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D8.1 Defining and testing the Industry 5.0 Platform.

WP8 Developing the Industry 5.0 Platform.

Deliverable 8.1

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List of abbreviations.

BRIDGES	Bridging Risks to an Inclusive Digital and Green future by Enhancing workforce Skills for industry 5.0
CB	Company Board
CM	Communication Manager
CNAM	Conservatoire National Des Arts et Métiers
DoA	Description of Action
EAB	Ethics Advisory Board
EB	Executive Board
EU	European Union
FTL	Fresh Thinking Labs
GA	Grant Agreement
GDPR	The EU General Data Protection Regulation
GnAs	General Assembly
HADEA	Research Executive Agency
KUL	KU Leuven
PAP	Preventive Action Plan
PC	Project Coordinator
PM	Project Manager
PMT	Project Management Team
PO	Project officer
QAP	Quality Assurance Plan
RM	Review Meetings
SAB	Scientific Advisory Board
SB	Stakeholder Board
TNO	Nederlandse organisatie voor toegepast natuurwetenschappelijk onderzoek TNO
WIE	Workplace Innovation Europe CLG
WP(s)	Work Package(s)

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Summary.

This report summarises the work undertaken as part of Task 8.1 to outline the purpose, functionality and governance of an Industry 5.0 Platform. After defining the nature of a 'platform', the report explains the role of Fresh Thinking Labs as a testbed for developing the Industry 5.0 Platform concept throughout the life of the Bridges 5.0 project. The report also considers the functionality and performance offered by proprietary software products on which platforms can be built. It then interrogates a wide body of literature to provide the basis for a critical assessment of existing platforms, 51 of which were examined to establish the state of the art in terms of functionality, governance and stakeholder engagement, identifying gaps and the potential for innovation. The report concludes with a roadmap for establishing the 'proof of concept' and a sustainable business model for an Industry 5.0 platform.

The document has been revised after the first review period. See yellow marked text for change.

1. Introduction.

1.1 Aims of the report.

WP8 will develop, test and establish the **proof-of-concept for an Industry 5.0 Platform** designed to integrate project outcomes, and **upscale project results** to the European level. The platform will **capture, analyse and distribute outputs** from WPs 1-7 throughout the life of the project.

Through the Platform, these outputs provide the building blocks with which an engaged community of Industry 5.0 stakeholders will be built. WP8 thus enables an extended process of dialogue with, and ultimately, the distribution and take-up of project recommendations by, the wider stakeholder community.

WP8 will also lead to a **sustainable business model**, designed to ensure the life of the Platform beyond the life of the project.

Work on the Industry 5.0 platform started at the outset of Bridges 5.0, allowing sufficient time for testing and development, and ensuring effective promotion amongst target groups.

Task 8.1, the principal focus of this report, determines the goals, actions, principles and mechanisms underpinning the subsequent development of the platform through the remaining life of the project. It does so through **an analytical review of literature**, which in turn informs **a critical appraisal of existing platforms**. The analysis is informed by the engagement of the Stakeholder and Company Boards as well as the involvement of external stakeholders, ensuring close integration with WP7.

Task 8.1 will thereby establish the state-of-the-art as well as emerging potential in terms of technical functionality, platform governance, and stakeholder engagement. Current gaps and shortcomings in existing platform design and management will be identified together with the potential for innovation, leading to the development of an Industry 5.0 platform which adds real value to existing provisions.

The final output from Task 8.1 is a **roadmap for the development of an Industry 5.0 platform** throughout and beyond the remaining life of Bridges 5.0. Task 8.1 began with the orientation and adaptation of the existing **Fresh Thinking Labs** platform to meet the requirements of Bridges 5.0. Fresh Thinking Labs was originally developed by WIE to provide seamless integration between online dialogue, knowledge sharing and e-learning functions. It has since been tested and deployed with diverse groups, including businesses, social partners, policymakers and researchers, and has undergone several iterations in the intervening years. The roadmap will guide the future development of Fresh Thinking Labs in terms of functionality, content and facilitation specifically relating to Industry 5.0, to be delivered by WP8.2 *et seq*., in order to establish the proof of concept. Decision points within the roadmap will determine the criteria for the ultimate location of the Industry 5.0 platform – either remaining within Fresh Thinking Labs or integrated within another site.

1.2 What is a platform?

'Networks' have a long and important lineage, not least in the integration of European research and practice across many fields, bringing together stakeholder groups across the EU. More recently, the emergence of digital platforms adds significant new potential for strengthening the cohesion and impact of such networks, enabling multi-channel interactions to take place daily. Digital platforms enable and encourage exciting new forms of dialogue, knowledge sharing and ideation, no longer limited to occasional face-to-face meetings and email.

Yet as the literature and the existing platforms reviewed below tell us, digital platforms do not replace other, more traditional forms of interaction. Truly 'engaged communities' online, those which demonstrate regular and frequent patterns of user engagement, are built on the affinity between members often established through in-person contact. The challenge faced by all platform builders is how to achieve the best possible synergies between the exploitation of digital potential and the need for relationship building, whether in-person or via technologies such as video conferencing.

We also need to consider platform governance which, in this context, essentially refers to the rules, practices and design decisions made in creating and managing a platform. It thereby determines the relationship of the user to the platform as well as shaping and regulating its content.

1.3 Methods.

We have used several methods to develop the roadmap to define an Industry 5.0 platform. To achieve this roadmap, we need the following:

- Design, management and governance criteria for the Industry 5.0 platform.
- Choosing a resilient technical platform.
- An understanding of what existing skills platforms offer and where the gaps lie.

Defining design criteria for an Industry 5.0 platform.

We have instigated a process of consultation and dialogue with stakeholders on the aspirations and potential for an Industry 5.0 platform (during the meetings held on March 29th), and this is continuing. Drawing on our findings to date, we can define several criteria for the platform's design, governance and management:

- A one-stop platform for stakeholder learning, knowledge exchange and dialogue.
- Absorption and assimilation of knowledge from across the Industry 4.0 spectrum.
- An 'engaged community' of frequent users.
- An approach to governance which identifies stakeholders as 'owners' of the platform.

- Bespoke pathways for researchers, policymakers, practitioners and social partners.
- Seamless integration of functions for relationship building, dialogue, user-generated content (such as blogs), knowledge bank access, conferencing and e-learning (including tuition and assessment).

We have tested and refined this understanding through literature analysis and the critical assessment of existing platforms.

Choosing a resilient technical platform.

A software base is required on which to build the active network activities that will form part of the Industry 5.0 platform. There are many proprietary options available and, using the technical expertise available in Fresh Thinking Labs, we undertake a critical comparison in order to recommend a solution that is both effective and resilient.

An understanding of what existing skills platforms offer.

There are several existing platforms relating to skills and digital innovation, many of them supported by the European Union. skills platforms available. A substantial part of them are already supported by the European Union. We analyse the capabilities of these platforms to understand how policymakers and stakeholder groups define their needs. This analysis also aims to identify possible platforms for cooperation.

These three steps will also provide practical insights into high-impact platform design, governance and facilitation. In turn, they inform the creation of a robust roadmap to guide Bridges 5.0 towards the creation of the Industry 5.0 platform.

2. A resilient and flexible software platform.

2.1 Assessing technical capabilities.

The first question we asked concerns the nature of the underlying software on which platforms can be built. In order to assess the state of the art in terms of platform functionality, we tested several proprietary software bases to assess the degree to which the following functions observed from existing sites (see below: Section 4.2, Table 4) were both present and seamlessly integrated within each one:

- user-to-user connectivity (e.g., 'search and connect' functions);
- dialogue (e.g., discussion forums, etc.);
- searchable knowledge banks;
- user feedback on content (e.g., documents);
- user-generated blogs and other substantive content;
- video conferencing;
- e-learning with integral tutor interaction and learner assessment.

From a technical perspective, we also examined:

- ease of customisation, adaptation and extension;
- the level of technical expertise required for customisation and maintenance;
- quality of user experience.

Together, these criteria help to identify software that is at the same time resilient and sufficiently flexible. By flexible, we mean platforms that allow for different kinds of functionality.

2.2 Ten proprietary platforms.

Ten of the most common proprietary software products on the market were examined and tested against these attributes by the Fresh Thinking Labs technical team using their knowledge and experience of platform development. Each product was scored as follows:

- S = the attribute is wholly or substantially present.
- P = the attribute is partially present.
- I = the attribute is not present or inadequate.

Each was given a number (S = 3; P = 2; I = 1) to enable an overall score to be attributed to every product.

Table 1: Evaluation of proprietary platform building software
(Overview = total score of the evaluation)

	BuddyBoss	Thinkific	Guild	Bettermode	Docebo	Mighty Networks	Discourse	Circle	Kajabi	SCOOCS
OVERVIEW	**29**	**20**	**18**	**21**	**15**	**22**	**16**	**19**	**23**	**21**
Ability to customise, adapt and extend	S	P	I	S	P	S	S	I	S	P
Level of technical expertise required	S	S	S	S	S	S	I	S	S	P
Quality of user experience	S	P	P	P	I	S	P	P	S	S
User-to-user connectivity (e.g., 'search & connect')	S	I	S	I	I	I	I	I	I	S
Dialogue (discussion forums etc)	S	S	P	S	I	S	S	S	S	S
Searchable knowledge banks	S	I	I	S	P	I	I	I	I	I
User feedback on content (e.g., documents)	S	I	I	I	I	I	I	I	I	I
User generated blogs/ other content	S	P	I	S	I	P	P	I	P	P
Integral video conferencing	P	P	S	I	I	S	I	S	S	S
e-learning with integral tutor interaction/ assessment	S	S	I	I	P	P	I	S	S	I

The results show that a comprehensive and integrated range of functions is hard to source from commonly used proprietary platform software. It is likely that this also poses significant technical challenges for the (considerably more costly) construction of bespoke platforms.

