LIAISE | Cooperation, development and cross-border transfer of industrial symbiosis

# D3.5. Technology Watch and Competitive Intelligence collaborative and online platform about Industrial Symbiosis topic

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This report is part of LIAISE COST Action. Concretely, it is the D3.5. Technology Watch and Competitive Intelligence collaborative and online platform about Industrial Symbiosis topic. LIAISE COST Action (CA22110) is a project funded by the COST Action Programme in 2023, whose objective is to ensure an inclusive and holistic Industrial Symbiosis approach by generating relevant synergies among different actors from the q-helix stakeholder model and by setting the groundwork for increased and robust development of knowledge, apart from promoting future results-oriented R&D.

# TABLE OF CONTENT

## Project Action Context

In the context of addressing climate change, industrial sectors play a significant role as major contributors to carbon dioxide emissions, energy consumption, and waste generation. To combat these challenges, adopting a Circular Economy strategy is imperative. The Circular Economy model diverges from the traditional linear approach by promoting sustainable production and consumption practices while considering societal, environmental, and economic factors in a balanced manner.

Industrial Symbiosis (IS) emerges as a practical solution within this framework. In IS, waste or by-products generated by one industry are repurposed as resources for another, presenting opportunities for environmental sustainability and economic efficiency. Despite its potential, many companies and industrial actors lack awareness of IS, and its development is hindered by various barriers, including environmental, economic, technical, regulatory, organizational, social, and cultural challenges.

To address these issues, the LIAISE COST Action seeks to foster an inclusive and holistic IS approach. By fostering synergies among stakeholders from diverse sectors and laying the groundwork for knowledge enhancement, LIAISE COST Action aims to bridge the gap between theory and practice. This initiative will involve developing a participatory approach to support cross-sector collaborations and establishing Key Performance Indicators (KPIs) for assessing the effectiveness of IS business models in industry.

The LIAISE COST Action represents a collective effort to make the Industrial Symbiosis a reality across Europe, fostering collaboration among researchers, practitioners, and policymakers. To achieve these objectives, LIAISE COST Action will leverage the expertise of four interdisciplinary Working Groups (WGs) and integrate their findings through a reference framework. This holistic approach aims to drive meaningful progress towards sustainable industrial practices and contribute to a more Circular Economy.

# 1. Introduction

Industrial Symbiosis (IS) has emerged as one of the most relevant operational strategies to accelerate the transition towards a circular and climate-neutral economy. Through the exchange of materials, energy, water, services and knowledge among industries and territories, IS contributes to improving resource efficiency, reducing environmental impacts and generating new economic opportunities.

Despite its recognised potential, the implementation of IS initiatives across Europe still faces important barriers related to fragmented information, limited collaboration among stakeholders, lack of visibility of technological opportunities, and difficulties in identifying relevant policies, funding schemes and enabling business models. In this context, access to updated, reliable and structured information becomes essential to support evidence-based decision-making and foster collaboration among actors involved in IS ecosystems.

The LIAISE COST Action was created to strengthen collaboration, knowledge exchange and capacity building among researchers, industries, public authorities, clusters and innovation intermediaries working on IS and Circular Economy topics. The Action promotes interdisciplinary and transnational cooperation aimed at enhancing the implementation and scalability of IS practices across different sectors and territories.

Within this framework, the development of a collaborative platform dedicated to Technology Watch and Competitive Intelligence responds to the need for a shared digital environment where relevant information can be continuously monitored, validated, organised and disseminated among members of the LIAISE community. The platform developed under Deliverable D3.5 is based on the VINCI Technology Watch software and has been specifically adapted to address Industrial Symbiosis-related monitoring needs.

The resulting online platform, accessible through the LIAISE infrastructure, provides a collaborative mechanism to identify emerging trends, monitor regulatory developments, analyse enabling technologies and facilitate the dissemination of relevant knowledge among stakeholders involved in IS activities.

## 1.1. Importance of Technology Watch and Competitive Intelligence in Industrial Symbiosis

IS environments are highly dynamic and influenced by continuous technological, regulatory, environmental and market changes. Organisations involved in IS initiatives require updated information to identify opportunities for resource valorisation, understand evolving policy frameworks, adopt innovative technologies and establish effective collaborations with strategic partners.

Technology Watch and Competitive Intelligence are systematic processes that support organisations in the identification, collection, analysis and dissemination of relevant information for strategic decision-making. In the context of IS, these processes are particularly important due to the multidisciplinary nature of the field, which combines technical, economic, environmental and governance dimensions.

A structured Technology Watch system enables stakeholders to:

- Monitor emerging technologies and innovative valorisation solutions;

- Identify relevant regulatory changes and policy incentives;
- Detect new funding opportunities and support mechanisms;
- Analyse trends related to Circular Economy and resource efficiency;
- Facilitate collaboration among industrial actors and territories;
- Improve the identification of synergies between companies and sectors;
- Support innovation management and strategic planning.

The VINCI Technology Watch software used within the LIAISE platform provides functionalities specifically designed to support systematic monitoring activities, collaborative validation of information and dissemination of results through alerts and newsletters. The platform allows the definition of Critical Watch Factors, the integration of multiple information sources and the automated retrieval and filtering of relevant information.

In addition, the collaborative nature of the platform strengthens knowledge sharing among members of the LIAISE COST Action, facilitating collective intelligence generation and improving the visibility of relevant developments in the field of IS.

## 1.2. Objectives of Deliverable D3.5

The main objective of Deliverable D3.5 is to develop and implement a collaborative and online Technology Watch and Competitive Intelligence platform focused on IS topics within the framework of the LIAISE COST Action.

More specifically, the deliverable aims to:

- Establish a digital collaborative environment for monitoring Industrial Symbiosis-related information;
- Facilitate the collection, organisation and dissemination of strategic information relevant to the LIAISE community;
- Support evidence-based decision-making among stakeholders involved in IS initiatives;
- Promote collaboration and knowledge exchange among researchers, industries, public administrations and innovation intermediaries;
- Identify and monitor key trends related to policies, technologies, resource flows, business models and collaboration ecosystems;
- Provide automated tools for alerts, newsletters and dissemination of validated information;
- Enhance the visibility and accessibility of relevant IS intelligence at European and international levels.

The deliverable also documents the methodological approach followed for the definition of Critical Watch Factors, the implementation of the platform architecture, and the operational procedures established for information validation and dissemination.

## 1.3. Scope and target users of the platform

The LIAISE Technology Watch and Competitive Intelligence platform has been designed as a collaborative tool supporting multiple stakeholders involved in IS and Circular Economy activities.

The scope of the platform includes the monitoring and dissemination of information related to four main Critical Watch Factors:

- Policy and Regulatory Intelligence;
- Data and Resource Flow Intelligence;

- Collaboration Ecosystems and Key Actors;
- Enabling Technologies and Business Models.

