H2020 – SPIRE-06-2015

Energy and resources management systems for improved efficiency in the process industries

Title: Secure Management Platform for Shared Process Resources

Acronym: SHAREBOX

Grant Agreement No: 680843

<table>
<thead>
<tr>
<th>Deliverable 7.8</th>
<th>Training Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associated WP</td>
<td>WP7 Innovation Impacts</td>
</tr>
</tbody>
</table>
| Associated Tasks| - T7.5 Training and skills building  
|                 | - ST 7.5.1 Training and upskilling activities  
|                 | - ST 7.5.2 Engagement with training institutions for European skills  |
| Due Date        | August 31, 2019 |
| Date Delivered  | August 20, 2019 |
| Prepared by (Lead Partner) | CCB |
| Partners involved | CCB, DECHEMA, IRIS, ISL, UT, ULEEDS, UPC, USTRATH, ZHAW, ITC-AICE, ESO |
| Authors         | Ansgar Rudolph (CCB) |
| Dissemination Level | Public |
© European Communities, 2018.

The information and views set out in this publication are those of the author(s) and do not necessarily reflect the official opinion of the European Communities. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.
Table of Contents

Executive summary .................................................................................................................. 5

1. Introduction .......................................................................................................................... 6
   1.1 The SHAREBOX project .............................................................................................. 6
   1.2 Scope of this document ............................................................................................... 6
   1.3 Document structure ................................................................................................... 7

2. Rationale of the training concept ....................................................................................... 7
   2.1 Challenges .................................................................................................................. 7
      2.1.1 Awareness about the benefits of industrial symbiosis ........................................ 8
      2.1.2 Knowledge about technological solutions that support synergy creation .......... 8
      2.1.3 Managing the process of synergy creation .......................................................... 8
      2.1.4 Using the potentials of the SHAREBOX software ............................................... 8
   2.2 Objectives .................................................................................................................... 9
   2.3 Tools ............................................................................................................................ 9
      2.3.1 Training and demonstration events ..................................................................... 9
      2.3.2 Web-based training platform .............................................................................. 10
      2.3.3 “Train the trainer” concept ................................................................................. 10

3. Training and demonstration events ............................................................................... 11
   3.1 IS workshop at Eskişehir, Turkey .............................................................................. 11
   3.2 Workshop at Nules, Spain .......................................................................................... 13
   3.3 Workshop at Castellón, Spain ...................................................................................... 17
   3.4 Industrial symbiosis Training at Bursa, Turkey .......................................................... 22
   3.5 Training event at NEPIC, UK .................................................................................... 24
   3.6 Master course on sustainable business development .................................................. 26
   3.7 Session on “Environmental Applications of AI”, Barcelona, Spain .......................... 28
   3.8 SPIRE side event on industrial symbiosis, ACHEMA fair, Frankfurt, Germany ........ 31
   3.9 SPIRE side event on industrial symbiosis, World Resources Forum, Antwerp, Belgium 33

4. Web-based training platform .......................................................................................... 38
   4.1 Introduction to and strategic benefits of IS ................................................................. 38
      4.1.1 SHAREBOX general introduction video ............................................................... 38
      4.1.2 Industrial symbiosis and its benefits .................................................................. 39
      4.1.3 Basic functionalities of the SHAREBOX platform ............................................... 40
   4.2 Water treatment and filtering technologies in the context of industrial symbiosis ...... 41
   4.3 Symbiotic exchange of energy: Technologies and management .............................. 42
4.4 Evaluating Industrial Symbiosis Opportunities (EVALIS Service) and Cost Allocation in Industrial Symbiosis Relations (COSTIS Service) ........................................................................................................ 43
4.5 How AI can support end-users evaluating IS potential ........................................................................ 44

5. “Train the trainer” concept .................................................................................................................. 45
5.1 Organisational and business model .................................................................................................. 45
5.2 Elements of the “Train the trainer” programme .............................................................................. 45
   5.2.1 Introduction course into IS ........................................................................................................ 45
   5.2.2 Internships with IS practitioners ............................................................................................. 45
   5.2.3 Courses on communication and group facilitation .................................................................. 46
   5.2.4 Course on IS European Standard ............................................................................................ 46
   5.2.4 Handbook on IS case studies .................................................................................................. 46
   5.2.5 Exercise courses with the SHAREBOX platform ...................................................................... 46
   5.2.6 Courses on methods of secondary resources re-use and processing ..................................... 47
   5.2.7 Courses on concept and functionality of SHAREBOX-related recommender systems . 47

6. Conclusions .......................................................................................................................................... 47
References .............................................................................................................................................. 49
Executive summary
The SHAREBOX web-based platform will provide plant operations and production managers with the robust and reliable information that they need in real-time in order to effectively and confidently share resources (plant, energy, water, residues, and recycled materials) with other companies in an optimum symbiotic eco-system.

However, the implementation of industrial symbiosis is a very complex task, requiring knowledge about industrial processes and technologies and industrial ecology as well as social aspects of cooperation in a context of competition (“co-opetition”) and management skills. The SHAREBOX web-based platform for resource management is also a complex product that requires some training for efficient application.

The SHAREBOX consortium members have therefore designed and implemented a comprehensive series of training activities to transfer knowledge on the management of secondary industrial resources to various target groups. The training tools combine the transfer of theoretical knowledge with practical experience in creating industrial synergies and handling the SHAREBOX software.

Based on an analysis of existing challenges, the objectives of the SHAREBOX training concept are:

- To impart a solid understanding of the concept of industrial symbiosis, including economic benefits and cross-sectoral opportunities,
- To enable companies to meet the organizational requirements for managing industrial symbiosis,
- To provide knowledge about SHAREBOX and its functionalities that support identification and evaluation of synergy opportunities and the process of creating synergies,
- To enable users to handle the SHAREBOX software in an effective way.

In this framework, the cluster organizations involved in the SHAREBOX project (ESO, ITC, NEPIC, CCB) organized in total nine training events to provide information on the concept of industrial symbiosis and to let them have an experience with the SHAREBOX web-based platform already during the design process. Some of these events were combined with facilitated IS workshops. Documentation of agendas, speakers, participants and media coverage of these events is part of this report.

The on-line training tool of SHAREBOX consists of in total seven training units in the form of videos and presentations to relevant topics. They have been made available via the SHAREBOX web page. A short description of these training units is also a part of this report.

The training report further develops the concept of a “train the trainer” programme, with elements like, internships with IS practitioners, courses on communication and group facilitation, courses on methods of secondary resources re-use and processing, and many others. The training units of this programme can be provided by SHAREBOX consortium partners along with the process of rolling out a commercial version of the SHAREBOX platform.
1. Introduction

1.1 The SHAREBOX project

In order to migrate to the energy and resource efficient zero-waste process industry of the future, the SPIRE work programme calls for “solutions for more efficient processing and energy systems for the process industry, including industrial symbiosis”. Industrial symbiosis (IS) is the use by one company or sector of by-products, including energy, water, logistics and materials, from another.

A limiting factor for the implementation of economic and ecological synergies based on the concept of industrial symbiosis is inadequate business-to-business information on, for example, what resources a product or process contains. This hinders efficient material flows and the creation of value in the circular economy.

The SHAREBOX project meets this challenge by developing a secure platform for the flexible management of shared process resources. The SHAREBOX web-based platform will provide plant operations and production managers with the robust and reliable information that they need in real-time in order to effectively and confidently share resources (plant, energy, water, residues, and recycled materials) with other companies in an optimum symbiotic eco-system. Beyond that, the SHAREBOX platform also helps to increase process efficiency and to ease decision making on resource management by providing intelligent support tools, based on input-output modelling, game theory, and agent-based modelling. The data on transactions generated by the SHAREBOX platform will be processed by data mining tools, following the Big Data concept. These can be used for the further optimisation of resource sharing procedures, and, in general, will provide more and in-depth knowledge on the success factors for the implementation of industrial symbiosis approaches in industrial ecosystems.