The full evaluation of all ten products can be found in Annexe 1, and a summary is contained in the following table. Overall, BuddyBoss (on which Fresh Thinking Labs was built) scores significantly higher than the other products tested including on its range of functions, adaptability and user experience.

2.3 Fresh Thinking Labs as a testbed.

WIE made **Fresh Thinking Labs** (FTL) available to Bridges 5.0 as an existing platform that could be deployed for the project from the outset, and which has sufficient flexibility to adapt and develop as new findings and requirements are generated by the different Work packages. FTL is built on BuddyBoss, a proprietary WordPress-based product designed for online learning and networking, replacing an earlier, Oxwall-based version dating from 2016. BuddyBoss is the same base as that used, for example, by the Polish Government's Future Industry Platform.

Extensive learning and experience gained from the operation of the original platform informed the selection of the BuddyBoss base and the subsequent redesign of Fresh Thinking Labs. WIE's team undertook an extensive programme of work to customise the BuddyBoss base during 2021/2022, creating the current FTL platform. This version incorporates high levels of security and is hosted on servers located in Belgium.

FTL currently has 311 members representing a diverse range of businesses as well as the European research and policymaking communities. Members typically participate in open or closed 'Labs' focused on themes of interest, projects, company-specific initiatives and peer-to-peer networking.

At the start of Bridges 5.0, WIE created a closed Lab for the entire project consortium. The FTL platform was demonstrated to partners at the Inception Meeting in Brussels on 25th/26th January 2023, and each individual project participant was provided with registration details and access to the 'Bridges 5.0 Consortium Lab'. Each partner organisation is represented on FTL by at least two people, amounting to a total of 61 Lab members.

The Lab includes member-generated discussion forums used to ask questions, stimulate dialogue on Workpackage-related topics, or share information (10 topics and 40 posts to date; this will increase as more project deliverables become available). The first of these topics invited participants to contribute their ideas and experiences in defining the nature of the prospective Industry 5.0 platform.

Members can also upload and review articles and project documents in the Knowledge Bank, contribute and discuss blogs, share photographs, and message each other.

Further Bridges 5.0 Labs were created for the launch meetings of the Company Board and Stakeholder Boards in Brussels on 29th March, currently with 20 and 38 members, respectively. Lab Administrators are: Dunja Suttnig (Infineon) and Karolien Lenaerts (KUL) for the Company Board; Steven Dhondt (TNO), Ton Driessen (EUWIN) and Karolien Lenaerts for the Stakeholder Board. WIE supports each Administrator in facilitating the Labs and in addressing any technical issues.

FTL will play a key role in supporting stakeholder dialogue on the outcomes of Tasks 1.1 and 1.2, capturing and extending outcomes from workshops to build a cumulative narrative about the experience and expectations of each group relating to Industry 5.0 and, specifically, to the design of WP5 and WP6.

2.4 Developing the testbed.

Engagement of project partners and other stakeholders during the course of WP8.1 has identified potential for the further development of FTL as a testbed for the Industry 5.0 platform including:

- enhancement of functionality and user experience to enable the platform to create a themed, easily navigable and highly searchable Knowledge Bank with different stakeholder pathways, capable of holding several hundred documents relating to each aspect of Industry 4.0 and Industry 5.0;
- integration of in-Lab video conferencing, enabling discussion forum input during calls without changing screens;
- further development of facilitation to build regular and continuous platform activity by stakeholders.

3. Developing criteria to assess platforms.

3.1 Research questions.

We conducted a literature search to assess several questions. Our main quest is to understand what the literature says about 'good practice' in platform design, functionality and governance, particularly in terms of user interaction and engagement. In particular, we are interested in the following questions:

- how people are using platforms for shared learning, knowledge exchange & dialogue;
- good practice in online community building;
- effective online facilitation;
- the current state of the art and emerging developments in platform functionality.

The literature has been selected using a set of keywords. A narrowing down of the numerous sources has been done by checking the abstracts. The selected sources have been read and analysed for the central questions of this section. See Annexe 2 for more information.

3.2 Use of platforms for shared learning, knowledge exchange and dialogue.

How people use platforms

Early in the emergence of e-learning platforms, researchers sought to identify the features and functions that characterised a high-quality delivery mechanism. Early findings from the likes of Bichelmeyer et al. (2001), and Smith et al. (2002) identified that **up-front planning and design work** was a key indicator in outright engagement, activities that require significant investment. Thompson and Macdonald (2005) also identify that to be truly effective, planning must be accompanied by responsiveness during delivery to ensure that learner needs are met. It was also identified that creating a learning community is critical in ensuring overall learning success (Thompson and MacDonald, 2005).

These assertions were built upon by Calvo-Porral et al. (2017) who found that user satisfaction was linked to perceived ease of use and the content itself, whilst loyalty, engagement and word-of-mouth reporting were the consequences of this satisfaction. These findings suggest that a **carefully curated environment** for the sharing of information, knowledge, and the exchange of dialogue need to be carefully curated, content focused, but also straightforward and intuitive to use.

Panori et al. (2021) found that the use of digital platforms was instrumental in **improving collaboration and information sharing**. It is argued that digital platforms allow for better data intelligence to be applied, enhancing the impact on participants. Digital platforms also allow for scalable engagement with a positive impact, something that is difficult to achieve as numbers grow in traditional engagement settings.

Van Fossem et al. (2018) found that there is complexity in establishing shared spaces for innovation through the investigation of **incubator, accelerator and innovation platforms**. Incubators were found to reduce uncertainty, being effective in building community networks, and facilitating networks and knowledge transfer. Accelerators were found to build strong communities and provide a platform for showcases.

Schwatz-Asher et al. (2020) showed that social media has a key role in encouraging **knowledge sharing** between users. This process is split down into different knowledge decisions, or behaviours. *Knowledge creation* determines what is created, shared or reused. *Knowledge framing* considers the way in which content is packaged and communicated. *Knowledge targeting* looks at whether to target a specific group or individual. These findings can be applied to *knowledge exchange* in online learning environments, specifically linked to communities of practice, as it can influence the way that communities are structured and managed to encourage greater knowledge exchange.

Knowledge exchange also has a positive impact on overall organisational commitment. Demirel and Goc (2013) consider that enabling participants to actively engage in knowledge sharing has a positive impact on the commitment to the organisation. A platform that enables effective knowledge exchange can be a tool not only to drive learning but also to drive engagement with the organisation. This has the added benefit of generating greater knowledge capital within the organisation overall.

Good practice in online community building

As online learning platforms began to become more popular there was a drive to replicate the experiences of the **classroom in an online environment**. Due to the demands of upfront planning, as discussed by Smith et al. (2002), it was shown that the review cycles applied to learning environments were not effective enough in enabling them to adapt to learner needs. At the time, a process of emergent design was advocated (Cavallo, 2000) and this would be built upon learning communities. Crucially, it is essential to ensure that learning communities enable learners to engage at a level that suits their comfort and capability. Enforcing engagement, or creating overly complicated systems, is more damaging.

McClannon et al. (2018) undertook a longitudinal study looking at predicting student engagement factors in online learning communities. The **presence, and use of systems**, is a strong indicator of community engagement. There is a benefit derived simply from the existence of the platform itself without the need for high levels of facilitation. The second key factor is that the longer users engage with platforms the stronger their sense of community becomes. Therefore, retaining users on platforms is an important activity to maintain the value derived from the online communities of practice.

Toledano and Maplesden (2016) noted that **networks** are important for developing social capital and building communities effectively. Importantly, these networks need to be effectively facilitated in order to get the most from them. Critically, well-managed online engagement communities can be used to enhance subsequent face-to-face activities as well. There are key roles for organisers and facilitators in creating effective communities and these roles need to work together effectively.

Just as seen in later studies into the co-creation of value (Ayvaz et al., 2018; Chan et al., 2022) and the value of social media engagements (De Luca et al., 2022) identifying and providing opportunities to gather, and act upon, **feedback** was viewed early on as being a critical success factor for online learning platforms (Thompson and MacDonald 2005). Importantly, these engagements need moderation to ensure that viable opportunities are provided to allow communities to develop.

Van Fossem et al. (2018) found that incubator platforms were excellent for online community building. The case studies reported that the platforms were essential in convening a supportive network, or community, and enabled better engagement. The accelerator platform used further embedded community development which was seen as valuable in all case examples. Tsujimoto et al. (2018) proposed the **ecosystem model** for engagement which suggested that platforms needed to create an organic engagement environment to facilitate community building. The idea of organic engagement helps to explain the findings of Van Fossem (2018). Importantly the boundaries of the ecosystem are not limited to national or regional clusters or relationships driven by contract, which increased the reach of the ecosystem's ability to stimulate community building.

Chan et al. (2022) argue that online platforms require a **co-creation of value** to occur in order for all parties to gain maximum value. Critically, online platforms provide an enhanced opportunity for this to take place and therefore are drivers of co-creation. The design of the platform itself is critical in achieving this but as Chan et al. (2022) noted, there is a lack of targeted effort to designing effective co-creation of value into systems at the fundamental level. Meaningful interactions are required in order to co-create value and so platforms need to be structured to stimulate this level of engagement from all actors. Kemp et al. (2021) observed that platform governance is generating a trend towards greater interactivity and community building, such as greater interactivity features and "helping others" types of engagement.