The platform integrates information from multiple types of sources, including technological news, scientific publications, regulations, funding opportunities, patents, projects, industrial initiatives and events. The system enables automated retrieval of information, collaborative review by responsible experts and dissemination through personalised alerts and newsletters.

The target users of the platform include:

- Researchers and academic institutions working on IS and Circular Economy;
- Industrial companies interested in resource efficiency and circular business opportunities;
- Industrial clusters and business associations;
- Public administrations and policymakers;
- Technology centres and innovation organisations;
- Environmental agencies and sustainability consultants;
- Members and stakeholders participating in the LIAISE COST Action.

The platform has been conceived not only as a repository of monitored information, but also as a collaborative intelligence ecosystem where users can contribute to the validation, dissemination and interpretation of relevant developments related to IS.

Through its online accessibility and collaborative functionalities, the platform contributes to strengthening the LIAISE network and fostering a shared knowledge base capable of supporting future IS initiatives across Europe and beyond.

# 2. Conceptual framework

## 2.1. Industrial Symbiosis and Circular Economy context

The transition from a linear economic model based on "take–make–dispose" practices towards a Circular Economy has become a strategic priority at European and global levels. In this context, Industrial Symbiosis (IS) is recognised as one of the key operational approaches to improve resource efficiency, reduce environmental impacts and promote sustainable industrial development.

IS refers to the collaborative use of resources among traditionally separate industries, where the waste, by-products, energy, water, logistics or expertise of one organisation become valuable inputs for another. This systemic approach generates environmental, economic and social benefits by extending resource lifecycles, reducing waste generation and promoting more efficient production systems.

The concept is strongly linked to the principles of the Circular Economy, which aim to maintain the value of products, materials and resources within the economy for as long as possible while minimising waste generation. IS contributes directly to several circular economy objectives, including:

- Reduction of raw material consumption;
- Waste prevention and valorisation;

- Energy efficiency improvement;
- Greenhouse gas emissions reduction;
- Development of regional circular ecosystems;
- Increased industrial competitiveness and resilience.

At the European level, IS is supported by several strategic initiatives and policy frameworks, including the European Green Deal, the Circular Economy Action Plan, the Industrial Strategy for Europe and multiple national and regional circular economy strategies. However, despite the growing political and industrial interest, the implementation of IS initiatives remains complex due to the need for coordination among multiple actors, access to reliable information, technological compatibility and regulatory compliance.

The multidisciplinary nature of IS requires continuous monitoring of technological innovations, regulatory changes, funding mechanisms, market opportunities and collaborative initiatives. Consequently, effective knowledge management and information exchange mechanisms are essential to facilitate the identification and implementation of industrial synergies.

Within this context, the LIAISE COST Action promotes collaborative approaches aimed at strengthening IS knowledge, networking and capacity building through transnational cooperation and information sharing.

## 2.2. Technology Watch and Competitive Intelligence concepts

Technology Watch and Competitive Intelligence are strategic processes that enable organisations to systematically identify, collect, analyse and disseminate relevant information from their external and internal environments to support informed decision-making and innovation processes.
Technology Watch focuses primarily on the continuous monitoring of scientific, technological, regulatory and market developments that may affect an organisation or sector. Its objective is to identify opportunities, risks, emerging trends and disruptive innovations at an early stage.

Competitive Intelligence complements this process by analysing the strategic implications of the collected information, supporting organisations in understanding their competitive environment, identifying collaboration opportunities and improving strategic planning.

In the field of Industrial Symbiosis, Technology Watch and Competitive Intelligence play a particularly important role due to:

- The rapid evolution of circular economy policies and regulations;
- The emergence of new valorisation and recycling technologies;
- The growing complexity of resource flow management;
- The need to identify potential industrial synergies;
- The importance of collaboration among multiple stakeholders and territories.

A structured Technology Watch process generally includes several stages:

- Identification of critical monitoring factors;
- Definition of keywords and search criteria;
- Selection of relevant information sources;
- Automated or manual retrieval of information;
- Validation and filtering of relevant results;
- Analysis and dissemination of strategic knowledge.

The VINCI Technology Watch software adopted within the LIAISE platform supports this methodology by enabling the definition of Critical Watch Factors, the integration of information sources and the collaborative validation and dissemination of monitored information. The system retrieves information periodically based on predefined keywords and monitoring criteria, facilitating continuous monitoring activities.

Additionally, the inclusion of personalised alerts and newsletters enhances the dissemination of validated intelligence among users and stakeholders, contributing to more effective knowledge transfer and decision-making processes.

## 2.3. Role of collaborative digital platforms in knowledge sharing

The increasing complexity of IS ecosystems requires collaborative digital environments capable of supporting information exchange, stakeholder interaction and collective intelligence generation.

Collaborative digital platforms have become essential tools for enabling distributed knowledge sharing among organisations, researchers, public administrations and industrial actors. These platforms facilitate:

- Centralised access to relevant information;
- Continuous monitoring of technological and regulatory developments;
- Collaborative validation and interpretation of information;
- Dissemination of knowledge among diverse stakeholders;
- Networking and community building;
- Faster identification of innovation opportunities and industrial synergies.

In Industrial Symbiosis contexts, collaboration is a critical success factor because the identification and implementation of synergies depend on the interaction among actors from different sectors, territories and disciplines. Digital collaborative platforms help overcome geographical and organisational barriers by creating shared spaces for information exchange and cooperation.

The LIAISE collaborative platform incorporates several functionalities designed to support knowledge sharing and collaborative intelligence generation, including:

- Automated retrieval of monitored information;
- Assignment of responsible users for validation of results;
- User and role management;
- Dissemination lists and newsletter groups;
- Personalised alerts and notifications;
- Front-end interfaces for consultation and filtering of validated information.

Through these functionalities, the platform supports the creation of a collaborative intelligence ecosystem that strengthens the exchange of knowledge within the LIAISE COST Action and enhances the visibility of relevant IS developments.

## 2.4. Alignment with LIAISE objectives and Working Groups

The development of the Technology Watch and Competitive Intelligence platform is fully aligned with the objectives of the LIAISE COST Action, particularly those related to networking, knowledge exchange, collaboration enhancement and dissemination of IS practices.

The platform contributes to the LIAISE mission by:

- Facilitating transnational cooperation among Industrial Symbiosis stakeholders;
- Supporting evidence-based knowledge generation and dissemination;
- Enhancing visibility of emerging technologies, policies and initiatives;
- Promoting interdisciplinary collaboration;
- Strengthening the European IS community.