The SHAREBOX consortium represents the complete value chain related to the development and market launch of the web-based management platform, from software developers and computer scientists to consultants facilitators and industrial cluster managers, right to the target group for application, companies from the process industry sector. This guarantees that the functionality of the platform and the applicability of its tools is checked by practitioners throughout the processes of development and market access.

1.2 Scope of this document

The implementation of industrial symbiosis is a very complex task, requiring knowledge about industrial processes and technologies and industrial ecology as well as social aspects of cooperation in a context of competition (“co-opetition”) and management skills. The SHAREBOX web-based platform for resource management is also a complex product that requires some training for efficient application.

The SHAREBOX consortium members have therefore designed and implemented a comprehensive series of training activities to transfer knowledge on the management of secondary industrial resources to different target groups like industrial resource managers or
students of sustainable business management. These activities ranged from half-day training sessions to intensive courses integrated into university master programs. Further, they introduced a series of on-line training units on related to industrial symbiosis, the SHAREBOX platform and on specific topics like the decision support tools. The training concept is following a rationale that is also outlined in this document.

By providing these training activities, the consortium members intend to facilitate understanding, acceptance and future uptake and exploitation of the results of this project by the industry. They are aware that more training activities will be required beyond the limited capacities that were available during the SHAREBOX project. They will commit to this issue beyond the funding period of this project, e. g. by continuing and intensifying the presence of the topic in university education programmes, or by intensifying cooperation between CCB and DECHEMA for common training and dissemination activities.

1.3 Document structure

This document is structured into four main chapters:

Chapter 1 introduces the content and structure of this document.

Chapter 2 discusses the rationale of a training concept for the application of industrial symbiosis and the use of a web-based support tool like SHAREBOX.

Chapter 3 provides a documentation of the training events that were staged in the context of the SHAREBOX project.

Chapter 4 provides a documentation of the online training platform that was elaborated in the context of this project.

2. Rationale of the training concept

2.1 Challenges

There are excellent examples of industrial symbiosis, such as the Industrial Park in Kalundborg, Denmark, which underline the enormous economic and ecological benefits that can arise from the creation of resource-related synergies between companies. However, we can also see that only a small fraction of the enormous potential of IS has been used yet. The work of the SHAREBOX consortium has also given evidence that most existing platforms for the exchange of resources are far away from being efficient (Gap analysis of related ICT tools – D1.2). This analysis and also the consortium partners’ ample practical experiences with corporate attitudes on IS lead to the conclusion that various challenges will have to be tackled for overcoming the barriers to a widespread implementation of industrial symbiosis:
2.1.1 Awareness about the benefits of industrial symbiosis

Whereas many companies are aware of the concept of circular economy and go to great lengths to reduce energy and material consumption in their internal processes, much less effort is spent on the creation of synergies beyond the organizational limits of an industrial production site. Industrial parks in the chemical and process industry often only valorise a limited number of the most important downstream products by passing them on to other companies in a connected system. Less attention is being paid to resources that only appear in smaller amounts or that could be valorised in synergies between partners across sectoral borders. In the companies, there is little to no knowledge about the potential value of such synergies. The training programme should motivate companies to learn more about industrial symbiosis and the opportunities in their own production site to save or earn money by creating synergies with external partners.

2.1.2 Knowledge about technological solutions that support synergy creation

The exchange of resources across sectorial boarders often demands for an intermediary step to make the supplied resource usable for a demander. For instance, process water from one production plant needs to be purified in order to meet specific requirements of the demander. In many cases, specific technologies to realise this intermediary step do exist, but the potential partners of a synergy do not know about these technologies and the respective solution providers. SHAREBOX therefore provides databases and recommender systems that support the access to this knowledge. Potential users of the software should be made aware that there are options for synergies that they currently do not know about and that the software helps the user to identify these platforms.

2.1.3 Managing the process of synergy creation

The consortium partners have learned that companies often lack organizational structures to manage processes of industrial symbiosis. The creation of a synergy may be for instance of concern for the sourcing, the sales, the environmental management, the energy management and the R&D departments of a company. Knowledge needs to be bundled and activities need to be coordinated between these departments. This requires a defined responsibility and the empowerment of a person or an organizational unit in the company to do the coordination. SHAREBOX training should help to enable companies of all sectors and sizes to manage there is processes in an effective way.

2.1.4 Using the potentials of the SHAREBOX software

SHAREBOX has developed into a very powerful but also complex instrument. The platform uses a specific syntax that may not be known from other computer applications. This applies for instance to the classification of industries and resources. Traditional classification systems like NACE or EWC do not cover the whole range of possible cases that are applicable for SHAREBOX. The process of negotiating a synergy also requires a specific syntax that defines the objects and the steps of negotiation. Sophisticated tools like the FISIF and FISVA recommender systems
require specific knowledge on their methodology and function. The software already has an extensive help function, which will certainly be improved with the introduction of a commercial version. However, a systematic introduction and training will help users a lot to handle the system more efficiently and with better results.

2.2 Objectives
Based on the analysis of existing challenges, the objectives of the SHAREBOX training concept are:

- To impart a solid understanding of the concept of industrial symbiosis, including economic benefits and cross-sectoral opportunities
- To enable companies to meet the organizational requirements for managing industrial symbiosis
- To provide knowledge about SHAREBOX and its functionalities that support identification and evaluation of synergy opportunities and the process of creating synergies
- To enable users to handle the SHAREBOX software in an effective way

When designing training measures, the timeframes of other SHAREBOX related tasks and the availability of specific competences and resources also had to be considered.

2.3 Tools
The SHAREBOX consortium has developed a set of training tools that is mainly addressed to the following target groups:

- Industrial companies, with a focus on small and medium companies from the process industry
- Other enterprises for which IS might be relevant, e.g. craft workshops or agricultural enterprises
- Multiplicators, like government and non-government organizations
- Academia, including university students
- Service providers that support the creation of industrial synergies, e.g. cluster organizations, consulting companies and others

The training tools developed combine the transfer of theoretical knowledge with practical experience in creating industrial synergies and handling the SHAREBOX software.

2.3.1 Training and demonstration events
The cluster organizations involved in the SHAREBOX project (ESO, ITC, NEPIC, CCB) organized training events for companies in their networks to provide information on the concept of industrial symbiosis and to let them have an experience with the SHAREBOX web-based platform already during the design process. Some of these events were combined with facilitated IS
workshops. Attention from these companies for the training events was very different: from very high in Turkey to rather low in Germany. Low attendance in Germany may be attributed to the manifold of event invitations that German companies are confronted with, and with the decentral structure of the industry, which often requires long travelling to the event.

Other training events were organized by academic partners (UPC, UT). They addressed the international academia. UPC and UT also included training on industrial symbiosis and an introduction into the concept of SHAREBOX into their master programs on artificial intelligence respectively on sustainable business development.

Selected training events are documented in ch. 3.

2.3.2 Web-based training platform
A web-based training platform is integrated into the SHAREBOX website and provides easy access to information on the SHAREBOX platform and its artificial intelligence components, and on the concept of industrial symbiosis. The platform is open, free and easily accessible for all target groups listed up above. Its intention is to raise interest on the concept of IS and the SHAREBOX platform, and to provide fundamental knowledge for building the capacity to manage IS processes and to operate the SHAREBOX platform.

The training platform is a subsection of the SHAREBOX website. Information was contributed by various consortium partners. Various training units can be downloaded as pdf or animated movie files from the website.

The contents of the web-based training platform are documented in ch. 4.