This approach is also considered by Saadatmand et al. (2019), who concluded that **multi-stakeholder engagement** via platforms is essential in creating a compelling value proposition. Moderation of this is key in ensuring that value can be derived by all participants. Zhang et al. (2020) identified that effective moderation of activity is important and helps to mediate user engagement. Once engaged there are considerations of breadth and depth of engagement. Where engagement opportunities are simplified there is greater depth of engagement at the expense of breadth. This depth of engagement helped to improve digital word of mouth, which improved engagement overall. There is an argument here that a successful online community should provide deep engagement opportunities to improve engagement.

This approach to engagement is supported by De Luca et al. (2022), who explored how social media activities, and therefore co-creation of content, can improve stakeholder engagement. Engagement in value co-creation through social media can indicate what is most important to users and enable platform managers to target their efforts. Using the data from engagements could make online platforms more effective and responsive. This supports assertions made by Kim et al. (2015), who found that social aspects of online learning

platforms were important in enabling students to feel comfortable and connected and therefore possess a higher motivation to share knowledge. Positive experience of social co-creation of value correlated with a good learning experience, overall, as long as this was facilitated to ensure a targeted and beneficial experience.

Other issues that need to be considered have to do with **retention and continued engagement** with online learning platforms (Panigrahi, 2018)). Yates et al. (2021) showed that continued motivation and engagement is an issue with online platforms. An important consideration is that adopting a platform, and then not continuing to invest and drive engagement actually leads to higher dropout rates from overall engagement than not implementing the systems at all. The satisfaction of participants leads to the ongoing sustainability of platforms and, therefore the communities that have been built. Therefore, driving continuance is very important to ensure the online community's survival.

It is generally accepted that persistent engagement, with co-creation of value and community building, is seen as a positive activity for online communities of practice (O'Brien et al., 2022) and that disengagement is to be considered negative. These views tend to be polarised, all engagement is good, and all disengagement is to be avoided. Balwant (2018) characterised disengagement as being symptomatic of burnout and born of apathy. Other colloquial definitions such as "going through the motions" or "tuning out" are also associated with the phenomenon. However, O'Brien and Toms (2008), also noted that disengagement could be viewed as a positive thing from the perspective of the participant, where time wasting or needing a break are cited as the reasons.

Therefore, O'Brien et al. (2018) sought to view disengagement more nuancedly. It was suggested that engagement is not always positive, especially if the participant no longer views that their time is being used appropriately. This can lead to the development of negative feelings towards future engagement. It is also suggested that more activity does not mean greater engagement. This links to the idea presented by Saadatmand et al. (2019), where breadth and depth of activity need to be considered. Greater engagement at a superficial level may not be as rewarding and engaging as deeper engagement on a focused level. Similarly, more engagement does not necessarily lead to better outcomes.

It is recommended that the engagement and disengagement process be **considered a cycle**. Allowing participants to disengage from activities that are not adding value, either to themselves or the wider community, should be viewed as a positive thing where the participants can be re-engaged later. Therefore, disengagement can be positive. As motivation, and therefore engagement, cannot be maintained forever, it is a fallacy to expect participants to be able to maintain their depth of engagement, so actively enabling elasticity in the concepts of breadth and depth would enable participants to control their level of engagement at any given time and could improve overall retention within the community. Critically, engagement could damage the overall community where the user is no longer motivated towards positive activities.

3.3 Effective online facilitation.

Early research into online learning sought ways to reproduce the classroom learning experience in an online learning environment. As shown earlier in this review **up-front planning and design** is critical in organising high quality learning experiences. This needs to be coupled with quality engagement throughout the learning journey to help support the learning journey.

Kearney et al. (2012) considered that **personalisation, authenticity and collaboration** are key in ensuring effective online platform facilitation. Through personalisation, learners can access customised activities that engender feelings of ownership and control. Critically, the pace of learning should be personalised. Authenticity refers to the contextualisation of learning activities to provide greater relevance. Collaboration refers to how effectively the learning activity enables learners to converse, connect and share a wide range of content and information.

Reimers and Schleicher (2020) mediated the determinants of effectiveness suggested by Kearney et al. (2012) by introducing factors associated with the **amount of time spent learning** and, therefore, predictors of opportunities to learn. Yates et al. (2021) found that learners who spent more time engaging with online learning systems felt that they learned more via that method when compared to face-to-face learning.

A concern over effective online facilitation is **maintaining levels of motivation** over a longer period of time. Studying students learning from home during COVID-19. Yates et al. (2021) found that 39% of learners cited that motivation was the hardest part of learning in a remote environment. External distraction factors were the key causes of this. It is not possible to mitigate against all potential external factors that may impact motivation, so finding ways of maintaining engagement over time, perhaps through effective, deep, engagement opportunities, engendering of effective communities and appropriate use of social media type activities to maintain motivation. The issue of adaptation online engagement is picked up by Doo et al. (2023), which show that successful engagement with online platforms is driven by interest, how effectively interactions are structured, and, critically, by the literacy of the construct itself. This means literacy of the systems but also literacy of the aims and “rules of engagement” associated with interaction for the co-creation of value.

There is an assumption that learners will be able to engage with online platforms effectively rather than requiring some sort of development in order to use them fully. Sze-Yeung and Hussain (2010) discussed that self-directed learning is an essential skill but is also one that requires some development in order to use effectively. Development of capability is linked to the effectiveness of the online learning experience. Byas (2012) identified that digital literacy in personal applications did not always transfer to digital literacy in online learning platforms. This suggests there is a need to enable progressive introductions to online platforms for them to be effective. This could mirror the approaches used to introduce people to games where there is a progressive introduction to the environment, engagements, controls etc. which enable players to learn how to play.

One of the key indicators of ongoing engagement of students with online platforms is the **engagement of facilitators** in the process. Orcutt and Dringus (2017) showed that student engagement and intellectual curiosity were influenced most by how active an interest facilitator showed in the process. This suggests that any creation of value must be a co-creation of value and that a shared goal for learning beyond just the learning objectives is key in retaining the engagement of learners in online communities.

According to Orcutt and Dringus (2017), the criteria that students value are related to the high levels of visibility of facilitators with intentional social and cognitive processes. The teaching presence must be active and proactive to gain participant trust and respect. The actions and enthusiasm of the facilitator set the tone for the environment and could be more important that the technology that underpins the platform.

Based on several previous studies, Wright et al. (2023) sought to quantify the determinants of **quality online learning experiences**. These can be split into three categories, the systems employed, the activity provided, and the pedagogical strategies employed. This review has previously noted the facilitator's role as central to the experience of online facilitation. What is clear is that frameworks need to be in place to ensure that facilitation is supported by flexibility (both in learning and assessment), opportunities for feedback and ample engagement between all stakeholders. The role of the facilitator needs to be carefully considered. As with other forms of engagement, more does not necessarily mean better (O'Brien et al., 2022), so facilitators need to be mindful of their own load but also of intervening in participant activities where their intervention would stifle the co-creation of value.

Dennen (2022) and Martin et al. (2023) suggest that effective facilitation in online learning is entirely dependent on the participants and that **their engagement** can offset some poor design or render the most effectively designed learning ineffective. They argue that systems design (macro), curricula (meso) and course delivery (micro) are all contingent on interaction (micro). Providing the participants, and facilitators, with agency is critical in ensuring the success of the planned intervention.

3.4 Current and emerging developments in platform functionality.

Based on the literature reviewed, the table below summarises some current and emerging developments in platform functionality and deployment. These can be considered as measured by which a digital engagement platform may be successful.

Table 2: Key functionality by author

Author	Key functionality
Chan et al. (2022)	The **co-creation** of value is critical in ensuring ongoing buy-in to digital platforms. Where all stakeholders have a role in creating the value derived from the platform, it helps to create a richer, more engaging and diverse environment for knowledge exchange.
De Luca et al. (2022)	Social media-type dynamics can be successfully integrated into online collaboration and learning platforms. The methods of **engagement, creation and dissemination of content and peer validation** can be applied to learning environments to drive ongoing engagement.
Thompson and MacDonald (2002)	An early, but critical consideration is that learning communities help to drive engagement with online platforms. Where **peer-to-peer engagement** is built in, and encouraged, there is greater uptake and lower attrition.
Yates et al. (2021)	**Greater agency** can lead to greater ongoing engagement. Giving learners the opportunity to decide what, and when, to learn outside of the core structure provides a more personalised experience linked to higher engagement over time.
Orcutt and Dringus (2017)	One of the key factors in successful online platform uptake is **the facilitator's input and passion**. As with other learning environments, the capability of the facilitator is linked to participant engagement and ongoing co-creation of value. However, an appropriate balance of input is required to allow participants to create links themselves without being too prescriptive.
Byas (2012)	Providing **opportunities for participants** to learn how to engage with systems, and how they work at a mechanical level, is important in ensuring successful learning platform deployment. There are opportunities to gamify this process.
McClannon et al. (2018)	Repeated, quality, engagement works to deepen the sense of community. This, in turn, helps to drive co-creation of value. Methods to **retain engagement** over time are positive.
O'Brien et al. (2022)	Slightly at odds with McClannon et al. (2018), it is suggested that the volume of engagement is not necessarily the deciding factor. Enabling participants to actively disengage through a **cyclical process** reduces fatigue and the chance of negative impacts through less-than-optimal community interactions.
Denned (2022), Martin et al. (2023)	As well as providing a structure, there is value in enabling participants and facilitators, agency to shape the environment as they see fit. **Personalisation** is critical in successful online delivery, and ownership can be engendered.
Boghady et al. (2019)	Whilst online environments provide excellent engagement opportunities and the potential for co-creation of value, where participants need to gain practical skills, a **blended method** needs to be applied so that face-to-face interactions can take place where they add value.