The definition of the Critical Watch Factors integrated into the platform reflects the strategic priorities of the LIAISE COST Action and its Working Groups. The four monitoring dimensions address key thematic areas relevant to IS implementation:

- Policy and Regulatory Intelligence: Focused on monitoring European, national and regional policies, legal frameworks, incentives and regulatory developments affecting IS and Circular Economy implementation.
- Data and Resource Flow Intelligence: Dedicated to monitoring resource mapping methodologies, material and energy flow information, data management approaches and standardisation tools supporting IS practices.
- Collaboration Ecosystems and Key Actors: Focused on identifying networks, industrial clusters, facilitators, governance models, projects and partnerships that foster collaboration among organisations and territories.
- Enabling Technologies and Business Models: Dedicated to monitoring technological solutions, digital platforms, valorisation technologies, energy recovery systems and innovative business and financing models supporting IS.

By structuring the monitoring activities around these factors, the platform provides a coherent framework that supports the thematic priorities and collaborative objectives of the LIAISE COST Action while facilitating participation from different stakeholder groups and disciplinary perspectives.

The collaborative nature of the platform also reinforces the role of Working Groups as active contributors to knowledge generation, validation and dissemination, fostering long-term cooperation and shared learning within the LIAISE network.

# 3. Methodological approach

## 3.1. Identification of Critical Watch Factors (CWFs)

The methodological approach adopted for the development of the LIAISE Technology Watch and Competitive Intelligence platform was based on the definition of Critical Watch Factors (CWFs), understood as the key thematic areas that require continuous monitoring in order to support IS implementation and decision-making processes.

The identification of these factors constituted the first and most important stage in the configuration of the platform, as the entire monitoring and information retrieval process depends on the adequate definition of the thematic priorities and associated keywords. According to the operational logic of the VINCI Technology Watch software, the monitoring results obtained by the system are directly linked to the Critical Watch Factors and their corresponding search criteria.

The selection of the CWFs was carried out considering the strategic objectives of the LIAISE COST Action, the thematic priorities addressed by its Working Groups, and the main dimensions influencing the implementation of IS initiatives in Europe. The process also considered the

multidisciplinary nature of IS, which integrates environmental, technological, economic, regulatory and governance-related aspects.

As a result of this analysis, four major Critical Watch Factors were defined for the platform: Policy and Regulatory Intelligence; Data and Resource Flow Intelligence; Collaboration Ecosystems and Key Actors; and Enabling Technologies and Business Models. These factors provide a coherent framework for organising monitoring activities and ensuring that the information collected by the platform addresses the most relevant challenges and opportunities associated with IS development.

The identification of these factors also aimed to facilitate the participation of different stakeholder profiles within the LIAISE community, including researchers, industrial companies, policymakers, innovation intermediaries and technology centres. By structuring the monitoring process around clearly defined thematic areas, the platform supports collaborative knowledge generation and simplifies the organisation and dissemination of information.

## 3.2. Definition of keywords and monitoring criteria

Once the Critical Watch Factors had been established, a set of keywords and monitoring criteria was defined for each thematic area. This stage was essential to ensure the effectiveness and relevance of the automated information retrieval process implemented by the platform.

The VINCI Technology Watch software operates through the continuous monitoring of predefined information sources using keyword-based search strategies. Consequently, the quality and precision of the monitoring results strongly depend on the adequate selection of keywords and search expressions.

The definition of keywords was performed through an iterative process involving the analysis of IS terminology, Circular Economy concepts, sector-specific vocabulary and relevant policy and technological trends. Special attention was given to ensuring that the selected terms adequately represented both established and emerging topics within the IS domain.

The monitoring criteria included combinations of technical terms, regulatory concepts, technological applications, industrial sectors and collaboration-related expressions associated with each Critical Watch Factor. The criteria were designed to maximise the retrieval of relevant information while reducing the number of non-relevant results generated by the automated searches.

In addition, the monitoring strategy considered the dynamic evolution of Industrial Symbiosis terminology and the need for periodic updates of keywords and search criteria. As new technologies, regulations or collaborative initiatives emerge, the platform can incorporate additional keywords and adapt its monitoring configuration accordingly.

This flexible approach enables the platform to maintain its relevance over time and ensures that the monitoring activities remain aligned with the evolving priorities of the LIAISE COST Action and the broader IS ecosystem.

## 3.3. Selection of information sources

The effectiveness of a Technology Watch and Competitive Intelligence system depends not only on the definition of adequate monitoring factors and keywords, but also on the quality and diversity of the information sources integrated into the platform.

For this reason, the methodological approach adopted in the LIAISE platform included the identification and integration of multiple types of information sources covering technological, regulatory, scientific, industrial and collaborative dimensions relevant to IS. According to the operational methodology of the VINCI software, these sources constitute the basis for the automated retrieval of information performed by the system on a periodic basis.

The selection process prioritised sources capable of providing updated, reliable and high-value information related to IS and Circular Economy developments. The integrated sources include technological and environmental news portals, European and national policy websites, scientific publication repositories, funding and grant databases, patent sources, project dissemination platforms, event portals and industrial cluster networks.

Particular attention was given to ensuring a balance between scientific, technical and policy-oriented information in order to support the diverse interests and needs of the platform users. Additionally, the methodology considered the inclusion of both European-level and international sources to guarantee broad coverage of relevant IS developments.

The platform was configured to periodically retrieve information from the selected sources using the previously defined keywords and monitoring criteria. The automated nature of this process significantly improves the efficiency of monitoring activities and facilitates the continuous update of the platform content.

At the same time, the methodology also recognised the importance of incorporating manually validated information when necessary. The VINCI platform allows users to manually introduce specific results and information items originating from non-monitored or one-time sources, ensuring additional flexibility and completeness of the monitoring process.

## 3.4. Validation and collaborative review methodology

Given the large volume of information retrieved through automated monitoring processes, the methodological approach incorporated a collaborative validation and review procedure aimed at ensuring the quality, relevance and reliability of the information disseminated through the platform.

The VINCI Technology Watch software includes a workflow in which retrieved results are initially classified as pending review before becoming visible to the wider user community. This mechanism allows designated responsible users associated with each Critical Watch Factor to evaluate the relevance of the retrieved information and determine whether it should be accepted, validated or discarded.

The collaborative review methodology implemented within the LIAISE platform contributes to improving the accuracy and usefulness of the monitored information while reducing the dissemination of irrelevant or duplicated content. This process is particularly important in the context of IS, where information may originate from highly heterogeneous sources and where the interpretation of technological or regulatory developments often requires expert knowledge.

The review process also strengthens stakeholder participation and collective intelligence generation within the LIAISE community. Different users and experts contribute to the validation and interpretation of monitored information according to their thematic expertise and professional background.

