. The sheet which is called 'action plan' in the Excel-file is to be used later in a follow-up workshop.

Estimated time: 30-45 mins. to assess overall IS network + 1 specific collaboration/resource exchange. Around 15-30 minutes more for each additional collaboration assessed.

Competencies needed: People with insight and knowledge regarding the contribution to the IS within each area that the matrix covers.

Outcome: Spider charts summarizing the assessment results.

When conducting a self-assessment with the ISRL matrix, go through each column and read the statements at each readiness level and assess whether they describe the current reality of the IS network or the specific IS collaboration you are assessing. At the top of each column, write down at which RL you place yourself in with regards to that perspective of readiness, together with a comment explaining or justifying your assessment. When assessing a specific collaboration, don't forget to note which one you are assessing in the 'Name' cell (i.e. Actor A – Actor B means Actor A assesses the resource exchange with Actor B).

Please keep the following in mind when conducting this exercise:

- It is not necessary for one actor to be at the same RL across the different perspectives. For example, one actor can position themselves in RL 4 for TIRL and RL 2 for the LRL.

- It is not necessary to fulfil all criteria in each cell of the matrix to climb to the next RL (i.e. this should not be regarded as an exhaustive checklist). This depends on the individual actor and the context in which the symbiosis exists. Therefore, clarifying comments are valuable and provide further nuance and context when interpreting the results.

- The purpose of the ISRL Matrix is not to generate an absolute measure but to help evaluate the overall readiness of the IS network or the specific collaboration in focus, shed light on where potential risks may lay ahead due to differences in readiness and where future development would benefit the IS progression.

After completing the assessment, please send the Excel-file back to your facilitator/RTO.

Description of Industrial Symbiosis Readiness Levels

Organizational Readiness Level

ORL helps to monitor and support the development of the IS network in a direction that enables existing business and managerial processes to adapt in a stepwise manner, so that mutually beneficial goals are achieved in partner organisations while they continue to deliver on business targets.

If there is already an IS governance structure in place, the main purpose of the ORL assessment is to evaluate and support it and to develop the IS network from a managerial/organizational perspective.

Societal Readiness Level

The SRL helps to ensure that the development of the IS complies with both expressed and unexpressed expectations and demands of society, i.e., local and regional communities ("license to operate"). SRL should also support the assessment of societal issues regarding for example social added values, contributions to social sustainability and ensure these aspects are seen to as the IS network develops.

Environmental Readiness Level

At the overall IS network level, the ERL is used to evaluate the IS network's ability to produce the same (or more) value yet generating lower environmental impact compared to "stand-alone" facilities with current state-of-the-art technologies and systems. For a specific collaboration within the IS network, the ERL can function as a support as of how to ensure that the environmental performance is adequately assessed throughout the development of the collaboration. To ensure contribution to global sustainable development, the environmental performance should be evaluated from a prospective system's perspective and also consider benchmarking towards global goals and future technological developments that could improve environmental performance and move the state-of-the-art forward.

Technology and Integration Readiness Level

For an industrial symbiosis to work sustainably, efficient integration is key. TIRL can be considered as an extension of the technological readiness level (TRL). In contrast to TRL, TIRL focuses on an extended system, e.g. a technical system in a (maybe new) context - in this case the symbiosis system. TIRL is a metric that aims to capture not only the maturity of the individual technical components but also its ability to operate in an integrated system environment. TIRL assesses the total level of system integration within a symbiotic collaboration.

Business Readiness Level

The BRL intends to support the development of a sustainable business model for a symbiotic collaboration in a way that satisfies both the user and the supplier of the shared resources. Furthermore, BRL will also help in the development of measurements of both direct and indirect values created by the collaboration.

Legal Readiness Level

The LRL is a metric to evaluate and support the development of an IS collaboration from a regulatory perspective to ensure conformity with the current legal framework throughout the different steps of the development process.

Guidelines for facilitators

Step 2 – Workshop to interpret results and gain insights for future work

Preparation: All participating actors have conducted an assessment with ISRL- Matrix.

Estimated time: 1.5-2 hrs.

Competencies needed: Minimum one representative per actor in the IS network. A facilitator to introduce the exercise, keep time and harvest results.

Outcome: Action plans (one for each assessed collaboration and one for the IS network), and notes with key take aways from the discussion of the results.

1. **Focusing on specific collaborations (~30-45 mins):** Begin with a session where actors split up into teams of 2, discussing the results form the readiness assessment of their specific collaboration that is presented in a joint diagram (categories TIRL, BRL, LRL, and ERL) as in the example in Figure 2. The aim for the discussion is to result in an action plan based on the outcomes of the discussions (see template in the excel file). The actors are also responsible for documenting the key points of their discussion.

   Suggested questions to discuss:

   • Are any of the RL differences between the IS parties more crucial than others to address for the future progress of the IS collaboration?

   • What, if any, are the implications of these differences in readiness for the IS collaboration?

   • Are there any co-dependencies between the readiness categories that hinder/enable further progress of the IS collaboration?

   • Which are the most important activities within each category in order to:

      • Minimize RL differences between the actors involved in the IS collaboration?

      • Enable further development of the IS collaboration?

      • Pro-actively mitigate future risks?

2. **A short round of sharing outcomes** from the previous exercise (~ 10-15 mins, depending on the number of collaborations assessed).

3. **Focusing on the overall IS network (~ 30-45 mins):** The facilitator presents the results from each actor's assessment of the whole IS network (categories ORL, SRL and ERL) in a joint diagram, see example in Figure 1. Then all actors are invited to collectively discuss the results. The facilitator takes notes and harvests outcomes from the discussion. The aim of the discussion is to result in an action plan (see template in the excel file).

Suggested questions to discuss:

- Are any of the RL differences between the IS parties more crucial than others to address for the overall IS progress?

- What, if any, are the implications of these differences in readiness between different IS partners?

- Are there any co-dependencies between IS parties that hinder/enable further progress within any readiness category? Or are there any co-dependencies between the readiness categories that hinder/enable further progress of the IS network?

- Which are the most important activities within each category in order to:

    - Minimize RL differences between the partners in the IS network? Is a collective effort needed or rather individual efforts of IS partners?

    - Enable further development of the IS network?

    - Pro-actively mitigate future risks?

4. **Converge essence of discussion into an action plan (~15-20 mins).** Facilitator to steer the discussion towards what can be agreed upon in terms of future work and next steps.

N.B. As previously stated, the results of the ISRL Matrix should be interpreted as guidance and help in developing the IS network. It is not a prerequisite that all perspectives reach readiness level 9 for the IS to be operating, nor that all actors within the IS network have positioned themselves at the same level of readiness. Some perspectives may be more or less important to different actors, and to different IS networks, depending on the composition of the network and the context in which they operate.

The aim is that the results contribute to creating a shared mental model of the current state of the IS network, and function as a foundation for further dialogues between all involved partners regarding how to continue the IS development going forward.