4. A critical assessment of existing skills platforms.

4.1 Overview and selection.

Drawing on our understanding of 'good practice' gained from the literature analysis, our next step was to interrogate existing platforms associated with Industry 4.0, Industry 5.0 and the European Skills Agenda in order to assess the current state of the art, perceived shortcomings and gaps, and opportunities for improvement and innovation.

We asked partners to identify the platforms with which they were familiar. To broaden the initial scope of the search and to avoid constraining it with a priori assumptions, we did not elaborate on the types of 'platform' sought for the study.

In total, we identified 51 separate platforms (see Annexe 3 for a full overview). Each was initially assessed separately by two research partners to ascertain its potential significance for identifying good practices in platform design. The following table provides an overview of the identified sites and whether these websites are still active.

Table 3: Initial selection of sites for critical assessment

	Active	Finished projects	Not Active	Not yet active	Total
Community of practice	3				3
National government	5	1			6
NGO initiative		1			1
Official EU website	7			1	8
Private initiative		1			1
Project site	22	9	1		32
Total	**37**	**12**	**2**		**51**

4.2 Findings.

Evidence was collected from an initial overview of all 51 sites though only 23 were of sufficient interest for deeper analysis. The analysis from both sets focused on the principal choices and challenges facing designers, administrators and facilitators in creating, managing and sustaining platforms.

Initial observations

- Only 37 of the 51 sites are still active in 2023. Non-active sites are mostly finished projects, or those with no indication of recent activity. This raises the question of how to create a business model that allows knowledge outputs from EU-funded projects and policy initiatives to be sustained as part of a living digital resource.
- The sites address a very diverse set of target groups. Most are focused on companies or on a broad EU public. Some are very specific: women, disabled persons, research, and education. A clear demarcation is not always apparent.
- Only six of the active platforms are completely open whilst six are completely password protected and the remainder are partially open. Password protection requires the participants to list their interests and to offer an email address, which means that access can be blocked in certain circumstances.
- Most of the platforms are funded by different EU sources (H2020; Horizon Europe; Erasmus+; Interreg; Agencies).
- The platforms vary considerably in the functions they offer. In half of those studied, four or more functions are visible including cascade funding, knowledge banks, libraries, e-learning, discussion forums, video integration, and events notification. The more specialised functions are offered behind password protection.

Purpose

The starting point is that platform functionality and operation should be fit for purpose – and that 'purpose' is not identical for all platforms.

Some platforms are project-specific, address a limited range of topics and are unlikely to be actively sustained far beyond the end of the funding period. Twelve sites were closed down, representing an evident loss of invested capital. Nonetheless they were selected for analysis because they may offer useful insights into platform design and user engagement. In contrast, other platforms are designed for long-term, multiple stakeholder engagement across a broad and evolving range of topics – examples include (amongst others) the Industrie 4.0 platforms in Austria and Germany, the European Commission's Digital Skills Accelerator, and the Dutch Smart Industry platform. It is this latter group which are of greatest interest in the context of the planned Industry 5.0 platform.

Functionality

In a topic as broad as Industry 5.0, a multifunctional platform with multiple channels to reflect the diverse interests of different stakeholders offers the best opportunity for creating a 'one-stop shop', the definitive location for information, knowledge sharing, dialogue, practical solutions and community. Multiple functions, and especially the potential for interaction with others, appear more likely to keep users returning to the platform.

Possible platform functions identified from our analysis include the following:

Table 4: Identified platform functions

CRITERIA	EXAMPLES
Searchable knowledge bank: downloadable, multimedia files searchable by theme, problems/solutions, stakeholder interest, keyword, etc., with opportunities for user feedback.	Future Industry Platform (Poland); CoP for Circularity (registration requirement).
Discussion forums: admin or user generated discussion threads for Q&A, ideation, knowledge sharing, or dissemination. Registration is normally required as a gatekeeping mechanism to help ensure that participation is relevant.	Digital Skills & Jobs Platform (EU) CoP for Circularity (EU)
Video integration: integral video conferencing in which the call and discussion forums are visible together without the need to change screens.	None found in this sample, though software bases such as Scoocs now offer this functionality.
Interactive tools: self-assessment questionnaires, diagnostics and other exercises usually involving pre-programmed feedback or gateway access.	Digital Skills and Jobs Platform (EU) Future Industry Platform (Poland)
E-learning: courses based on multimedia content with integral assessment capability, either pre-programmed or involving interaction with a tutor.	Future Industry Platform (Poland) Entrepreneurship4All (EU) WeGate (EU)
Working groups: online, often multidisciplinary forums focus on specific challenges and opportunities.	Industrie4.0 (Germany) European Digital Innovation Hubs Network (EU)
Community building: enabling informal peer-to-peer connections including searchable member profiles, peer-to-peer introductions, user-generated affinity groups, etc. Usually password protected.	I4MS (International) Dialogue Platform for Social Responsibility (DE)
Bespoke advice/support: access to accredited expertise and/or subsidy.	Platform Industrie4.0 (Austria) Future Industry Platform (Poland) SURE5.0 (EU)
Blogs: generated by administrators, commissioned experts and/or (subject to moderation) users.	
News, Events, etc.	All

The interconnectedness of these functions is also apparent in certain cases. For example, several sites offering e-learning stress that participants are joining a 'community', with opportunities for peer-to-peer knowledge exchange as integral to the learning process.

User interaction

Only 16 of the 51 sites demonstrated significant capacity for community building or user engagement, the remainder being principally designed as knowledge banks, to provide access to specific tools, or for project outcome dissemination.

The following platforms appeared to include functions that enabled significant opportunities for user interaction and engagement, and were selected for further investigation even though some were not directly relevant in terms of content. The platforms were:

Table 5: Platforms with capacity for user interaction

NAME	TYPE	WEB ADDRESS
Community of Practice for Circularity	EU funded project	https://www.h4c-community.eu/knowledge-platform/
Dialogue Platform for Social Responsibility	Private Network	https://www.managerfragen.org/
Digital Skills and Jobs Platform	European Commission	https://digital-skills-jobs.europa.eu/en
EFFRA	Industry Association	https://www.effra.eu/
Entrepreneurship4All	European Commission	https://entrepreneurship4all.eu/
European Digital Innovation Hubs Network	European Commission	https://european-digital-innovation-hubs.ec.europa.eu/home
Future Industry Platform (Poland)	National Government	https://przemyslprzyszlosci.gov.pl/
I4MS	Horizon	I4MS – I4MS
Industrie4.0 (Germany)	National Government	https://www.plattform-i40.de/IP/Navigation/EN/Home/home.html
LEADS Advanced Digital Skills	EU funded project	https://advancedskills.eu/

Lifelong Learning Platform	EU funded project	https://lllplatform.eu/
Platform Industrie4.0 (Austria)	Companies, social partners & researchers	https://plattformindustrie40.at/?lang=en
Skillability Marketplace	EU Erasmus+	https://skilltalent.eu/
Smart Industry (Netherlands)	National Government	https://smartindustry.nl/en
Sure Project	EU funded project	https://sureproject.eu/
WeGate	EU COSME Programme	https://www.wegate.eu/

Table 6: Case Example

DIGITAL SKILLS & JOBS PLATFORM (European Commission) **https://digital-skills-jobs.europa.eu/en**	
OVERVIEW	A comprehensive platform which "helps Europeans to advance their digital skills and knowledge, further their careers and add value to their organisations" through access to high quality information, resources, links to training provision and other forms of support. The platform provides the focal point for a coalition of Member States, companies, social partners, non-profit organisations and education providers, together with National Coalitions in 25 EU countries.
TARGET USERS	There is a focus on individual citizens seeking to enhance their digital skills, but the platform also encourages participation by companies and other organisations to be part of a networking Community, to share ideas and experiences, and to pledge their commitment to reducing the digital skills gap in Europe.
USER ENGAGEMENT	For individual users, the most likely pathway is to explore the 'Opportunities' tab which provides access to a catalogue of training courses targeted at students, job seekers or workers. Careers guidance material and information on current funding opportunities are also available. Organisations can access case studies, research and other resources directly from the site, which acts as a curated knowledge bank for project

	deliverables from programmes such as Erasmus+ and others. Deeper engagement with the platform is available by registering for membership of the Community via the EU Login authentication service. Community members can join campaigns, access a number of discussion forums, identify partnership opportunities and connect with others. There are just short of 1500 individuals and 280 organisations registered at present.
COMMENTARY	This is an ambitious platform which clearly seeks to become the definitive location for information and community building related to digital skills and jobs. A key strength lies in the supporting coalitions at both Member State and EU levels, providing an unprecedented opportunity to curate a diverse range of information, knowledge and resources. In terms of user experience, registration via the EU portal might be a deterrent for some individuals and organisations. Navigation inside the Community requires an investment of time to gain familiarity with the platform, and some functions are hard to access. There is currently little evidence of user engagement in discussion topics at present, perhaps because the platform is relatively new. Other user-generated content is also limited, though there is a standard form that can be completed if members of the Community wish to suggest new topics or add further material, presumably subject to moderation. Overall, the platform appears extremely valuable as a knowledge hub but the Community is strongly admin-driven and is likely to need a fresh approach if high levels of user engagement are to be realised.