In addition, the platform includes user management and role assignment functionalities that facilitate the organisation of responsibilities and access permissions. Different user roles can be assigned according to the required level of participation in the monitoring, validation and dissemination activities.

This collaborative methodology transforms the platform from a simple information repository into an active knowledge-sharing ecosystem in which users contribute not only to accessing information, but also to improving its quality and strategic value.

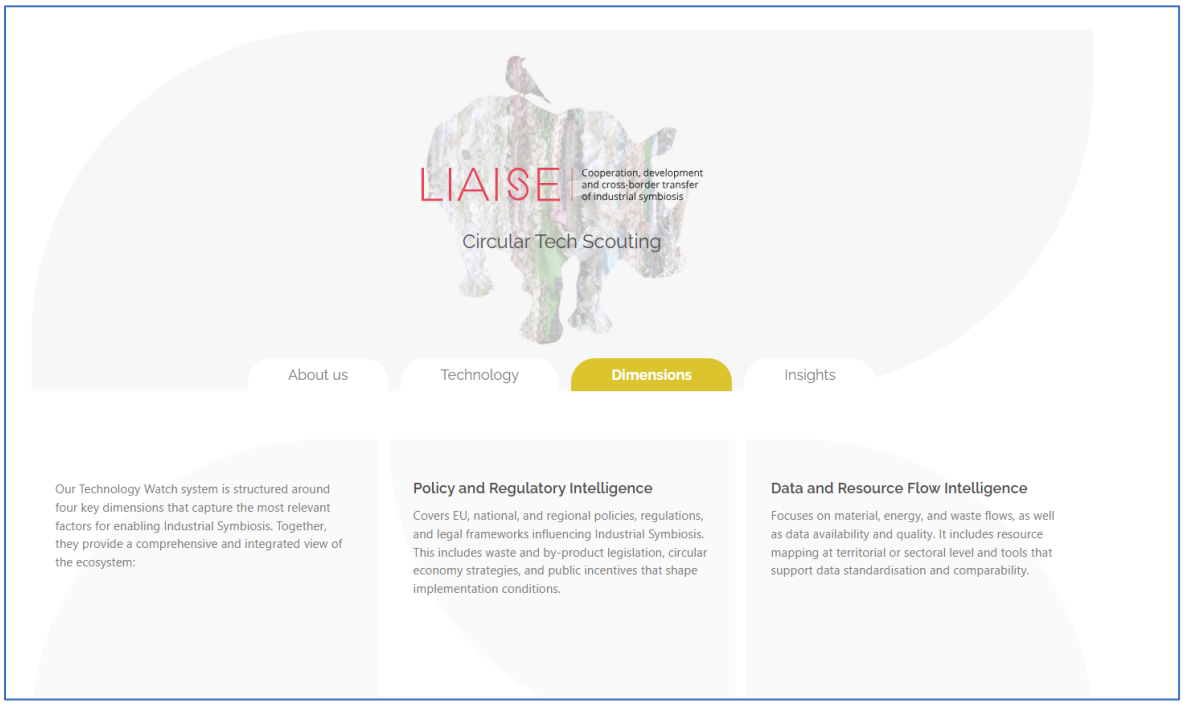
# 4. Description of the online collaborative platform

## 4.1. General overview of the platform

The LIAISE Technology Watch and Competitive Intelligence platform has been developed as a collaborative online environment aimed at supporting the systematic monitoring, validation and dissemination of information related to Industrial Symbiosis. The platform constitutes one of the main operational tools developed within the framework of the LIAISE COST Action to strengthen knowledge exchange, collaboration and strategic intelligence generation among stakeholders working in IS and Circular Economy fields.

The platform is accessible online through the LIAISE infrastructure at:
https://vinciindustrialsymbiosis.liaise-action.eu/

Figure 1. Vinci Industrial Symbiosis frontpage




Source: LIAISE COST Action

Its development is based on the VINCI Technology Watch software, a digital solution specifically designed to support Technology Watch and Competitive Intelligence activities through automated monitoring, collaborative information management and dissemination functionalities. The platform has been adapted to the specific requirements of IS monitoring, incorporating thematic structures and workflows aligned with the objectives of the LIAISE COST Action.

The platform operates as a collaborative intelligence ecosystem in which information from multiple external sources is continuously monitored, processed and validated by users with expertise in different thematic areas. The validated information is subsequently disseminated through newsletters, alerts and front-end consultation interfaces accessible to the members of the LIAISE community and other relevant stakeholders.

Beyond its technical functionality, the platform also serves as a networking and knowledge-sharing tool that facilitates collaboration among researchers, industrial companies, clusters, public administrations and innovation intermediaries involved in IS initiatives.

## 4.2. Platform architecture and operational workflow

The operational architecture of the platform is based on a structured workflow that integrates automated information retrieval processes with collaborative review and dissemination mechanisms.

The workflow begins with the configuration of Critical Watch Factors and associated keywords that define the thematic priorities of the monitoring activities. Once these factors and criteria are introduced into the system, the platform periodically retrieves information from predefined external sources using automated search and monitoring functionalities.

The architecture of the platform combines several interconnected modules that support the different stages of the Technology Watch process. These include:

- the monitoring and retrieval module;
- the validation and review module;
- the dissemination and newsletter module;
- the user and role management module;
- the front-end consultation and interaction interface.

The information retrieved by the system is initially stored in a pending review area where designated responsible users analyse the relevance and quality of the results. Only validated information becomes accessible to the wider user community through newsletters, alerts or the front-end consultation interface.

The platform also incorporates collaborative functionalities that enable multiple users to participate in the monitoring and validation processes according to their thematic expertise and assigned responsibilities. This distributed workflow supports collective intelligence generation and improves the quality and reliability of the disseminated information.

In operational terms, the platform performs automated retrieval processes on a daily basis, ensuring continuous updating of the monitored information. The integration of both automated and manual information management functionalities provides flexibility and allows the platform to adapt to evolving monitoring needs and emerging Industrial Symbiosis topics.

## 4.3. VINCI Technology Watch software

The technological basis of the platform is the VINCI Technology Watch software, a specialised solution designed for the comprehensive management of Technology Watch and Competitive Intelligence processes. According to the software documentation, VINCI supports organisations in strategic decision-making and innovation management through systematic monitoring and collaborative information analysis.

The software is designed to support organisations of different types, including companies, clusters, universities, governments and technology centres. Its functionalities are aimed at facilitating the identification of technological innovations, regulatory developments and emerging trends that may affect organisational strategies and innovation processes.

One of the main advantages of the VINCI software is its capacity to integrate automated monitoring functionalities with collaborative review and dissemination mechanisms. The system enables the configuration of customised monitoring structures based on Critical Watch Factors and keyword-based search strategies, allowing adaptation to different thematic domains and organisational contexts.