2.3.3 “Train the trainer” concept
“Train the trainer” is an education model whereby individuals identified to teach, mentor or train others attend training themselves. In the context of the SHAREBOX project, it will be very important to have qualified instructors and facilitators who can introduce and provide support in the use of the platform, and help to stimulate and coordinate negotiation processes along with the creation of synergies. This requires profound knowledge about the SHAREBOX software, its user interface and its functionalities as well as organisational and communicative capacities. The competencies to be taught in a SHAREBOX “Train the trainer” programme can be listed up as follows:

- Capacity to handle the SHAREBOX platform in the standard and in the facilitator mode
- Knowledge and understanding of the artificial intelligence and recommender systems related to SHAREBOX
- Knowledge about the concept of industrial symbiosis and its ecological as well as economic benefits
- Knowledge about standards to manage processes of IS synergy creation
- Knowledge about secondary materials and existing technologies to process them
• Knowledge about existing technologies and industrial applications for secondary energy use
• Knowledge about existing successful role models for IS
• Organisational capacities and knowledge about tools to facilitate group work
• Communicative capacities to present the SHAREBOX concept and to facilitate group discussions
• Knowledge about communication channels and potential support structures for customer/target group access

The outlines of a possible future SHAREBOX “Train the trainer programme are given in ch. 5.

3. Training and demonstration events
The SHAREBOX consortium has made excellent experience with training and demonstration events, which with their hands-on approach help to understand the complex mechanisms of industrial symbiosis. Preparing and celebrating these events requires considerable effort. For the future, the resources of strategic partners should be mobilized to bring these events near to the potential users of the SHAREBOX platform.

3.1 IS workshop at Eskişehir, Turkey

<table>
<thead>
<tr>
<th>Date of event:</th>
<th>17.11.2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place of event:</td>
<td>Eskişehir Rixos Hotel, Turkey</td>
</tr>
<tr>
<td>Number of participants:</td>
<td>100, of them</td>
</tr>
<tr>
<td>50 Industry</td>
<td></td>
</tr>
<tr>
<td>10 Technical service providers</td>
<td></td>
</tr>
<tr>
<td>10 Consultants</td>
<td></td>
</tr>
<tr>
<td>10 Scientific institutions</td>
<td></td>
</tr>
<tr>
<td>10 Government institutions</td>
<td></td>
</tr>
<tr>
<td>10 Intermediaries and NGO</td>
<td></td>
</tr>
<tr>
<td>SHAREBOX consortium partners involved:</td>
<td></td>
</tr>
</tbody>
</table>
**Eskişehir Sanayi Odası (Eskişehir Chamber of Industry, ESO)**

**Speakers/facilitators:**

TTGV (Turkey Technology Development Foundation)

**Agenda:**

**Part 1: Information**

- 09:30 - 10:00  Registration
- 10:00 - 10:30  Opening Remarks
- 10:30 - 10:50  Presentation: Concept of industrial symbiosis and Good Examples
- 10:50 - 11:10  Documentary: What is industrial symbiosis?
- 11:10 - 11:30  Introduction of the Project
- 11:30 - 11:40  Coffee Break

**Part 2: IS Workshop**

- 11:40 - 13:30  Workshop: Identifying the possibilities of IS among firms
- 14:00 - 16:00  Lunch and Networking

**Short summary:**

In the first part of the event, an informative meeting was held to all relevant companies and stakeholders, especially in the public and private sectors. In the workshop, leading companies of sectors such as food, machinery equipment, trailer-trailer manufacturing, ceramics, construction, as well as universities, municipalities, recycling, engineering, consulting firms, etc. representatives from the institutions took part. 100 participants from different sectors participated in the workshop.

**Results:**

In the second part of the event, a workshop was held to determine the possible symbiosis (cooperation) between companies. 392 symbiosis possibilities were determined in the workshop. Thus, a very important step was taken for the realization of the symbiosis opportunities in the region.

**Materials for documentation:**

n/a
3.2 Workshop at Nules, Spain

<table>
<thead>
<tr>
<th>Date of event:</th>
<th>23.06.2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place of event:</td>
<td>City Hall, Social Services building, Nules, Spain</td>
</tr>
<tr>
<td>Number of participants:</td>
<td>15, of them</td>
</tr>
<tr>
<td>8</td>
<td>Industry</td>
</tr>
<tr>
<td></td>
<td>Technical service providers</td>
</tr>
<tr>
<td></td>
<td>Consultants</td>
</tr>
<tr>
<td>2</td>
<td>Scientific institutions</td>
</tr>
<tr>
<td>5</td>
<td>Government institutions</td>
</tr>
<tr>
<td></td>
<td>Intermediaries and NGO</td>
</tr>
</tbody>
</table>
**SHAREBOX consortium partners involved:**

ITC, GUZMAN GLOBAL, ISSA, KEROS, KERAFLIT

**Agenda / speakers:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:00-15:15</td>
<td>Reception of participants</td>
</tr>
<tr>
<td>15:15-15:30</td>
<td>Welcome notes</td>
</tr>
<tr>
<td></td>
<td><strong>David García, Mayor of the Municipality of Nules</strong></td>
</tr>
<tr>
<td></td>
<td><strong>César Estañol, Councillor for Industry</strong></td>
</tr>
<tr>
<td>15:30-15:50</td>
<td>Presentation on the SHAREBOX project</td>
</tr>
<tr>
<td></td>
<td><strong>Carlos Gil, KEROS, S.L.</strong></td>
</tr>
<tr>
<td>15:50-16:00</td>
<td>Examples of industrial symbiosis processes</td>
</tr>
<tr>
<td></td>
<td><strong>Victoria Bargues (GUZMAN GLOBAL, S.L.)</strong></td>
</tr>
<tr>
<td>16:00-16:20</td>
<td>Presentations of the participating enterprises</td>
</tr>
<tr>
<td>16:20-16:30</td>
<td>Introduction into the methodology</td>
</tr>
<tr>
<td></td>
<td><strong>Encarna Bou, ITC-AICE</strong></td>
</tr>
<tr>
<td>16:30-17:00</td>
<td>Coffee break</td>
</tr>
<tr>
<td>17:00-18:00</td>
<td>Practical workshop on industrial symbiosis</td>
</tr>
<tr>
<td></td>
<td><strong>ITC-AICE</strong></td>
</tr>
<tr>
<td>18:00-18:30</td>
<td>Recap of the results of the practical workshops</td>
</tr>
<tr>
<td></td>
<td><strong>ITC-AICE</strong></td>
</tr>
</tbody>
</table>

**Short summary:**

The event was organized by the City Government of Nules and by ITC, with the support of the companies from the Nules Industrial Zone that participate in the SHAREBOX project. There was an introduction into the concept of IS, and participating enterprises had the opportunity to present themselves. The training unit was followed by a practical IS workshop, which gave the participating companies the opportunity to create synergies for exchanging resources.

**Results:**

Numerous synergy requests were collected and processed for the creation of the SHAREBOX software and databases. There was ample coverage of the event in regional media.
Materials for documentation:

Web publications:

Newspaper “El periódico del Azulejo”:

https://www.elperiodicodelazulejo.es/noticias/actualidad/busca-mayor-simbiosis-industrial_2911.html

Nules Town Hall web (Consultation: 29/06/2016):

http://www.nules.es/es/noticia/ayuntamiento-nules-cola...</nuelles-cola</nuelles-cola-

Journal “Técnica Cerámica” (Consultation: 08/09/2016):

https://issuu.com/publicas/docs/tc-431
El ITC y varios miembros del proyecto Sharebox impulsan talleres prácticos de simbiosis industrial con empresas...
### Workshop at Castellón, Spain