Activating stakeholder engagement

Creating a truly engaged online community is notoriously difficult, a challenge which many of the platforms studied above have yet to overcome. Single channel interaction with a platform is commonplace – for example to download files, search a knowledge bank or make use of an online tool. Giving back, for example by contributing to discussion forums, sharing own resources, providing feedback on content and connecting with others requires the platform to stimulate a psychological and/or emotional commitment by the user.

Our analysis emphasises the difficulties involved in creating such a bond with users. Lessons can also be drawn from successful commercial networking platforms such as **Guild**, an international professional community within which individual and corporate users can create open communities on key topics or closed communities to strengthen their own stakeholder networks. Guild, which offers a tiered membership structure including a basic, free-of-charge starter, hosts 6,000+ communities of which 200+ are listed as open. Read more **here**.

Whilst successful examples are rare, they draw attention to three factors:

- *Users have a sense of ownership* – not necessarily in a proprietorial sense but through a system of governance which enables their ability to shape content, for example by instigating discussions, uploading material and creating open or closed groups. Governance is discussed more fully in Section 5.3 below.
- Platform administrators *actively stimulate engagement* by sourcing user contributions, facilitating connections and adding new material.
- The platform is *authoritative* – a strong brand backed by comprehensive and trusted knowledge resources, an active membership including high-level expertise and experience, and an approach to governance which minimises irrelevant, self-promotion and selling activity.

4.3 Reflections.

We have drawn four principal lessons from this analysis:

1. There is a clear distinction between the governance of the EU-owned websites and the rest. Notably, there is no collaboration with external partners and this limits the room for Bridges 5.0 to co-develop an Industry 5.0 platform with the EU. We will investigate that option, but do not expect to find a solution in this direction.
2. We will contact the remaining 12 platforms (of the 23 studied for further analysis) in the coming period to understand whether and how collaboration might be possible.
3. Whilst a certain level of access to resources will be available on the public website, password protection will be central to any viable solution for a vibrant Industry 5.0 community based on the different functions reflected in our analysis of current platforms across the EU.
4. We have concluded that Fresh Thinking Labs should be further developed as a multi-function web-based platform that supports the Bridges 5.0 community.

5. Conclusions and the way forward.

5.1 Challenges.

The foregoing analysis reveals the challenges involved in building a multi-function platform that can also host a diverse and highly engaged community of stakeholders. From the sites examined, there is no single example that achieves the vision and criteria that we set out in the first section of this report. However, we have identified several specific aspects of good practice from which we can learn, as well as general lessons for the design, governance and facilitation of the Industry 5.0 platform.

In this final section, we assess Fresh Thinking Labs against the criteria discussed in the report and outline a potential roadmap towards its evolution into the Industry 5.0 platform. We also identify the means by which we will identify, explore and evaluate alternative options. This means that our analysis is not yet finished. Several questions will be researched during the remainder of the project.

5.2 Fresh Thinking Labs.

Fresh Thinking Labs matches or exceeds the functionality and operation found in the platforms analysed in this report (Table 7, below), whilst Tasks 8.2 and 8.3 (M7-48) allow for the further expansion of platform functions (within the technical limits of the underlying BuddyBoss software) and for the development of effective facilitation and community building methods targeted at engaging a wide range of stakeholders.

Table 7: How does Fresh Thinking Labs compare?

CRITERIA	COMMENTS / ACTIONS
Searchable knowledge bank YES but navigability and user experience is currently elementary.	Currently a priority for development within Bridges 5.0 (Task 8.2)
Discussion forums YES. Users can create and contribute to discussion topics across the entire platform or in the Labs of which they are members. Users can also create open or closed Labs on specific topics.	Enhanced facilitation (Task 8.2) and upscaling to include external stakeholders (Tasks 1.2, 7 & 8.3)
Video integration PARTIAL. Administrators have the capacity to open a Zoom meeting from within a Lab, but it appears on a separate screen.	The possibility for full video integration will be investigated (Task 8.2)

Interactive tools YES. Interactive tools are embedded in several of the e-learning courses currently accessed via the platform, and there is the potential to do so directly via the Labs.	Further development possible under Task 8.2.
E-learning YES. Integral to Fresh Thinking Labs, including Learning Logs for assessment and direct tutor feedback.	Potential application for Teaching and Learning Factories (Tasks 5 & 6).
Working groups YES. Can be established in dedicated Labs including forum topics, document uploads and feedback, and peer-to-peer messaging.	Potential application throughout the project.
Community building YES. Individual profiling enables users to 'search and connect' with people sharing similar interests or backgrounds. Facilitated discussions support community building too.	This is beginning to happen within the Bridges 5.0 community and will be actively facilitated.
Successful user engagement PARTIAL. Regular user interaction is successful on FTL when supported by highly active facilitation.	To be developed further under Tasks 8.2 and 8.3. A User Board will also be created in M10 to provide formative evaluation and ideas for refinement.
Bespoke advice/support YES. There is the capacity for users to ask questions or request one-to-one consultations with experts.	Potential application for Teaching and Learning Factories (Tasks 5 & 6).
Blogs YES – by administrators, commissioned experts and (subject to moderation) users.	Already utilised by Bridges 5.0 Consortium members.
News, Events, etc. YES.	In use for communication within the Bridges 5.0 community.
Sustainability beyond Bridges 5.0 FTL hosts multiple programmes and user groups, leading to shared costs for the Industry 5.0 platform as well as the potential for wider interaction and engagement.	Task 8.4 will examine the feasibility of sustaining the Industry 5.0 platform on FTL beyond the life of the project.

The outcome of Tasks 8.2 and 8.3 will be a fully developed and tested Industry 5.0 platform, including an engaged community of stakeholders, hosted on Fresh Thinking Labs.

5.3 Governance.

The EU websites examined in this study are managed by the European Commission and have clear and specific purposes, directly driven by policy frameworks and governed conservatively. Ownership and control by the Commission is clearly evident to users, and user-driven content is rarely seen in most cases. Our analysis in Task 8.1 identifies the need for a more flexible, multi-stakeholder approach.

Industry 5.0 is a shared concept, shaped and adapted by diverse stakeholders. This common ownership should be reflected as far as possible in the governance of the Industry 5.0 platform. Whilst the platform will have a strong focus on knowledge sharing and learning, it must also be a place where Industry 5.0 can be debated, questioned and reshaped by creating meeting points and synergies between diverse perspectives. We also know from the literature review that creating a sense of shared ownership by platform users creates higher levels of engagement and community building.

This is not to say that the Industry 5.0 platform should be unregulated. In line with the earlier discussion on stakeholder engagement, our respondents have made clear that platform content must be authoritative, informed and free from commercial selling. This requires clever moderation, capable of balancing the need to exclude inappropriate material on the one hand with the active stimulation and curation of new knowledge and fresh insights on the other.

Likewise, the requirement to register before accessing substantive content and meeting other users will help to prevent spamming as well as enhancing platform security. As in Fresh Thinking Labs, users will be required to accept a code of conduct defining the standards of behaviour expected on the platform, including respect for others. Administrators have the right and ability to expel those who are not compliant.

Governance structures need to be considered with care. Creating a strong consortium of Industry 5.0 stakeholders with a clearly specified commitment to the platform, including an active role in moderation, would help to ensure relevant focus as well as enhanced levels of user engagement. Consortium members would ideally include industry associations, social partners, companies, policymakers and researchers, together with representatives from existing Industry 4.0 platforms.

The nature and membership of such a consortium may require the creation of a specific legal entity and/or a binding contract with an existing platform provider. This, together with the question of legal ownership and how the platform will be managed will be pursued in Tasks 8.3 and 8.4 during the remainder of the project.

5.4 The roadmap.

Task 8.4 (M25-48) involves in depth consultation with stakeholders to identify a business model capable of sustaining the Industry 5.0 platform beyond the life of Bridges 5.0, demonstrating its value proposition, value chain and revenue streams.

Assuming the successful delivery of Tasks 8.2 and 8.3, retaining the Industry 5.0 platform on FTL may present itself as a clear option. In making the decision, factors to consider include the following:

- We cannot predict whether new platform software will become available in the next 42 months that is superior in functionality and use to the BuddyBoss base on which FTL is based. In such an event, FTL itself might migrate to the new product. Alternatively, it might be deemed appropriate to rebuild the Industry 5.0 platform as a separate entity.
- As part of Task 8.3, we will consult with selected platforms to identify opportunities for future collaboration. Options might range from mutual signposting to full merger, either by migrating the Industry 5.0 platform to another site or vice-versa. Should relevant new platforms appear during this timescale, we will include them within the consultation.
- FTL was developed and is owned by WIE, with whom an acceptable plan for governance and revenue will need to be agreed should the Industry 5.0 platform remain there beyond the life of the project.