Within the LIAISE COST Action, the VINCI software has been configured specifically for Industrial Symbiosis monitoring, integrating thematic factors associated with policy intelligence, resource flow management, collaboration ecosystems and enabling technologies.

The software also provides functionalities for user management, role assignment, newsletter generation, dissemination list configuration and personalised alerts. These features support the collaborative nature of the platform and facilitate the participation of different stakeholders in the Technology Watch process.

Additionally, the platform includes a front-end dissemination environment that allows users to consult validated information, subscribe to thematic interests and receive personalised notifications based on their monitoring preferences.

## 4.4. Main functionalities of the system

### 4.4.1. Identification of Critical Wath Factors

The first functional stage of the platform consists of the identification and configuration of Critical Watch Factors, which define the strategic thematic areas monitored by the system. These factors constitute the structural basis of the Technology Watch process and determine how information is organised, retrieved and disseminated within the platform.

The VINCI software enables administrators and responsible users to define monitoring factors and associate them with specific keywords and search criteria. The software documentation highlights the importance of accurately defining these keywords, as the quality and relevance of the retrieved information depend directly on the monitoring criteria introduced into the system.

Within the LIAISE platform, the Critical Watch Factors were adapted to the Industrial Symbiosis context and organised around four major thematic dimensions aligned with the objectives of the COST Action.

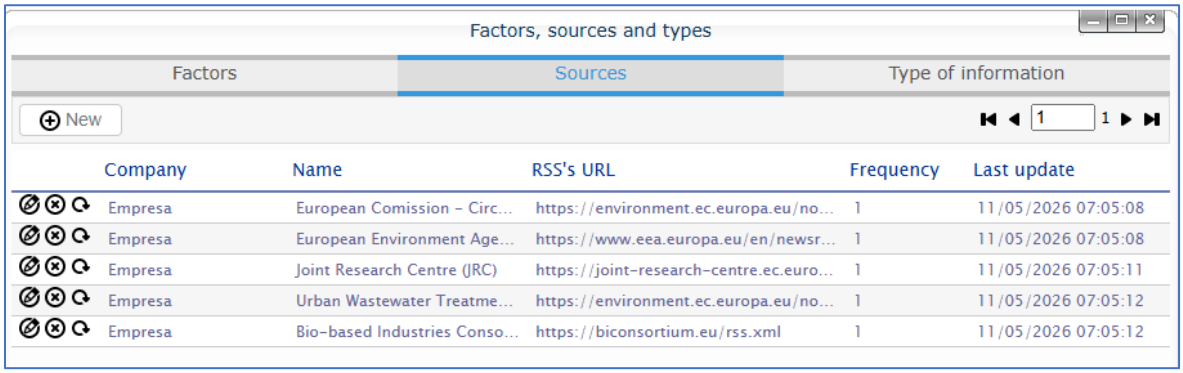
### 4.4.2. Information source integration and monitoring

The platform incorporates functionalities for the integration and management of multiple external information sources. These sources include technological news portals, environmental information channels, regulatory repositories, grants and funding databases, scientific publications, patents, projects and event platforms related to Industrial Symbiosis and circular economy topics.

Once integrated into the system, the information sources are continuously monitored using the predefined keywords associated with each Critical Watch Factor. The monitoring process is performed automatically and periodically, enabling the platform to retrieve updated information without requiring manual searches by users.

The diversity of integrated sources ensures broad thematic coverage and facilitates access to technological, scientific, regulatory and market-related developments relevant to Industrial Symbiosis stakeholders.

Figure 2. Sources integrated in VINCI platform




Source: LIAISE COST Action

### 4.4.3. Automated retrieval and filtering of results

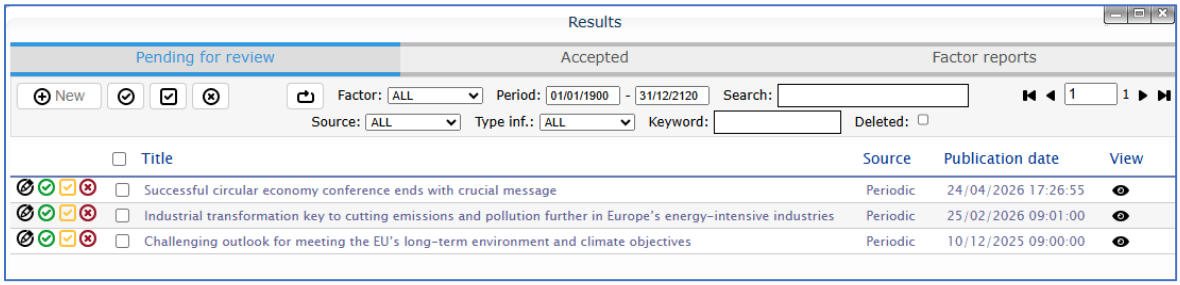
One of the central functionalities of the platform is the automated retrieval of information from the selected sources. According to the VINCI operational workflow, the system performs daily retrieval processes that identify results matching the predefined monitoring criteria.

The retrieved information is automatically organised according to the associated Critical Watch Factors and stored within the system for subsequent review. This automated process significantly improves the efficiency of monitoring activities and enables continuous updating of the platform content.

Given the large amount of information potentially generated through automated searches, the platform also incorporates filtering mechanisms aimed at facilitating the identification of relevant results. These filtering processes combine automated categorisation with human validation, ensuring that the final disseminated information maintains high levels of relevance and quality.

Additionally, the system allows the manual introduction of information when necessary, enabling the incorporation of relevant developments originating from occasional or non-monitored sources.