**Date of event:**

21.07.2016

**Place of event:**

Castellón Chamber of Commerce

**Number of participants:**

26, of them

<table>
<thead>
<tr>
<th>Industry</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>Technical service providers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consultants</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scientific institutions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Government institutions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>9:00-9:15</td>
<td>Reception of participants</td>
</tr>
<tr>
<td>9:15-9:30</td>
<td>Welcome note</td>
</tr>
<tr>
<td></td>
<td>Javier García, Subdirector of ITC-AICE</td>
</tr>
<tr>
<td>9:30-9:45</td>
<td>Presentation on the SHAREBOX project</td>
</tr>
<tr>
<td></td>
<td>Encarna Bou (ITC-AICE)</td>
</tr>
<tr>
<td>9:45-10:00</td>
<td>Industrial symbiosis in an international context</td>
</tr>
<tr>
<td></td>
<td>James Woodcock (ISL International Synergies Limited)</td>
</tr>
<tr>
<td>10:00-10:15</td>
<td>Examples of industrial symbiosis processes</td>
</tr>
<tr>
<td></td>
<td>Victoria Bargues (GUZMAN GLOBAL, S.L.)</td>
</tr>
<tr>
<td>10:15-10:45</td>
<td>Coffee break</td>
</tr>
<tr>
<td>10:45-11:00</td>
<td>Introduction to the practical workshop</td>
</tr>
<tr>
<td></td>
<td>James Woodcock (ISL International Synergies Limited)</td>
</tr>
<tr>
<td>11:00-13:00</td>
<td>Practical workshop on industrial symbiosis</td>
</tr>
<tr>
<td>13:00-13:30</td>
<td>Recap of the results of the practical workshops</td>
</tr>
</tbody>
</table>

**Short summary:**

The event was organized by ITC and ISL, with the support of companies from the Nules Industrial Zone that participate in the SHAREBOX project. There was an introduction into the concept of IS, including presentation of existing examples, and participating enterprises had the opportunity to present themselves. In the practical part of the workshop, companies had the chance to formulate their needs as far as available or necessary resources are concerned. All the information gathered was entered into the SHAREBOX platform to enhance the performance of IS, with the ultimate aim of being more efficient and sustainable when optimizing resources, energy and manufacturing processes.

**Results:**

Numerous synergy requests were collected and processed for the creation of the SHAREBOX software and databases. Participating companies will, over the course of the project, try to promote resource exchange in order to cut production costs and industrial consumption through the platform that has been created to that effect. There was ample coverage of the event in regional media.
**Materials for documentation:**

**Newspaper publications:**

**El Periódico Mediterráneo**
Fecha: sábado, 20 de julio de 2016
Página: 13

**ITC organiza un taller sobre recursos**

El Instituto de Tecnología Cerámica (ITC) en colaboración con la Cámara de Comercio de Castellón, y con el fin de impulsar las fábricas del futuro, organiza un taller práctico en el marco del proyecto europeo Sharebox, que persigue, a través de una plataforma TIC segura, la gestión flexible de los recursos de proceso compartidos entre las empresas. El taller se celebrará en la Cámara de Comercio de Castellón el próximo jueves 21 de julio de 9:30 a 14:00 horas y contará con la participación de empresas de toda la cadena cerámica y de la zona. MD

---

**El Periódico Mediterráneo Vila-Real - Suplemento Empresa Innovación**
Fecha: domingo, 17 de julio de 2016
Página: 6

**ITC apuesta por Sharebox, un proyecto para flexibilizar la gestión de recursos**

ITC organiza un taller práctico en el marco del proyecto europeo Sharebox, que ya se encuentra implantado en seis países.

El Instituto de Tecnología Cerámica (ITC) organizó la próxima semana un taller práctico dentro del marco del proyecto europeo Sharebox, un servicio que ya se encuentra implantado en seis países y que persigue, a través de una plataforma TIC segura, la gestión flexible de los recursos de proceso compartidos entre las diversas empresas colaboradoras.

Este taller también colabora con la Cámara de Comercio de Castellón y tiene como objetivo fundamental impulsar las fábricas del futuro, en donde producir más con menos va a ser la tônica general. Esta talla tendrá lugar en las instalaciones de la Cámara de Comercio el próximo jueves, día 21 de julio, de 9:30 a 14:00 horas y contará con la participación de empresas representantes de toda la cadena de valor del sector cerámico, así como con otras empresas de la zona.

El objetivo es fomentar la simbiosis industrial entre las empresas, tanto del sector cerámico como de otras sectores, además de ser más eficientes y sostenibles a la hora de optimizar recursos, energía y los procesos de fabricación.

 Actualmente, el Instituto de Tecnología Cerámica y trabajan con varias empresas participantes que se ubican en la zona del Polígono La Mitra, situado en el término municipal de Pataix. Concretamente, el Instituto trabaja con Keram Cerámica SL, Refrut SA, Geminis Global SL y Hornas Suspendidas SL.
Este conjunto de empresas apoyará, a lo largo del desarrollo del actual proyecto, fomentar el intercambio de recursos entre ellas para, de esta manera, reducir costos, como el de producción, y el consumo industrial, cuya parte de esta plataforma creada por el ITC, se
Las empresas aprenden a compartir recursos

Taller práctico sobre simbiosis industrial con el ITC y la Cámara

El Instituto de Tecnología Cerámica (ITC), en colaboración con la Cámara de Comercio de Castellón, desarrolló ayer un taller práctico sobre simbiosis industrial en el marco del proyecto europeo Sharebox, cuyo objetivo fundamental es, utilizando una plataforma ITC segura, realizar una gestión flexible de los recursos del proceso compartidos entre las empresas castellonenses.

Un total de 24 participantes, representantes de empresas tanto cerámicas como de otros sectores productivos de la provincia, se sentaron a trabajar por grupos para constatar que los recursos que algunas fábricas poseen pueden ser necesarios y útiles para otras y, al mismo tiempo, los recursos que todas ellas necesitan pueden tenerlos otras empresas que además están ubicadas en un área geográfica próxima.
Un azulejo estabilizado tira de la exportación

El sector vende fuera un 5.59% más en mayo mientras las titas se contraen.


Taller Sharebox en Cámara de Comercio 11 de julio de 2016 - Economía de Hoy
### Web publications:

http://www.economiadehoy.es/noticia/7214/empresas/empresas-de-castellon-aprenden-a-compartir-sus-recursos-gracias-al-proyecto-sharebox.html

---

3.4 Industrial symbiosis Training at Bursa, Turkey

**Date of event:**

01.02.2017

**Place of event:**

BEBKA Development Agency, Bursa, Turkey

**Number of participants:**

25, of them

<table>
<thead>
<tr>
<th>Industry</th>
<th>Technical service providers</th>
<th>Consultants</th>
<th>Scientific institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

---

Economía de Hoy-taller Sharebox Cámara de Comercio, 21 de julio de 2016
<table>
<thead>
<tr>
<th>4</th>
<th>Government institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Intermediaries and NGO</td>
</tr>
</tbody>
</table>

**SHAREBOX consortium partners involved:**

Eskişehir Sanayi Odası (Eskişehir Chamber of Industry)

**Speakers/facilitators:**

BEBKA Development Agency, Eskişehir Chamber of Industry

**Agenda:**

10:00 – 16:00 Training: industrial symbiosis

16:00 – 17:00 Good Practice Example: ShareBox Project

**Short summary:**

Participated in the industrial symbiosis training program organized by BEBKA Development Agency for the presentation of ShareBox project

**Results:**

The content and outputs of the ShareBox project were shared with the companies and other participants.

**Materials for documentation:**

n/a
Training event at NEPIC, UK

**Date of event:**
Oct. 19th, 2016

**Place of event:**
Wilton Centre,
Northeast of England Process Industry Cluster (NEPIC), Redcar UK

**Number of participants:**
21, of them

<table>
<thead>
<tr>
<th>Industry</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical service providers</td>
<td></td>
</tr>
<tr>
<td>Consultants</td>
<td>1</td>
</tr>
<tr>
<td>Scientific institutions</td>
<td></td>
</tr>
<tr>
<td>SHAREBOX consortium partners involved:</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>ISL, NEPIC</td>
<td></td>
</tr>
</tbody>
</table>

**Speakers/facilitators:**

Dr. Rachel Lombardi, John Brady, Dave Robson, Justin Wilkinson, Liz Rooney, Andrew Buchanan, Mark Lewis

**Agenda:**

9:30 Introduction to industrial symbiosis and Sharebox project
10:00 Workshop: resource matching
12:30 Results and Q&A
13:00 Close and lunch

**Short summary:**

NEPIC together with International Synergies Limited (ISL) are 2 of 14 project partners in an EU Horizon 2020 funded project called Sharebox which runs from 2015-2018. Together, they delivered a project workshop at Wilton on Thursday 19th October featuring a number of local companies including Ineos, Sembcorp, Lotte, Northumbrian Water, Johnson Matthey, Chemoxy, Inter Terminals, Conoco Phillips, px, Thomas Swan as well companies from outside our local geographic region including Enerkem and Remondis. The project’s main principles are in developing a secure management data platform for shared process resources, delivering next generation industrial symbiosis (IS) and creating an optimum symbiotic ecosystem where companies are able to effectively and confidently share resources. There are essentially 6 project phases, with this particular workshop focussing on industry engagement and Identifying industry requirements. In less than 2 hours, in excess of 100 potential synergies (potential business opportunities) were discussed. One of the participants, Marjory Houseman of Northumbrian Water commented “It is always surprising to see what is available within our local business communities, and then hopefully we can match those synergies locally”.