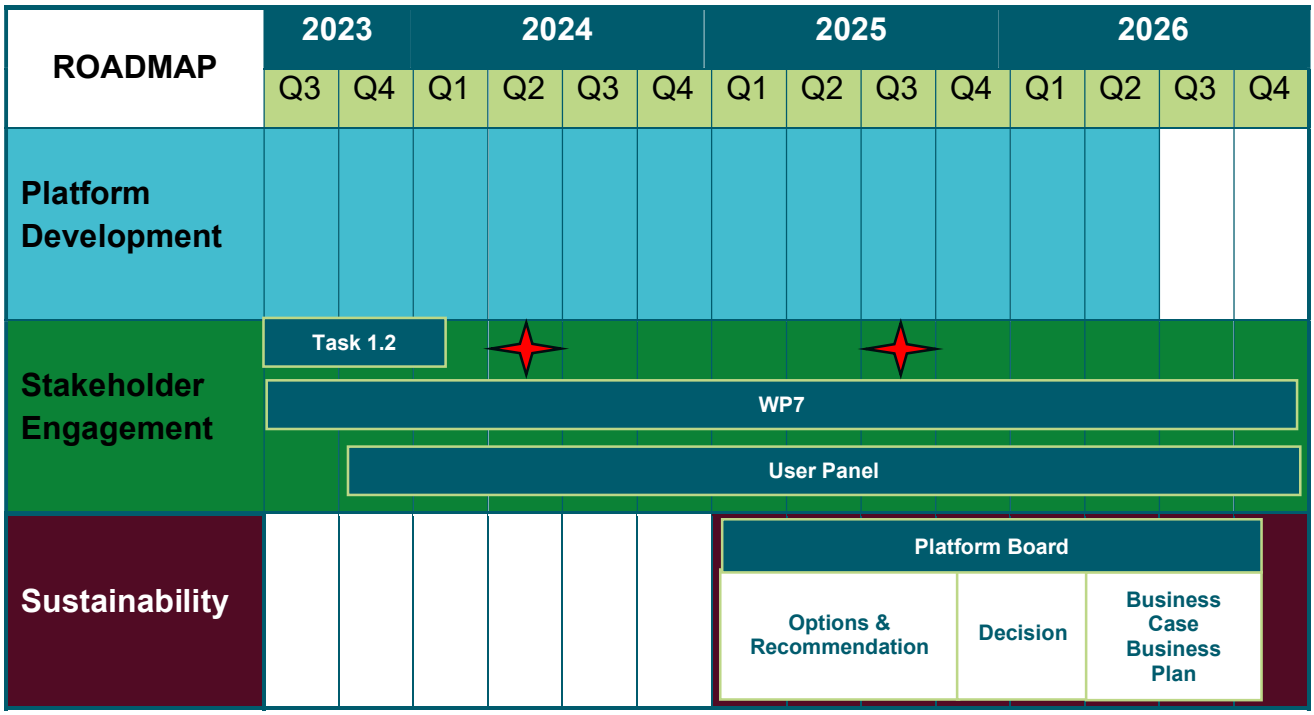
During M25 we will create an Industry 5.0 Platform Board with representatives from key stakeholder groups in order to:

- Evaluate the current platform and make recommendations for further refinement.
- Define the criteria against which decisions of the post-project future of the Industry 5.0 platform will be made.
- Review evidence relating to options for the future of the platform available at the time and to make appropriate recommendations.
- Contribute to the development of the business case and business model.

In line with RP1 recommendations, we will create a pathway designed to raise awareness of Industry 5.0 amongst a wider section of the public including young people, workers and in-company change leaders, paying particular attention to the engagement of women. This will take the form of a new website (https://industry5-0.net/) designed to act as a gateway to the i5.0 platform on Fresh Thinking Labs. The website, to be launched in January 2026, will gradually be extended with content derived from Bridges 5.0 and other HORIZON Industry 5.0 projects adapted to reach a broader population.

The following chart summarises the roadmap. Precise timings may be subject to amendment depending on outcomes at each stage.

Table 8: Roadmap



= Discussion/update with HADEA / Evaluators

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Annexes.

Annexe 1: Comparison of Platform Software.

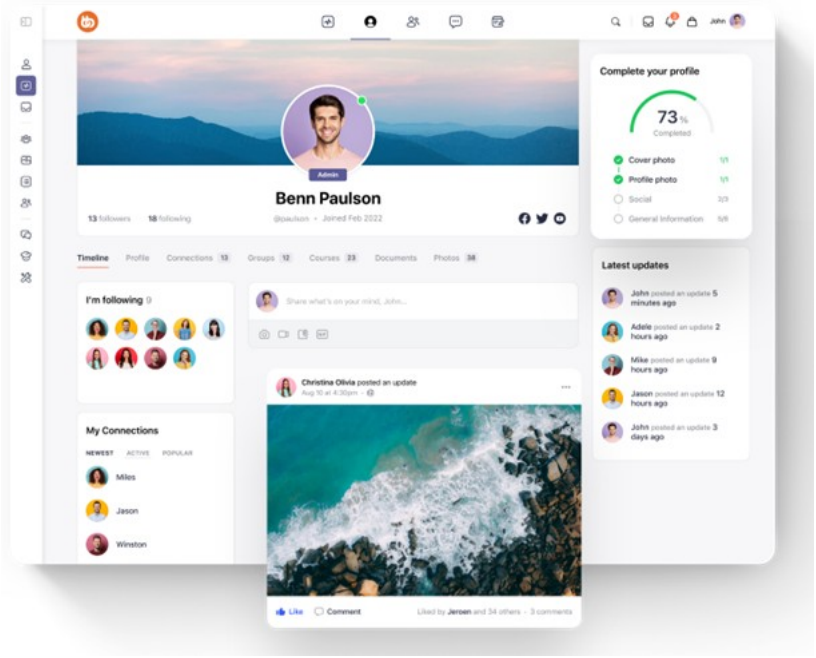
Product attributes were scored as follows:

S = the attribute is wholly or substantially present.

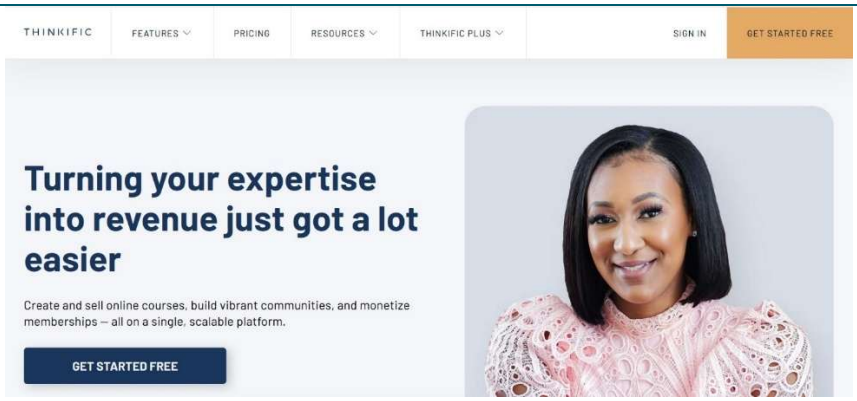
P = the attribute is partially present.

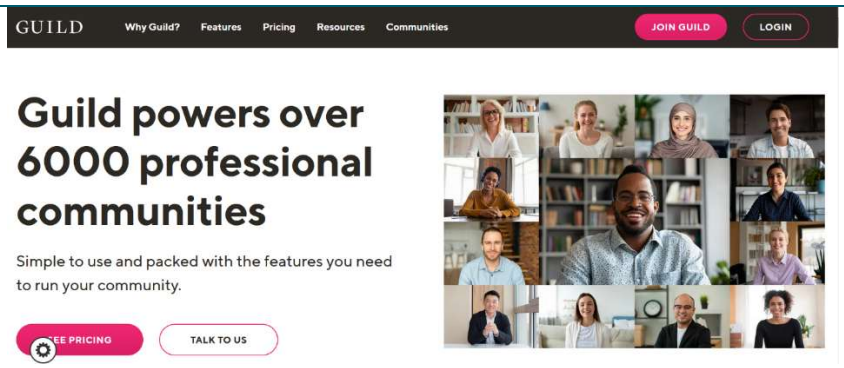
I = the attribute is not present or inadequate.

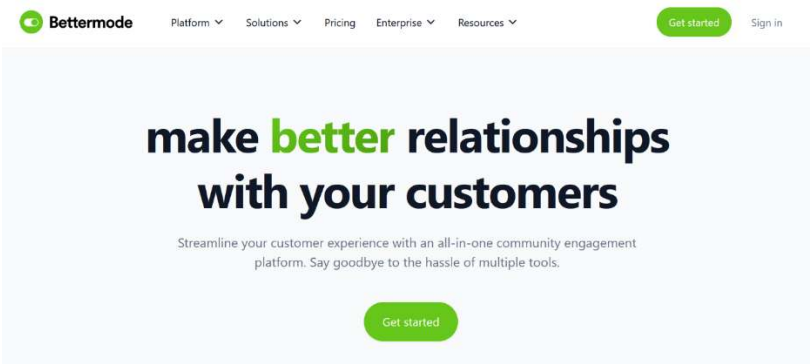
Each was given a number (S = 3; P = 2; I = 1) to enable an overall score to be attributed to every product.