Figure 3. Results related to IS retrieved from VIINCI

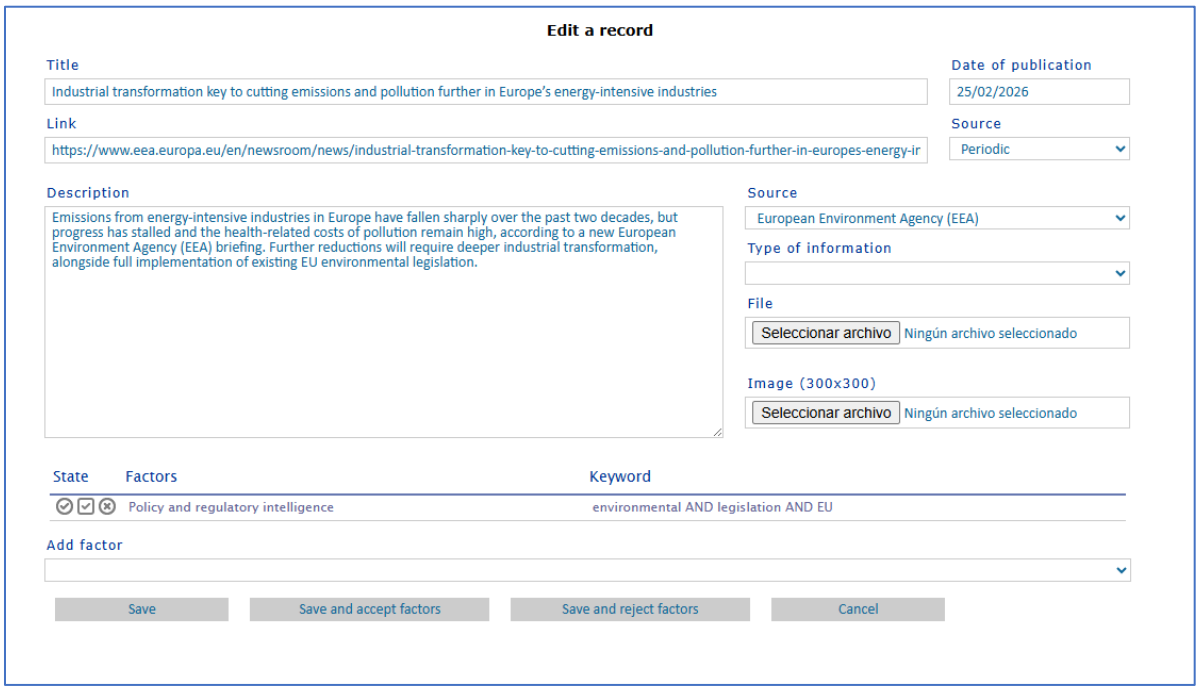



Source: LIAISE COST Action

### 4.4.4. Collaborative validation of information

The collaborative validation process is one of the most important components of the platform architecture. After information is retrieved automatically, the results are placed in a pending review area where responsible users associated with each monitoring factor evaluate their relevance and validity.

Figure 4. Acceptance of a source




Source: LIAISE COST Action

This collaborative review process enables experts from different thematic areas to participate actively in the curation and validation of monitored information. Through this methodology, the platform combines automated intelligence retrieval with expert judgement and collective knowledge generation.

Responsible users can validate, reject or classify retrieved information according to its relevance for the Industrial Symbiosis community. This process improves the reliability of disseminated information and reduces the risk of irrelevant or duplicated results being distributed to users.

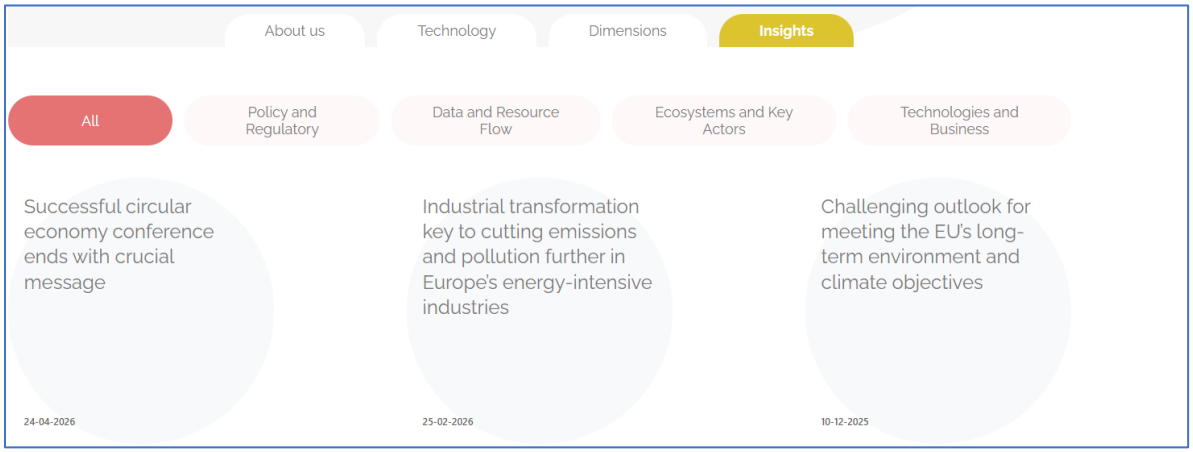
The collaborative validation workflow also contributes to strengthening stakeholder engagement and reinforces the role of the platform as an active knowledge-sharing environment rather than a passive information repository.

### 4.4.5. Front-end dissemination interface

The platform includes a front-end dissemination environment that provides users with direct access to validated monitoring results through an intuitive consultation interface.

The front-end allows users to browse and filter information according to the monitoring factor. This dissemination interface transforms the platform into an accessible and user-oriented knowledge-sharing environment that supports continuous interaction, collaborative learning and information dissemination within the IS community fostered by the LIAISE COST Action.

Figure 5. Acceptance of a source




Source: LIAISE COST Action

### 4.4.6. User management and access roles

The platform includes functionalities for user creation, role assignment and access management, supporting the collaborative and distributed nature of the Technology Watch process.

Administrators can create users within the system and assign different permissions and access levels depending on the user's role and responsibilities. This structure enables the organisation of collaborative workflows and ensures that monitoring, validation and dissemination activities are managed appropriately.

The platform also allows the creation of newsletter dissemination groups, facilitating structured communication with different stakeholder communities. Users can be assigned to specific groups according to their thematic interests or organisational affiliation.

The implementation of differentiated access roles improves operational management and supports secure and efficient collaboration among platform participants.

# 5. Critical Watch Factors for Industrial Symbiosis

The definition of Critical Watch Factors (CWFs) constitutes the core methodological structure of the LIAISE Technology Watch and Competitive Intelligence platform. These factors establish the thematic areas around which monitoring activities, information retrieval and dissemination processes are organised.

Given the multidisciplinary and evolving nature of IS, the monitoring framework needed to integrate regulatory, technological, organisational and economic dimensions capable of supporting a comprehensive understanding of the ecosystem. The selected factors were therefore designed to capture the main drivers, barriers and enabling conditions affecting the implementation and scaling-up of IS initiatives across Europe and internationally.

The four Critical Watch Factors adopted within the platform provide a coherent structure for organising monitored information while facilitating collaboration among stakeholders with different areas of expertise and professional interests. Together, they enable the systematic identification of emerging trends, opportunities, risks and innovations relevant to the IS community.

## 5.1. Policy and Regulatory Intelligence

The Policy and Regulatory Intelligence factor focuses on monitoring legislative, institutional and policy-related developments that influence the implementation of IS and Circular Economy practices.

Regulatory frameworks play a decisive role in enabling or limiting IS initiatives. Issues related to waste classification, by-product recognition, environmental permitting procedures, taxation schemes, public procurement criteria and state aid regulations directly affect the feasibility of industrial resource exchanges and circular business models. Consequently, continuous monitoring of policy developments is essential for organisations seeking to identify opportunities, ensure compliance and anticipate future regulatory changes.