**Results:**

Resource data from 19 companies provided to the consortium for analysis; 100 potential synergies identified.

**Materials for documentation:**

Photographs:
3.6 Master course on sustainable business development

<table>
<thead>
<tr>
<th>Date of event:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Semester 2018 [10 Weeks: 3 September 2018 – 5 November 2018]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Place of event:</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Twente, The Netherlands</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of participants:</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 university students</td>
</tr>
<tr>
<td>Industry</td>
</tr>
<tr>
<td>Technical service providers</td>
</tr>
<tr>
<td>Consultants</td>
</tr>
<tr>
<td>30 Scientific institutions (university students)</td>
</tr>
</tbody>
</table>
Government institutions

Intermediaries and NGO

SHAREBOX consortium partners involved:

UT

Speakers/facilitators:

dr. Devrim M. Yazan, dr. Luca Fraccascia, Mr. Guido van Capelleveen, Mr. Vahid Yazdanpanah

Agenda:

Sustainable business development based on circular economic business models is implemented on four phases: identification, assessment and evaluation, implementation, and monitoring sustainability. Therefore, this course is based on four principle learning goals:

1. **Identify** opportunities for business-making and value-recovery in line with circular economy principles

2. **Assess and evaluate** the dynamic conditions influencing the decision-making and define managerial strategies for identified business opportunities in a real case

3. **Implement** circular economic business in a real case based on the identification and assessment outcomes

4. **Monitor** the sustainability of the implemented business over time based on the decisions made in the assessment phase

Short summary:

In the context of sustainable development, circular economy plays a key role for the transition to sustainable production and consumption. It is useful for students to learn the principles of circular economy in line with the triple-bottom-line of sustainable business development, as they are expected to be the future managers and decision-makers. Triple-bottom-line concerns three P’s of sustainability: people (social sustainability), planet (environmental sustainability) and profit (economic sustainability) and students are expected to gain knowledge and insight about corporate social responsibility with a mix of these three perspectives to sustainable business development.

The course starts with a general description of sustainable and circular economy and provides several case examples/success stories at world, national and regional level (Chapter 1). It follows with the in-depth analysis of sustainable production zones’ contribution to regional economy in the form of industrial symbiosis, eco-industrial parks, sustainable clusters, etc. (Chapter 2). The course follows with the techniques for measuring the sustainability which basically contain two approaches: life cycle assessment (LCA) and input-output modelling (Chapter 3).
Next, the level of analysis is detailed into supply chain and company levels where students learn the drivers, dynamics, and benefits of sustainable business development (Chapter 4 and 5). Chapter 4 relates to the enterprise management model focusing on value-recovery from end-of-life products, co-products, wastes, and by-products. Chapter 5 is the most extensive part of the course addressing different phases and aspects of sustainable business making: (i) sustainable product and supply chain design, (ii) sustainable production and 6R of sustainable production: rethink, reduce, reuse, recycle, replace, remanufacture, (iii) lean, green, reverse, and closed-loop supply chains, (iv) company behaviour and decision-making in the transition phase from linear business models to circular economic business models (a game play for real-life oriented practice supports this section). Methodologically, part (iv) is supported by the use of game theory for one-to-one decision-making and use of agent-based modelling decision-making at production network level.

The course ends with sustainable marketing and consumption topic which helps students to understand the role of final consumers influenced by companies’ marketing strategies (Chapter 7). Each chapter of the course contains case studies from energy intensive, environmentally unfriendly sectors, particularly those ones located in process industry: bioenergy, concrete, ceramics, construction and demolition waste recycling, waste to energy production, etc.

| Results: |
| n / a |

<table>
<thead>
<tr>
<th>Materials for documentation:</th>
</tr>
</thead>
</table>

### 3.7 Session on “Environmental Applications of AI”, Barcelona, Spain

| Date of event: |
| April 16th-20th 2018, 15:00-19:00 |

| Place of event: |
| UPC Campus Nord, Barcelona |

| Number of participants: |
| 28, of them |

<table>
<thead>
<tr>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical service providers</td>
</tr>
<tr>
<td>Consultants</td>
</tr>
<tr>
<td>28 Scientific institutions</td>
</tr>
<tr>
<td>Government institutions</td>
</tr>
<tr>
<td>Intermediaries and NGO</td>
</tr>
</tbody>
</table>

**SHAREBOX consortium partners involved:**

**UPC**

**Facilitator:**

- Dr Antonio Moreno, Universitat Rovira i Virgili (URV) (seminar coordinator)

**Agenda / speakers:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Topic</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday, April 16th</td>
<td>15:00 – 19:00</td>
<td>Environmental applications of the ELECTRE TRI multi-criteria decision aiding ordinal sorting method</td>
<td>Dr. Luis Dias (Universidade de Coimbra)</td>
</tr>
<tr>
<td>Tuesday, April 17th</td>
<td>15:00 – 19:00</td>
<td>Models of hierarchical aggregation of large sets of criteria under uncertain conditions. Applications to environmental risk analysis</td>
<td>Dr. Aida Valls (URV)</td>
</tr>
<tr>
<td>Wednesday, April 18th</td>
<td>15:00 – 19:00</td>
<td>Using AI for profiling and intelligent recommenders in environmental applications [incl. SHAREBOX]</td>
<td>Dr. Karina Gibert and Dr. Miquel Sànchez-Marré (UPC)</td>
</tr>
<tr>
<td>Thursday, April 19th</td>
<td>15:00 – 19:00</td>
<td>A comparison between mechanistic and data-driven environmental models</td>
<td>Dr. Stefano Marsili-Libelli (Univ. degli studi di Firenze)</td>
</tr>
<tr>
<td>Friday, April 20th</td>
<td>15:00 – 19:00</td>
<td>Smart data modelling with RDF and Linked Data</td>
<td>Dr. Hanh Hoang Huu (Hue Univ.)</td>
</tr>
</tbody>
</table>

**Short summary:**

The world has already reached a population over 7,500 million people. The appropriate and efficient use of natural resources is probably one of the biggest challenges faced by humanity.

The issues considered in this field include, among others, the purification of water, the detection and management of water and air pollution, the analysis and uptake of renewable energies, the management of plastic and hazardous waste, the improvement of the
performance of agricultural fields and fisheries with sustainable practices, and the promotion of a sustainable growth of green cities.

The application of Artificial Intelligence techniques to some of these issues is currently a hot research topic. This seminar combined theoretical lectures with hands-on sessions in which students interacted with analytic tools, providing a general introduction to the area of environmental applications of Artificial Intelligence. The invited speakers are specialists in this area and described different techniques used in the field and the specific tools and systems they have developed.