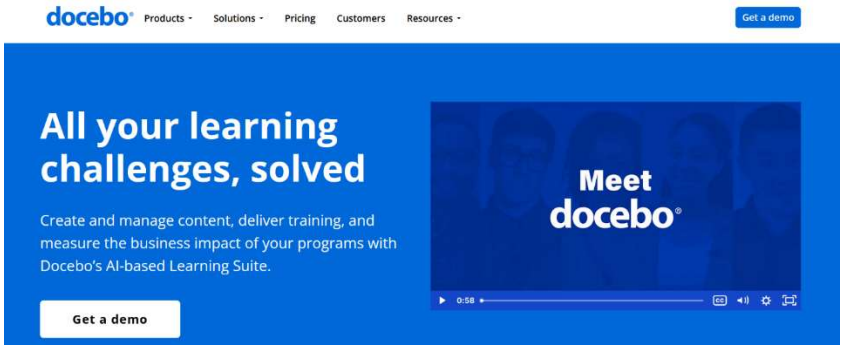
Name of product: BuddyBoss		**Score**
Overall assessment	 WordPress for online learning & community. **Grow**. BuddyBoss gives you the freedom to grow your platform without limits. **BuddyBoss Web for Courses.** Create an online school and inspire your students with the world's most powerful online learning platform. **BuddyBoss Web for Community.** Build a private or public social network with your own features, no restrictions and no algorithms.	29
Ability to customise, adapt & extend	Built on WordPress, BuddyBoss is fully customisable both visually and in terms of functionality, either through built-in native integrations or by taking advantage of WordPress' plugin directory.	S
Technical expertise	Flexible dependent on your platform's needs. The level of technical expertise will depend on the customisation needed, ranging no coding out of the box for visual customisation to medium and high levels required for complex tasks.	S

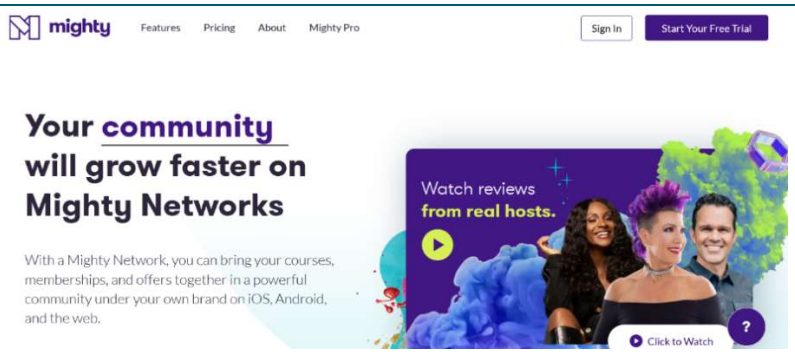
Quality of user experience	Based on existing users.	S
User-to-user connectivity	Built in.	S
Dialogue	Built in forums.	S
Searchable knowledge banks	Built in. Powerful privacy settings that apply for each document. Accessibility is defined by public, contacts only or members of the same lab (group).	S
User feedback on content	Built in. Feedback/comments can be made for each document either in the feed, or in the Documents section.	S
User generated content	Additional BuddyBoss plugin allows for users to generate blog posts.	S
Integral video conferencing	Zoom integration for managing meeting. Meeting details available in labs (groups). No built-in video conferencing.	P
e-learning with integral tutor interaction/ assessment	Integrated e-learning through LearnDash plugin.	S

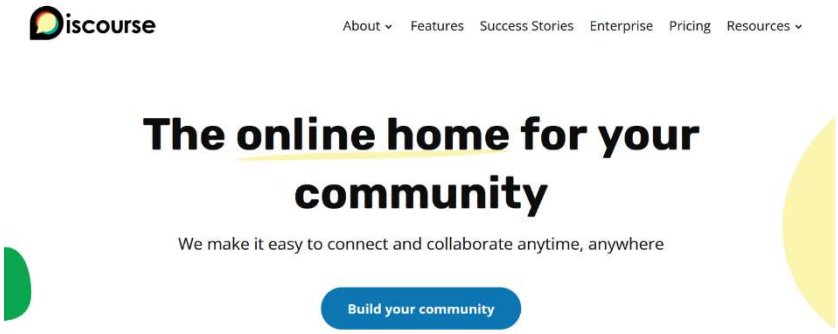
Name of product: Thinkific		Score
Overall assessment	 Thinkific is a powerful but intuitive platform for creating, designing and selling online courses. It doesn't require coding — you can start with a well-designed template and customize it with a drag-and-drop editor in real time. After your course is done, you can add community to it, so your customers can get to know each other, discuss common issues and share expertise. Key features Courses and communities in one place. White-label customization without coding.	20
Ability to customise, adapt & extend	Software is presented as is. Visual customisation is built in. Functional customisation is only possible through the hire of an expert.	P
Technical expertise	No coding required to set up and launch.	S
Quality of user experience	Limited info available.	P
User-to-user connectivity	Not enough information available.	I
Dialogue	Communities and spaces.	S
Searchable knowledge banks	N/A	I
User feedback on content	N/A	I
User generated content	User generated content possible inside communities and spaces, but is limited to statuses.	P
Integral video conferencing	Zoom integration for creating and managing meetings, but no native solution.	P
e-learning with integral tutor interaction/ assessment	e-learning built in. Limited info about assessment.	S

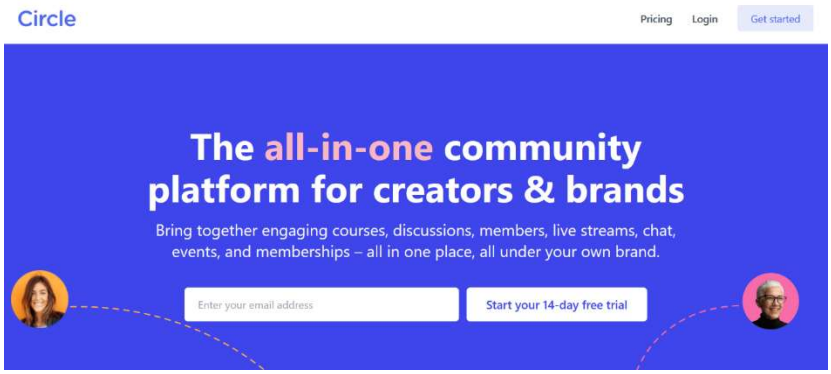
Name of product: Guild		**Score**
Overall assessment	 Engage your members, drive collaboration, value and member growth. Increase member networking and collaboration Add value to your events program / content Support special interest, regional groups or different member tiers Support your learning / training programs	18
Ability to customise, adapt & extend	Provided as is. Branding and visual customisation possible. Info about functional customisation not available.	I
Technical expertise required	No coding knowledge required.	S
Quality of user experience	Limited info available.	P
User-to-user connectivity	Built in networking features such as ‘Connect to user’ and ‘Introduce user to’	S
Dialogue	Built in functionality: Groups	P
Searchable knowledge banks	N/A	I
User feedback on content	N/A	I
User generated content	User created content relates only to networking. Not enough info about ‘Groups’.	I
Integral video conferencing	Built in	S
e-learning with integral tutor interaction/ assessment	N/A	I

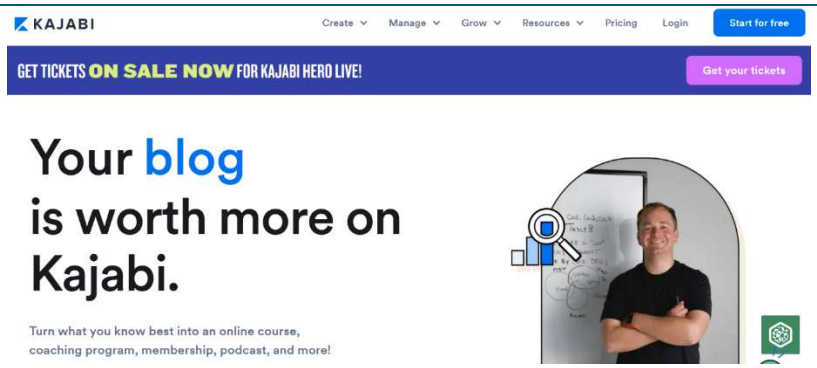
Name of product: Bettermode		**Score**
Overall assessment	 This no-code solution allows you to build and customize a platform for your brand's audience. Everything from the layout and colours to the custom domain and extra widgets is easy to add and tailor to your needs. Your community members can join groups, write posts and participate in discussions. They will have their own activity feed for updates and can use their existing social media logins to sign in to the platform. Key features A no-code editor Easy login for all users Customizable branding Member roles for clear permissions Powerful analytics Engage your members, drive collaboration, value and member growth. Increase member networking and collaboration Add value to your events program / content Support special interest, regional groups or different member tiers Support your learning / training programs	21
Ability to customise, adapt & extend	White label platform, visual customisation only.	S
Technical expertise	No code platform.	S
Quality of user experience	No info available.	P
User-to-user connectivity	Limited.	I
Dialogue	Discussion, ideation, Q&A.	S
Searchable knowledge banks	Included.	S
User feedback on content	No information available.	-
User generated content	Built in.	S
Integral video conferencing	N/A	I
e-learning with integral tutor interaction/ assessment	N/A	I

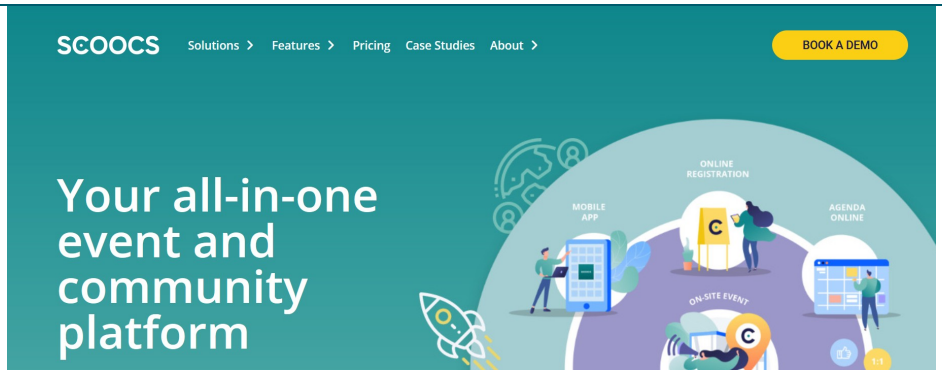
Name of product: Docebo		**Score**
Overall assessment	 Docebo is a community platform that offers course creators the opportunity to build truly engaging discussion spaces for their learners and ties those discussions closely into their course material. The platform is simple to use, easy to integrate, and offers beautiful posts, member segmentation, notifications, commenting and insight tools to help course creators get the most out of their learner communities. Key features: White label and customizable.	15
Ability to customise, adapt & extend	Visual customisation possible. Functionality can't be extended.	P
Technical expertise	No coding skills required.	S
Quality of user experience	N/A	-
User-to-user connectivity	N/A	I
Dialogue	Not enough information.	I
Searchable knowledge banks	Possible. Not enough information.	P
User feedback on content	N/A	I
User generated content	N/A	I
Integral video conferencing	N/A	I
e-learning with integral tutor interaction/ assessment	No information available.	P