Within the platform, this factor includes the monitoring of European Union legislation and strategies, national and regional Circular Economy policies, IS roadmaps, environmental regulations and public support mechanisms relevant to resource efficiency and industrial collaboration. Special attention is given to policy initiatives associated with the European Green Deal, the Circular Economy Action Plan, climate neutrality targets and sustainable industrial transition policies.

The monitoring activities also consider funding programmes, public incentives and institutional initiatives promoting IS implementation at different governance levels. This includes European funding opportunities, innovation programmes, industrial transition initiatives and policy instruments supporting sustainable industrial development.

The integration of this factor within the platform enables stakeholders to remain informed about evolving legal frameworks and strategic policy directions while facilitating evidence-based adaptation to regulatory changes. In addition, the dissemination of validated policy intelligence contributes to improving awareness among IS actors and supports strategic planning activities within the LIAISE community.

## 5.2. Data and Resource Flow Intelligence

The Data and Resource Flow Intelligence factor addresses the monitoring of information related to material, energy and waste flows, as well as methodologies and tools supporting data management, resource mapping and interoperability in IS contexts.

One of the principal challenges in IS implementation lies in the identification and characterisation of available resources, by-products and potential synergies among industrial actors. Effective IS initiatives depend on reliable and comparable information regarding the quantity, quality, geographical location and temporal availability of industrial resources.

For this reason, the platform monitors developments related to resource flow analysis methodologies, digital mapping tools, industrial metabolism studies, data-sharing systems and territorial resource inventories. This includes information on methodologies for material flow analysis, energy integration, waste valorisation and industrial ecosystem mapping.

The factor also incorporates monitoring activities associated with digitalisation and data standardisation, recognising the growing importance of digital tools in facilitating IS implementation. Emerging technologies such as digital twins, resource exchange platforms, geographic information systems, artificial intelligence applications and industrial data interoperability solutions are particularly relevant within this thematic area.

In addition, the monitoring process considers initiatives aimed at improving transparency, traceability and comparability of resource-related data. This is especially important given the need for harmonised information systems capable of supporting cross-sector and cross-regional collaboration.

By integrating Data and Resource Flow Intelligence into the platform, the LIAISE community gains access to updated knowledge regarding resource management methodologies and digital solutions capable of supporting more efficient identification and implementation of IS opportunities.

## 5.3. Collaboration Ecosystems and Key Actors

IS is fundamentally based on collaboration among organisations, sectors and territories. Consequently, the identification and analysis of collaboration ecosystems and key actors constitute an essential dimension of the Technology Watch framework developed within the platform.

This factor focuses on monitoring the networks, partnerships, governance structures and intermediary organisations that facilitate IS development and circular economy collaboration. Industrial clusters, innovation ecosystems, regional agencies, research institutions, facilitators and sectoral associations all play a critical role in enabling cooperation and trust-building among stakeholders.

The platform therefore monitors collaborative projects, European initiatives, regional ecosystems, cluster activities, knowledge-sharing networks and institutional partnerships associated with IS and Circular Economy implementation. Particular attention is given to initiatives promoting cross-sector collaboration, territorial industrial transition and stakeholder engagement.

In addition, this factor includes monitoring information related to governance models and facilitation methodologies that support the operational implementation of IS initiatives. Since successful symbiosis projects often require coordination among actors with different interests and

organisational cultures, governance and facilitation mechanisms represent key enabling conditions for long-term collaboration.

The analysis of collaboration ecosystems also contributes to identifying best practices, replicable organisational models and successful partnership structures that can inspire future initiatives within the LIAISE network and beyond.

By integrating information related to actors, networks and collaborative initiatives, the platform strengthens community-building processes and enhances opportunities for cooperation among stakeholders involved in IS activities.

## 5.4. Enabling Technologies and Business Models

The Enabling Technologies and Business Models factor focuses on monitoring technological innovations, digital solutions and economic approaches that facilitate the implementation and scalability of IS initiatives.

Technological innovation represents one of the main drivers of IS development. Advances in recycling technologies, waste valorisation systems, energy recovery solutions, industrial biotechnology, digital monitoring tools and process optimisation technologies continuously generate new opportunities for resource efficiency and circular resource use.

Within this factor, the platform monitors emerging technologies capable of supporting material recovery, by-product valorisation, industrial process integration and environmental performance improvement. Particular attention is given to technologies associated with digitalisation, automation and data-driven decision-making, as these increasingly contribute to improving the identification and operational management of IS opportunities.

The factor also incorporates monitoring activities related to digital platforms and software tools designed to facilitate industrial matchmaking, resource exchange and collaborative management of industrial ecosystems. These technologies are becoming increasingly important in enabling large-scale IS implementation and improving coordination among stakeholders.

Beyond technological aspects, the factor includes information related to business models, economic feasibility and financing mechanisms associated with IS initiatives. Circular business models, shared-value approaches, industrial cooperation agreements and innovative financing schemes are critical components for ensuring the long-term viability of symbiosis projects.

Monitoring activities therefore include developments related to investment mechanisms, public-private partnerships, circular economy financing instruments and economic assessment methodologies relevant to IS implementation.

The integration of this factor within the platform enables stakeholders to remain informed about emerging technological and economic opportunities while supporting strategic decision-making and innovation management processes within the IS ecosystem.

# 6. Implementation of the LIAISE Industrial Symbiosis Platform

## 6.1. Platform deployment and hosting

The implementation of the LIAISE Industrial Symbiosis Technology Watch and Competitive Intelligence platform was carried out through the deployment of the VINCI Technology Watch software within the digital infrastructure associated with the LIAISE COST Action.

The deployment process involved the configuration of the platform architecture, the adaptation of the monitoring structure to IS thematic priorities and the integration of collaborative functionalities supporting information validation and dissemination. Particular attention was given to ensuring that the platform could operate as a stable, scalable and user-oriented environment capable of supporting continuous monitoring activities and collaborative interaction among stakeholders.

The implementation process also included the configuration of Critical Watch Factors, the definition of user roles and responsibilities, and the integration of relevant information sources associated with IS and Circular Economy topics. The platform was customised to reflect the objectives and thematic areas of the LIAISE COST Action while maintaining the operational functionalities provided by the VINCI software.

From a technical perspective, the deployment aimed to ensure secure access, operational continuity and efficient information management. The hosting configuration allows the platform to support automated monitoring activities, user interaction and dissemination processes on a continuous basis.

The deployment strategy was conceived not only as the implementation of a software solution, but also as the creation of a collaborative digital ecosystem supporting knowledge exchange and collective intelligence generation within the IS community.