**Results:**

Reports by Master students (confidential)

**Materials for documentation:**

Powerpoints of presentations (confidential)
### 3.8 SPIRE side event on industrial symbiosis, ACHEMA fair, Frankfurt, Germany

<table>
<thead>
<tr>
<th>Date of event:</th>
<th>June 13(^{th}), 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place of event:</td>
<td>ACHEMA fair, Frankfurt, Germany</td>
</tr>
<tr>
<td>Number of participants:</td>
<td>9, of them</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td>SHAREBOX consortium partners involved:</td>
<td>CCB, DECHEMA, ISL, NEPIC</td>
</tr>
<tr>
<td>Facilitator:</td>
<td>Ansgar Rudolph, CCB</td>
</tr>
<tr>
<td>Agenda / Speakers:</td>
<td></td>
</tr>
<tr>
<td><strong>Morning: Presentations and advice for companies from the Frankfurt region</strong></td>
<td></td>
</tr>
<tr>
<td>10:30</td>
<td>Welcome notes</td>
</tr>
</tbody>
</table>
| 10:40 | **industrial symbiosis – An Overview**  
Dr. Rachel Lombardi - Director of Business Development – Industrial Synergies Ltd. |
| 11:10 | **SHAREBOX – How SHAREBOX can help you to be more resource efficient**  
Yorgos Chalkias, Project Coordinator SHAREBOX |
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:30</td>
<td>Discussion, individual advice in bilateral talks</td>
</tr>
<tr>
<td>12:30</td>
<td>Lunch</td>
</tr>
</tbody>
</table>

**Afternoon: Presentation for all interested ACHEMA visitors**

<table>
<thead>
<tr>
<th>Time</th>
<th>Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:30</td>
<td><strong>Industrial symbiosis – An Overview</strong></td>
</tr>
<tr>
<td></td>
<td>Dr. Rachel Lombardi - Director of Business Development – Industrial Synergies Ltd.</td>
</tr>
<tr>
<td>14:00</td>
<td><strong>SHAREBOX – How SHAREBOX can help you to be more resource efficient</strong></td>
</tr>
<tr>
<td></td>
<td>Yorgos Chalkias, Project Coordinator SHAREBOX, IRIS Innovation, IRIS Technology Group</td>
</tr>
<tr>
<td>14:30</td>
<td><strong>NEPIC – industrial symbiosis in the UK – a success story</strong></td>
</tr>
<tr>
<td></td>
<td>Dave Robson, Project Manager, North East of England Process Industry Cluster (NEPIC)</td>
</tr>
<tr>
<td>15:00</td>
<td><strong>Break</strong></td>
</tr>
<tr>
<td>15:15</td>
<td><strong>EPOS – development of a management toolbox and replicable business cases to enhance cross-sectorial industrial symbiosis</strong></td>
</tr>
<tr>
<td></td>
<td>Maria Albuquerque, Project Manager Research &amp; Innovation, Veolia Environnement S.A.</td>
</tr>
<tr>
<td>15:30</td>
<td><strong>MAESTRI – Development of a flexible and scalable platform for managing resource efficiency improvement processes</strong></td>
</tr>
<tr>
<td></td>
<td>Marco Estrela, ISQ Portugal Sustainable Innovation Centre</td>
</tr>
<tr>
<td>15:45</td>
<td><strong>FISSAC – Facilitating information exchange across the extended construction value chain</strong></td>
</tr>
<tr>
<td></td>
<td>Fiona Craddock, Project Officer, ACR+</td>
</tr>
<tr>
<td>16:00</td>
<td><strong>Panel discussion with all presenters</strong></td>
</tr>
</tbody>
</table>
### Short summary:

The event consisted of two sessions: a general introduction before lunch aimed at introducing the idea of industrial symbiosis and the SHAREBOX platform to enterprises from the process industry in the Frankfurt region, and an afternoon session that allowed to make comparisons with other SPIRE projects that were also being presented at the event. There was also a discussion round on the opportunities and barriers of industrial symbiosis. The SHAREBOX project was also presented at a common booth of various SPIRE project on the ACHEMA.

### Results:

In the framework of the very large ACHEMA fair, our event didn’t find the desired attention. In the discussion, the high importance of industrial symbiosis infrastructure for sustainable water management was emphasized. The example of numerous by-products from the plastics industry showed that there is a strong demand for ICT-based solutions that can handle large amounts of data and assist in the process of synergy creation.

### Materials for documentation:

None

### 3.9 SPIRE side event on industrial symbiosis, World Resources Forum, Antwerp, Belgium

<table>
<thead>
<tr>
<th>Date of event:</th>
<th>Feb 25th and 26th, 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place of event:</td>
<td>World Resources Forum, Antwerp, Belgium</td>
</tr>
<tr>
<td>Number of participants:</td>
<td>about 60, of them</td>
</tr>
<tr>
<td>Industry</td>
<td>3</td>
</tr>
<tr>
<td>Technical service providers</td>
<td>6</td>
</tr>
<tr>
<td>Consultants</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Scientific institutions</td>
</tr>
<tr>
<td>----</td>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
<td>Government institutions</td>
</tr>
<tr>
<td>16</td>
<td>Intermediaries and NGO</td>
</tr>
<tr>
<td>Rest</td>
<td>unknown</td>
</tr>
</tbody>
</table>

**SHAREBOX consortium partners involved:**

IRIS, CCB, DECHEMA, UT

**Facilitator:**

Àngels Orduña – Executive director, A.SPIRE

**Agenda / Speakers:**

### 1st Day | 25th February

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 14:00 | Opening statement: industrial symbiosis in Europe and the vision of the process industries  
Àngels Orduña – A.SPIRE |
| 14:15 | EPOS Toolbox  
Greet Van Eetvelde (UGent) & Ivan Kantor (EPFL) – EPOS Project |
| 15:15 | New valuable applications from the Pulp & Paper Industry waste. Practical examples of industrial symbiosis  
Juan José Cepriá (ACCIONA) – PAPERCHAIN Project |
| 16:00 | Break - Projection of project videos in the conference room |
| 16:15 | FISSAC industrial symbiosis Platform  
Davide Maglio (RINA) & Ozge Yilmaz (EKODENGE) - FISSAC Project |
| 17:00 | SPRING: enhancing the impact of industrial symbiosis projects in the SPIRE portfolio  
Amy Peace (Britest) & John Henderson (Britest) – SPRING Project |

### 2nd Day | 26th February

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00</td>
<td>Opening 2nd day: industrial symbiosis in Europe</td>
</tr>
<tr>
<td>Time</td>
<td>Topic</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>10:15</td>
<td><strong>Best practices and key enabling technologies &amp; intermediaries for</strong></td>
</tr>
<tr>
<td></td>
<td>effective industrial symbiosis</td>
</tr>
<tr>
<td>11:00</td>
<td><strong>Industrial symbiosis in the Urbanrec project</strong></td>
</tr>
<tr>
<td>12:00</td>
<td><strong>SHAREBOX - How to acquire symbiotic synergies successfully on the</strong></td>
</tr>
<tr>
<td></td>
<td>web</td>
</tr>
<tr>
<td>13:00</td>
<td><strong>Lunch break</strong></td>
</tr>
<tr>
<td>15:00</td>
<td><strong>MAESTRI T4IS (Toolkit 4 industrial symbiosis)</strong></td>
</tr>
<tr>
<td>16:00</td>
<td><strong>Collaborative demand response by optimal production scheduling in</strong></td>
</tr>
<tr>
<td></td>
<td>an industrial cluster</td>
</tr>
<tr>
<td>17:00</td>
<td><strong>Symby-Net: a new tool for industrial symbiosis</strong></td>
</tr>
</tbody>
</table>

**Short summary:**

#

**Results:**

#

**Materials for documentation:**

**Media publications:**


https://eco-circular.com/2019/02/05/evento-industrial-symbiosis-in-europe/58/

**Agenda – flyer**

**1st Day | 25th February**

**14:00** Opening statement: Industrial Symbiosis in Europe and the vision of the process industries. Arjan Oudekerk – ASPIRE

**14:15** EPOS ToolBox: Great Van Esthede (UGent) & Ivan Koster (EPFL) - EPOS Project Introduction and exploration of the EPOS toolbox. Presentation of generic kit cases.

**15:15** New valuable applications from the Pulp & Paper Industry waste. Practical examples of Industrial Symbiosis: Juan José Caro (Acciona) – PAPERCHAIN Project. Description of results from the collaboration among different sectors and the Pulp & Paper Industry. How to gather requirements for the innovative valorisation of complex waste streams.