Name of product: Mighty Networks		**Score**
Overall assessment	 This community platform makes it easy to invite community members to discuss anything you have to offer, from online courses to ebooks. Let users post too and chat with each other, further strengthening your community. New posts are easy to create with an intuitive CMS and can include images, videos, audio, surveys and more. Users can engage with your content on the web or through mobile apps. Key features Unlimited storage for your community files Add and sell online courses Direct messages between members.	22
Ability to customise, adapt & extend	White label as is; extensive visual customisation.	S
Technical expertise	A no code platform.	S
Quality of user experience	Limited info available.	S
User-to-user connectivity	N/A	I
Dialogue	Built in	S
Searchable knowledge banks	N/A	I
User feedback on content	N/A	I
User generated content	Networking user generated content only.	P
Integral video conferencing	Zoom integration and live streaming inside ‘spaces’.	S
e-learning with integral tutor interaction/ assessment	Courses built in. No assessment.	P

Name of product: Discourse		**Score**
Overall assessment	 Discourse is a pretty powerful platform right out of the box. Bring together a community, organize categories and threads, assign moderators and more. Users, in turn, can post, message each other, share content, etc. A very helpful power feature that Discourse offers is automatic filtering for spammers and trolls. Key features Open-source code and flexible API Social media logins available Powerful automatic moderation.	16
Ability to customise, adapt & extend	Open-source.	S
Technical expertise	Medium to high.	I
Quality of user experience	Not enough info available.	P
User-to-user connectivity	N/A	I
Dialogue	Built in.	S
Searchable knowledge banks	N/A	I
User feedback on content	N/A	I
User generated content	Forum posts only.	P
Integral video conferencing	N/A	I
e-learning with integral tutor interaction/ assessment	N/A	I

Name of product: Circle		**Score**
Overall assessment	 Circle makes it easy to create your own branded community with a custom domain name. You can quickly add wikis, discussions, FAQs, Q&As and integrations with other apps. There's a mobile app as well to make sure your community can always stay connected. Key features A beautiful interface A mobile app Most community features are included.	19
Ability to customise, adapt & extend	N/A	I
Technical expertise	No coding platform.	S
Quality of user experience	Not enough info available.	P
User-to-user connectivity	N/A	I
Dialogue	Built in.	S
Searchable knowledge banks	N/A	I
User feedback on content	N/A	I
User generated content	Networking generated content.	I
Integral video conferencing	Built in.	S
e-learning with integral tutor interaction/ assessment	Built in. No info available on assessment.	S

Name of product: Kajabi		Score
Overall assessment	 Kajabi is an all-in-one online community platform that can help you grow your business with custom solutions. With Kajabi, you can manage growth with built-in CRM, collect payments with Stripe and Paypal integrations, and use analytics to make informed business decisions. Kajabi provides you with the tools you need to create all kinds of content to showcase what you know best, including online courses, coaching programs, podcasts, memberships, and more while building up your online community. Key features Allows you to customize your own branding style Create discussion posts with comment feeds Offers an assortment of tools to monetize and market your content. Has a fully integrated website.	23
Ability to customise, adapt & extend	Visual customisation.	S
Technical expertise	No coding platform.	S
Quality of user experience	Limited info available.	S
User-to-user connectivity	N/A	I
Dialogue	Built in.	S
Searchable knowledge banks	N/A	I
User feedback	N/A	I
User generated content	Networking content only.	P
Integral video conferencing	Built in.	S
e-learning with integral tutor interaction/ assessment	Built in. No info available about assessment/tutors.	S

Name of product: Scoocs		**Score**
Overall assessment	 Your all-in-one event and community platform. Unlock all the power features that will increase your event's engagement, leverage your sponsor's ROI and delight your attendees. Create any event on your own Customize YOUR event Measure your success Simply better virtual & hybrid event features.	21
Ability to customise, adapt & extend	Visual customisation.	P
Technical expertise	From no coding to high (CSS).	P
Quality of user experience	No info available.	S
User-to-user connectivity	Built in.	S
Dialogue	Built in	S
Searchable knowledge banks	N/A	I
User feedback on content	N/A	I
User generated content	Networking content.	P
Integral video conferencing	Built in.	S
e-learning with integral tutor interaction/ assessment	N/A	I

Annexe 2: Selection of literature.

Titles were selected in the Science Direct database. The following table provides an overview of the keywords used for selecting titles. Initially, some 3990 titles were selected. Using different criteria, this selection was reduced to 536 titles. Of 111 titles, abstracts were read. This last reduction was done on the basis of specific content related criteria. The criteria have been listed in the table.

Keyword	Initial number of titles selected	After filtering	Abstracts selected after screening	Inclusion criteria
human-centric and manufacturing	217	136	34	related to manufacturing & shop floor; rather generic & not technology specific
task based approach	52	35	5	automation/digitalisation and development of jobs & job profiles
high performance organisations	24	13	4	
High Road	126	79	2	
technology platform	821	16	6	about processes that allow knowledge-sharing/learning particularly in a platform & virtual environment
workplace and innovation	322	62	16	focus on organisational innovation context, and what could be relevant for manufacturing
platform governance	36	19	11	platform governance success factors; governance towards transition
social and online platforms	339	31	9	Processes for community building, knowledge sharing and learning with focus on online settings
online facilitation	21	5	1	other articles were too “old”
Innovation platform	97	8	3	diffusion of innovations to customers, use of wikis, internationalisation of multinationals, curriculum for I 4.0
platform management	35	1	1	not relevant in other publication titles
stakeholder engagement	1570	82	11	only articles that have “stakeholder engagement” or similar in title and propose formats/processes of engagement
community building	330	49	8	Only articles that include online platforms as technologies and means of community building and help to understand how to enable such community building and within that also knowledge exchange/skilling; also where social capital is raised as a topic
Total	3990	536	111	

Annexe 3: Overview of 51 Selected Platforms.

European Commission Platforms	
1	Digital Skills & Jobs Platform
2	European Digital Innovation Hubs Network
3	COVES – Centres of Vocational Excellence
4	Community of Practice for I5.0 (Awaited)
5	LEADS
6	Entrepreneurship4all
7	Europass
8	EU Skills Profile Tool for Third Country Nationals
9	Skills-OVATE (CEDEFOP)
National Platforms	
10	Catapult (UK)
11	Future Industry Platform (Poland)
12	Industrie 4.0 (Austria)
13	Industrie 4.0 (Germany)
14	Smart Industry (Netherlands)
15	Industry 4.0 (Lithuania)
22	EIT Manufacturing
Independent Network Platforms	
16	Dialogue platform for social responsibility of the economy
17	EFFRA
EU Projects	
18	I4MS
19	Community of Practice for Circularity
20	Virtual ADMA
21	Sure Project
23	WEgate
24	Digital Skillup
25	Skillability Marketplace
26	DISK
27	ECVET Skill Platform
28	Career Skills Project
29	Lifelong Learning Programme
30	EU4Digital
31	DRIVES

32	Mates
33	EO4GEO
34	Skills Smart
35	NTG
36	SAM
37	Construction Blueprint
38	Skill Sea
39	ESSA
40	Database
41	Albatts
42	ASSETS+
43	Eddie-Education-Energy-Digitalization
44	ASPIRE
45	METIS
46	CHAISE
47	Charter
48	REWIRE
49	STAFFER
50	B-WISE
51	ESSA

BRIDGES 5.0 PROJECT IDENTITY.

Project name	BRIDGES 5.0 **B**ridging **R**isks to an **I**nclusive **D**igital and **G**reen future by **E**nhancing workforce **S**kills for industry 5.0
Coordinator	**Prof. Dr Steven Dhondt (scientific coordinator).Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), (Netherlands)**
Consortium	Katholieke Universiteit Leuven Austrian Institute of Technology Panepistimio Patron (Patras University) Conservatoire National des Arts et Métiers, Centre d'Études de l'Emploi et du Travail-Lirsa Departamento de Educacion del Gobierno Vasco The University of Warwick Technische Universität Dortmund Stichting Platform Beta en Techniek Mondragon Goi Eskola Politeknikoa, Jose Maria Arizmendiarrieta S Coop Lietuvos Pramonininku Konfederacija Universita degli Studi di Bari Aldo Moro Universitetet I Agder Workplace Innovation Europe CLG Comau SPA Infineon Technologies Austria AG UAB Kitron Industrie 4.0 Plattform Osterreich Kriziu tyrimo centras (Hybridlab) FH Joanneum Gesellshaft MBH Kauno Technologijos Universitetas
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Duration	2023-2027

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