## 6.2. Platform URL and accessibility

The LIAISE Industrial Symbiosis platform is accessible online through the following dedicated web address: https://vinciindustrialsymbiosis.liaise-action.eu/

The online accessibility of the platform constitutes a fundamental element of its collaborative approach, enabling geographically distributed stakeholders to participate in monitoring, validation and dissemination activities regardless of their institutional or territorial location.

The platform has been designed to provide a user-friendly environment where authorised users can access validated information through a web-based interface. Accessibility considerations were integrated into the implementation process in order to facilitate consultation and interaction by users with different professional backgrounds and levels of technical expertise.

The front-end environment enables users to access monitoring results through a factor filter, improving usability and facilitating efficient information retrieval. According to the VINCI software functionalities, users can browse information.

The online accessibility of the platform also contributes to enhancing the visibility and dissemination capacity of the LIAISE COST Action, reinforcing its role as a collaborative European network supporting Industrial Symbiosis implementation and knowledge exchange.

## 6.3. User structure and governance

The governance structure of the platform was designed to support collaborative participation while ensuring appropriate management of monitoring, validation and dissemination activities.

The VINCI software incorporates functionalities for user creation, access management and role assignment, enabling the establishment of differentiated responsibilities according to the functions performed by each participant within the platform.

The governance model implemented within the LIAISE platform is based on a distributed collaborative structure in which users can assume different roles associated with information management, validation and dissemination processes. This approach facilitates the participation of stakeholders with diverse expertise and organisational profiles while ensuring quality control over disseminated information.

Responsible users were assigned to the different Critical Watch Factors in order to supervise monitoring activities and validate retrieved information according to thematic expertise. These users play a central role in the collaborative review process, contributing to the reliability and relevance of the information made available through the platform.

The governance structure also includes administrative functions associated with user management, dissemination group configuration and operational maintenance of the platform. Through these functionalities, administrators can create users, define access permissions and organise newsletter dissemination groups according to thematic interests or stakeholder categories.

This distributed governance approach reinforces the collaborative nature of the platform while supporting efficient coordination of monitoring activities and promoting shared responsibility in knowledge generation and dissemination.

## 6.4. Workflow for information validation and publication

The operational workflow implemented within the platform combines automated information retrieval processes with collaborative expert validation mechanisms to ensure the quality and relevance of disseminated content.

The process begins with the automated monitoring of predefined information sources based on the keywords and search criteria associated with each Critical Watch Factor. According to the VINCI operational configuration, the platform performs periodic retrieval activities that identify new information matching the established monitoring criteria.

Once retrieved, the information is transferred to a pending review environment where responsible users associated with the corresponding thematic factors evaluate the relevance and validity of the results. This review stage constitutes a critical component of the workflow, as it enables expert assessment of the monitored information before dissemination.

Validated results are subsequently incorporated into the public consultation environment and may also be included in dissemination activities. Information considered irrelevant or duplicated can be rejected or discarded during the review process.

The workflow therefore combines the efficiency of automated monitoring with the reliability provided by expert-based collaborative validation. This hybrid approach improves the strategic value of the disseminated information while reducing the risk of irrelevant or low-quality content reaching users.

The platform also allows manual introduction of information when necessary, providing flexibility for incorporating relevant developments originating from non-monitored or exceptional sources.

Overall, the validation and publication workflow contributes to transforming raw monitored information into structured and validated intelligence capable of supporting decision-making and knowledge exchange within the IS community.

### 6.5. Collaborative participation mechanisms

Collaboration constitutes one of the central principles guiding the implementation of the LIAISE Industrial Symbiosis platform. The system was specifically designed to facilitate interaction, shared participation and collective intelligence generation among members of the LIAISE COST Action and other relevant stakeholders.

The platform incorporates collaborative mechanisms at multiple operational levels. Firstly, the distributed validation process allows experts from different thematic areas and institutions to participate actively in the review and curation of monitored information. This approach improves information quality while fostering stakeholder engagement and interdisciplinary cooperation.

The collaborative nature of the platform is also reinforced by its front-end consultation environment, which enables users to explore validated information, monitor developments associated with specific thematic areas and remain connected to ongoing IS activities and trends.

Through these mechanisms, the platform supports the creation of a shared knowledge ecosystem where information is not only consumed but also collaboratively validated, organised and disseminated. This participatory approach aligns closely with the networking and knowledge-sharing objectives of the LIAISE COST Action.

Furthermore, the collaborative implementation model contributes to strengthening long-term relationships among stakeholders and promotes the emergence of new opportunities for cooperation, innovation and IS development.

## 7. Conclusions

The development and implementation of the LIAISE Technology Watch and Competitive Intelligence platform represents a significant contribution to the objectives of the LIAISE COST Action and to the broader IS community. The platform provides a collaborative digital environment specifically designed to support the systematic monitoring, validation and dissemination of information related to IS and Circular Economy developments.

Through the deployment of the VINCI Technology Watch software, the platform integrates automated monitoring functionalities with collaborative knowledge management and dissemination mechanisms. This combination enables the continuous identification of relevant technological, regulatory, organisational and economic developments while ensuring that the information disseminated to users is validated and aligned with the priorities of the IS ecosystem.

The implementation of the platform has demonstrated the importance of structured Technology Watch methodologies in supporting IS initiatives. By organising monitoring activities around four Critical Watch Factors (Policy and Regulatory Intelligence, Data and Resource Flow Intelligence, Collaboration Ecosystems and Key Actors, and Enabling Technologies and Business Models) the platform provides a coherent framework for analysing the multidimensional challenges and opportunities associated with IS implementation.

In addition to its monitoring capabilities, the platform strengthens collaboration and knowledge exchange among members of the LIAISE COST Action and other stakeholders. The incorporation of collaborative validation workflows and the open access to the visualization frontpage contributes to the creation of a shared intelligence ecosystem that facilitates communication, networking and collective learning.

The online accessibility of the platform through the dedicated LIAISE infrastructure also reinforces its dissemination potential and supports transnational participation among stakeholders from different sectors, institutions and territories. The platform therefore contributes not only to information management but also to the consolidation of a collaborative European community focused on IS and Circular Economy transition.

From a strategic perspective, the platform establishes a scalable and adaptable basis for future Technology Watch and Competitive Intelligence activities related to IS. Its modular structure and flexible monitoring configuration enable the incorporation of additional thematic areas, information sources and collaborative functionalities according to future needs and developments within the IS field.

Overall, Deliverable D3.5 demonstrates the feasibility and added value of implementing a collaborative Technology Watch platform dedicated to IS. The resulting system provides a practical and operational tool capable of supporting informed decision-making, facilitating knowledge transfer and strengthening collaboration among stakeholders involved in sustainable industrial transition processes.

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