**16:00** Break. Projection of project videos in the conference room.

**16:15** FISSAC Industrial Symbiosis Platform: Davide Miglio (INRIM) & Oreste De Martino (I4S) FISSAC Project. Presentation and demonstration of the Industrial Symbiosis Platform developed under FISSAC Project. The platform connects builders, symbiosis experts, government representatives, and companies under one roof to successfully create symbiosis networks. Key features: Flexible production and facility modelling, LCA, EEC, KPI-based analysis and marketplace.

**17:00** SPRING: enhancing the impact of Industrial Symbiosis projects in the SPIRE portfolio. Any Point Nord & John Interbrand (Edited) - SPRING Project. An overview of activities and learning from the SPRING project to enhance the impact of collaborative projects, including methods to address barriers to industrial exploitation and adoption to aid better decision making when considering industry implementation opportunities.

**17:30** Closing – End of 1st day.

---

**2nd Day | 26th February**

**10:00** Opening 2nd day: Industrial Symbiosis in Europe. Arjan Oudekerk – ASPIRE

**10:15** Best practices and key enabling technologies & intermediaries for effective industrial symbiosis: Marco Estrella (ISG) & Elena Hoarte (Eunate – KIC) SCALER Project. Presentation of the findings from SCALER “on” best practices and key enabling technologies & intermediaries for effective industrial symbiosis.

**11:00** Industrial symbiosis in the Urban area: Sven Risch (INMRI) & Ugo Pugliese (URBANREC Project). The role of industrial symbiosis in the Urban area. Case study: the added value of the use of the Dutch symbols platform for providers of new technologies.

**12:00** SHAREBOX - How to accelerate symbiotic synergies successfully on the web: Arjen Rudolph (CDH) - SHAREBOX Project. Introduction to the SHAREBOX concept and showing how the other solution works.

**12:30** Lunch break. Projection of project videos in the conference room.

**15:00** MASTRI T4S (ToolKit 4 Industrial Symbiosis): Oscar Sarmiento (UCA) & Marco Estrella (ISG) - MASTRI Project. Short overview of MASTRI and then a focus on the work developed concerning IS, namely the T4S.

**16:00** Collaborative demand response by optimized production scheduling in an industrial cluster: Andrea Balivet (ITAE), Juliane Cornelius (WIT) - SYMBOTIMA Project. Integrated Solution for managing energy demand response of a cluster of companies, including load flexibility by energy aware production scheduling.

**17:30** Closing – End of 2nd day: EVA the future of industrial symbiosis. Carla Blasi, Antonio Cusano (ITAE) - SYMBOTIMA Project. A test to manage and optimise LCA impacts of industrial symbiotic networks.

---

**Activities Booth 28**

**25th & 26th February**

**17:30** Closing Side – Event 2nd day.

**26th February**

**10:00** Showcase of Industrial Symbiosis IT tools and live testing:

- SHAREBOX online platform
- SPRING online platform
- SYMBOTIMA IT tools
- The Flexible Symbiosis Platform (URBANREC)
- FISSAC (Industrial Symbiosis platform)

**Exhibition of samples – from initial waste to the valorized raw materials**

Continuous presentation of videos and presentations.

Meet & Greet project partners:

- Project partners, benefits and communication materials.
Photographs - selection
4. Web-based training platform
The SHAREBOX web-based training platform provides easy-to-understand information on various core topics of the project. It has been made available on the project’s website in PM48 (August 2019). It represents a large portion of the non-confidential knowledge created in the framework, and also takes into accounts the experiences made in the project’s field trials. The platform consists of the project video and various presentations elaborated by different members of the project consortium. The following chapter provides a catalogue with short descriptions of the training elements.

4.1 Introduction to and strategic benefits of IS
4.1.1 SHAREBOX general introduction video

Screenshot:

![SHAREBOX general introduction video](http://sharebox-project.eu/#project)

**URL:**

http://sharebox-project.eu/#project
https://www.youtube.com/watch?time_continue=37&v=FEXy3delf8

**Author(s):**

IRIS (see also D7.5)

**Summary:**

The three-minute video consists of animated images. It was produced in summer 2018 and submitted as D7.5 in August 2018. It provides an easy-to-understand introduction into the concept of industrial symbiosis and the potential benefits from the use of IS. Further, it introduces into the basic functions of the SHAREBOX web-based platform. It is available on the
SHAREBOX project website and on Youtube®. There is also a link to the video from the SPIRE website on SHAREBOX: https://www.spire2030.eu/projects/outputs/sharebox-secure-management-platform-shared-process-resources

URLs mentioned in this chapter last checked July 5th, 2019.

4.1.2 Industrial symbiosis and its benefits

**Screenshot:**

![Strategic benefits of industrial symbiosis](http://sharebox-project.eu/training-tool/)

**URL:**

http://sharebox-project.eu/training-tool/

**Author(s):**

Ansgar Rudolph       CCB
Peter Laybourn       ISL
Rachel Lombardi      ISL
René Itten           ZHAW
Jürgen Ebert         ZHAW

**Summary:**

The presentation provides a definition of industrial symbiosis, explains the rationale of this concept and its importance for sustainable industrial development and competitiveness. It explains different approaches of industrial symbiosis and gives various examples in the form of case studies. It discusses barriers and success factors for implementation, and it introduces into the contents of the CEN Workshop Agreement on industrial symbiosis, which can be seen as a first step towards standardisation of IS-related procedures. Finally, the presentation informs
future industrial applicants about which challenges they may have to expect and how to cope with them.

4.1.3 Basic functionalities of the SHAREBOX platform

**Screenshot:**

![The SHAREBOX dashboard](URL)

**URL:**

http://sharebox-project.eu/training-tool/

**Author(s): IRIS, CCB**

Ansgar Rudolph CCB
Devrim M. Yazan UT

**Summary:**

The presentation introduces into the motivation for creating the SHAREBOX web-based platform and how the objectives were met by the design of the platform. It explains the concept and the basic elements of the platform, using several screenshots. It further introduces into the platform’s decision support tools.
4.2 Water treatment and filtering technologies in the context of industrial symbiosis

Screenshot:

The SHAREBOX approach on wastewater reuse

<table>
<thead>
<tr>
<th>Requirements:</th>
<th>Solutions provided:</th>
</tr>
</thead>
<tbody>
<tr>
<td>High knowledge about quality of water for reuse</td>
<td>Self-sustaining database for tailored purification and waste treatment technologies</td>
</tr>
<tr>
<td>Modification of current operations both for direct reuse and treat-and-reuse</td>
<td>Safe and discrete web-based resource exchange platform</td>
</tr>
<tr>
<td>High level of trust between industries</td>
<td>Proximity to cluster organizations with access to public funding and private investors</td>
</tr>
<tr>
<td>Financial investments</td>
<td></td>
</tr>
</tbody>
</table>

URL:

http://sharebox-project.eu/training-tool/

Author(s):

CCB Ansgar Rudolph
ZHAW Jürgen Ebert, René Itten

Summary:

Industrial water reuse may help reduce water stress rates (ratio between water consumption and water reproduction), which are high to severe in many European countries. SHAREBOX tackles the challenges that come along with creating waste or surplus water synergies by establishing a self-sustaining database for tailored purification and waste treatment technologies. More than 300 filter aids and filter media and more than 50 filter equipments and their application have been characterized. This together with the character of SX as a safe and discrete resource exchange platform provides valuable support to overcome the barriers of synergy implementation.
4.3 Symbiotic exchange of energy: Technologies and management

*Screenshot:*

**Waste Heat to Energy and Storage Integration Database**

*URL:*

http://sharebox-project.eu/training-tool/

*Author(s):*

CCB Ansgar Rudolph  
USTRATH Hassan Javed, Andrew Heyes  
ULEEDS Frans Muller

*Summary:*

The presentation gives an example for synergetic use of electricity and waste heat in a German industrial park. It describes the challenges for successful implementation of energy-related synergies. The approach and various tools for waste energy management developed in the framework of the SHAREBOX project are explained. The “Reseau” tool developed by the University of Leeds supports waste energy management by an agent-based simulation of manufacturing and transactions. This tool will be made available on a public-domain basis.
4.4 Evaluating Industrial Symbiosis Opportunities (EVALIS Service) and Cost Allocation in Industrial Symbiosis Relations (COSTIS Service)

Screenshot:

**Introduction: Industrial Symbiosis (IS) Phases**

SHAREBOX decision support tools developed by the University of Twente provide two services that support firms in:

- the Evaluation phase (EVALIS Service)
- and the cost-allocation process in the Implementation Phase (COSTIS Service).

**URL:**

http://sharebox-project.eu/training-tool/

**Author(s):**

Vahid Yazdanpanah UT
Devrim M. Yazan UT

**Summary:**

The presentation introduces into the evaluation tools EVALIS and COSTIS. It explains the difference between single and shared mode of these tools, and it provides instructions how to use them.
4.5 How AI can support end-users evaluating IS potential

Screenshot:

![CBR application in Resource Recommendation](http://sharebox-project.eu/traini
ng-tool/)

URL:

http://sharebox-project.eu/training-tool/

Author(s):

Miquel Sànchez-Marrè  
UPC

Karina Gibert  
UPC

Anna Gatzioura  
UPC

Summary:

The presentation defines the basic terminology and discusses how artificial intelligence tools like recommender systems and case based reasoning can support the process of creating IS synergies. It describes the approach chosen in SHAREBOX, with the creation of a hybrid recommender system using case-based reasoning and ontological knowledge from European Waste Classifications to improve strategies for resource selection and starting of synergies. It further describes the key features for entering a resource and posting a user query. Examples from the SHAREBOX testing reports are given to explain the system’s functionality.
5. “Train the trainer” concept

5.1 Organisational and business model

The “Train to trainer” programme will have to be financed outside of the EU-funded SHAREBOX project. This will mean that all elements mentioned below will have to be offered on a service-for-payment basis, with either a public or a private funding. The providers of the services will calculate the effort for implementation and the prices autonomously, but there will be the need for coordination and common marketing of the services offered. This will be the task of the future owner of SHAREBOX after roll-out to the market.

The SHAREBOX consortium partner DECHEMA provides an extensive range of training programmes for life-long learning. It should be checked if some of the suggested training modules of this concept could be integrated into DECHEMA’s portfolio. Similar cooperation partners outside of the SHAREBOX consortium could be the British Royal Society for Chemistry, and comparable institutions in other countries. Integration into their portfolio of training programmes would have the advantage to reach large target groups with relatively little effort.

5.2 Elements of the “Train the trainer” programme

5.2.1 Introduction course into IS

The course could provide an introduction into the concept and practical implementation of IS, featuring the following elements:

- History and basic terminology of Industrial symbiosis
- Ecological and economic benefits
- Principles of IS synergy management
- IS support policies on European, national and regional levels
- Successful case studies

The format could vary from an one-hour webinar to an intensive seminar of several days with visit of case study sites.

Potential service providers: ISL, UT

5.2.2 Internships with IS practitioners

Practical experience is an essential capacity required for disseminating the concept of industrial symbiosis and motivating companies to identify and negotiate synergetic use of resources. SHAREBOX consortium members can share their experience in synergy creation and business network management by letting trainees observe their daily business over a period of between one week and three months.

Potential service providers: ISL, ITC, ESO, NEPIC, CCB
5.2.3 Courses on communication and group facilitation
Creating industrial synergies is very often a task that requires structured communication and professional facilitation of workshops and group meetings of potential cooperation partners. Methods of group moderation can be adapted specifically to the needs of companies interested in symbiotic cooperation, meeting their demands for effective matching and discrete handling of sensitive corporate knowledge. Specific knowledge of industrial symbiosis facilitation is held within the SHAREBOX consortium. Parts of this knowledge can be communicated via training units to strategic partners for dissemination, as listed up in the Interim Plan for the Dissemination and exploitation of the project’s results (D7.3). Existing intellectual property rights will have to be taken into account.

Potential service providers: ISL, CCB. May also be provided by third parties after case-specific instruction by SHAREBOX consortium members.

5.2.4 Course on IS European Standard
SHAREBOX consortium members have played a key role in the development of the Workshop Agreement on industrial symbiosis (CWA 17354:2018) of the European Committee for Standardization (CEN). The agreement documents a consensus on best practice methodologies supporting industrial symbiosis implementation across Europe and beyond. It is a vital interest of SHAREBOX consortium members to train future IS trainers on the terminology and methodology fixed in this document, which can be seen as a first step towards official and binding standards of industrial symbiosis.

Potential service providers: ISL, DECHEMA

5.2.4 Handbook on IS case studies
Practical work with companies in the training and validation sessions of SHAREBOX has produced a large number of case studies for successful implementation of industrial symbiosis. These and also case studies from outside the SHAREBOX project, e.g. from other SPIRE-related projects, can be catalogued and evaluated in a handbook as role models for future synergy creation. Existing intellectual property rights will have to be taken into account.

Potential service providers: ISL, DECHEMA and various consortium members from partner SPIRE projects

5.2.5 Exercise courses with the SHAREBOX platform
Future trainers for industrial symbiosis will be provided with profound knowledge and practical experience in the use of the SHAREBOX platform. Courses can be offered in different parts of Europe, with a focus of the home countries of the consortium members. They can only be provided after the roll-out of a commercial version of the platform. Existing intellectual property rights will have to be taken into account.
Potential service providers: ISL, IRIS, UT, UPC, USTRATH, ZHAW, DECHEMA, ITC, ESO, NEPIC, CCB

5.2.6 Courses on methods of secondary resources re-use and processing
These courses will contain in-depth transfer of technical knowledge on specific topics in this context, e.g. water treatment or symbiotic use of underutilised heat. They will provide an advanced level of training, helping future IS trainers to specialize on focus topics.

Potential service providers: ISL, USTRATH, ZHAW, DECHEMA

5.2.7 Courses on concept and functionality of SHAREBOX-related recommender systems
These courses will help to acquire more profound knowledge on the artificial intelligence integrated into the SHAREBOX platform and on methods to use it in the most effective way. Existing intellectual property rights will have to be taken into account.

Potential service providers: UPC, UT

6. Conclusions
The SHAREBOX consortium has implemented an extensive range of training activities that addressed different target groups: small and medium companies, local politicians and administrative stuff, experts for waste disposal and circular economy, and students interested in circular economy and sustainable business management both from the economic or management perspective as well as from the technological or data processing perspective.

Most of the training activities found considerable interest. Companies today have realized that resource efficiency is a key factor for future competitiveness, especially in Europe. But many of them still have to learn how to manage the issue effectively, especially when it is about exchanging resources with external partners. On the other hand, many university students are strongly interested to acquire competencies in this field, as they are willing to contribute to sustainable industrial development in networks with complex flows of resources.

The SHAREBOX on-line training tool will contribute to the dissemination of industrial symbiosis issues and of the knowledge created during the SHAREBOX project even after the end of the funding period. Industrial symbiosis and AI-based resource management tools will continue to be highly important elements in the training activities of the industrial associations, clusters and universities of the consortium.

Industrial symbiosis is a very complex management task that is still a new challenge for European industries – many companies do not have yet a clear perspective how to organize themselves and how to use supporting tools like SHAREBOX to handle this issue. The effort that is necessary to transfer this knowledge to hundreds of thousands of companies across Europe goes far...
beyond the capacities that can be provided within a single EU H2020 project. SHAREBOX and its SPIRE partner projects have set milestones in the promotion of industrial symbiosis, but Europe and the European Commission will have continue their efforts towards circular industrial structures over a long time.
References


European Commission (2014): Consultation on policy options to optimise water reuse in the EU. Available at: https://ec.europa.eu/environment/consultations/water_reuse_en.htm


