D2.3 ECOSYSTEM ACTIVITIES AND BUSINESS SUPPORT (V2)

WP2 – Ecosystem and support tools development

April 2024

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Disclaimer

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LIST OF ABBREVIATIONS

BA	Beacon application
EdTech	Educational Technologies
DECP	Dissemination, Exploitation and Communication Plan
IPR	Intellectual property rights
ICT	Information Communication Technologies
KER	Key exploitable results
KPI	Key performance indicator
NFT	Non-fungible token
OC	Open call
PDCER	Plan for Dissemination and Exploitation of Results
PDT	Platform Design Toolkit
SME	Small and medium-sized enterprises
TRL	Technology readiness level
WP	Work package
XR	Extended reality
Partners' names and acronyms	
CNIT	CONSORZIO NAZIONALE INTERUNIVERSITARIO PER LE TELECOMUNICAZIONI
F6S	F6S NETWORK IRELAND LIMITED
MAG	MAGGIOLI SPA
LS	LIGHT AND SHADOWS
SYN	SYNELIXIS SOLUTIONS SA

SUPSI	SCUOLA UNIVERSITARIA PROFESSIONALE DELLA SVIZZERA ITALIANA
UM	UNIVERSITEIT MAASTRICHT
HOU	HELLENIC OPEN UNIVERSITY
EADTU	EUROPEAN ASSOCIATION OF DISTANCE TEACHING UNIVERSITIES
EITM	EIT MANUFACTURING SOUTH SRL

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EXECUTIVE SUMMARY

WP2 is dedicated to developing all necessary means, tools, and activities to establish and support the XR2Learn ecosystem. This includes: (i) analyzing the value chain of XR-applications for education/training; (ii) identifying and understanding the needs of actors involved in and influencing the value chain; (iii) setting up the XR2Learn ecosystem to attract and engage representatives from all actor categories who will benefit from the XR2Learn platform, its services, and FSTP activities; (iv) defining innovative business models to enhance the penetration of XR-applications; (v) creating the XR2Learn marketplace, the blockchain-based IPR tools, and the on-demand application creation component of the platform; (vi) developing and integrating the XR2Learn platform; (vii) collecting and processing stakeholder feedback for result assessment.

This document details the second phase of activities carried out in Task 2.1, which addresses activities i) – iii) and activity vii), and in Task 2.2, which addresses activity iv). It builds upon the baseline results reported in the previous version of this document (D2.1) and introduces the activities undertaken during this period along with the results obtained.

During the first iteration of our methodology, we utilized the Platform Design Toolkit (PDT) for stakeholder analysis within the XR2Learn ecosystem, focusing on context, needs, potential gains, existing relationships, and transactions. In this second phase, we deepened the analysis of specific stakeholders by leveraging the EC service Horizon Results Booster and conducting a workshop for OC1 winners to refine preliminary results. Further iterations are planned for the final document (D2.5). The results obtained confirmed the identified challenges of the stakeholders and potential benefits that the XR2Learn solutions could offer, and provided additional insights about the most relevant stakeholders to engage.

Simultaneously with the stakeholder analysis, we continued the activities related to establishing the XR2Learn ecosystem, following the strategy defined during the first month of the project. The document reports the initial efforts to build the community and outlines the plans for the upcoming months. Furthermore, it describes the current state of the XR2Learn ecosystem, emphasizing the importance of stakeholder engagement and collaboration with related projects for community development.

Lastly, the document provides an updated analysis of business models in educational platforms, NFT (Non Fungible Token)-based applications, and XR-based applications, which will guide the development of the XR2Learn platform.

All analyses reported in this document form the basis for driving the development of the XR2Learn platform (in WP2, WP3, and WP4), defining its business model, and thus, shaping the exploitation plans (in WP5).

The results achieved so far will be further refined and expanded in the final version of the document at M42.

1. INTRODUCTION

This document reports the work carried out in Task 2.1 and 2.2 of WP2. The first version of the document (D2.1) has been released at M6 and reported the general approach and first outcomes of the work performed in those tasks. The present version of the document is an update of D2.1, summarising the previously reported contents and focusing on novel results related to:

- analysis of the target stakeholders;
- ongoing and future activities aimed at developing the XR2Learn community;
- business modelling.

WP2 aims at developing all the means, tools, and activities to create and support the XR2Learn ecosystem. The following tables summarises the expected activities of WP2 and the respective tasks, deliverables and deadlines.

Table 1 – Mapping WP2 activities with tasks and deadlines

Activity	Task	Deadline
analysing the value chain of the XR-applications for education/training	T2.1	D2.1 at M6, D2.3 at M16, D2.5 at M42
identifying the actors involved and affecting the value chain and capture their needs	T2.1	D2.1 at M6, D2.3 at M16, D2.5 at M42
setting-up the XR2Learn ecosystem attracting and engaging representatives from all actors categories that will benefit from the XR2Learn platform, its services and FSTP activities	T2.1	D2.1 at M6, D2.3 at M16, D2.5 at M42
defining novel business models that can be adapted to foster the penetration of XR-applications	T2.2	D2.1 at M6, D2.3 at M16, D2.5 at M42
developing the XR2Learn marketplace, the blockchain-based IPR tools and the on-demand application creation part of the platform	T2.3	D2.2 at M12, D2.4 at M30
developing and integrating the XR2Learn platform	T2.4	D2.2 at M12, D2.4 at M30
collecting and processing the feedback from stakeholders for the assessment of results	T2.1	D2.3 at M16, D2.5 at M42

In the period between M6 and M16, Task 2.1 and Task 2.2 performed a second iteration of the aforementioned activities and started: (i) demo and showcase activities to create awareness about the first release of the XR2Learn platform; (ii) the collection of preliminary feedback from engaged stakeholders.

The rest of the document is structured as follows:

- *Section 2*, summarises the overall approach that has been followed and the results of the previous iteration of the stakeholder analysis.

- *Section 3*, reports the results of additional stakeholder analysis that emerged from a workshop with the winners of the first Open Call (OC1).
- *Section 4*, reports on the first activities to build the community and the plan for the next months;
- *Section 5,* reports an updated analysis and results of the business modelling activities;
- *Section 6*, concludes the document with an outline of the next steps for both Task 2.1 and Task 2.2 activities.

2. STAKEHOLDER ANALYSIS: APPROACH AND RESULTS FROM THE PREVIOUS PHASE

In the previous version of this document (D2.1), we reported the overall approach that has been devised to drive the activities and coordinate among the different involved partners for the stakeholder analysis.

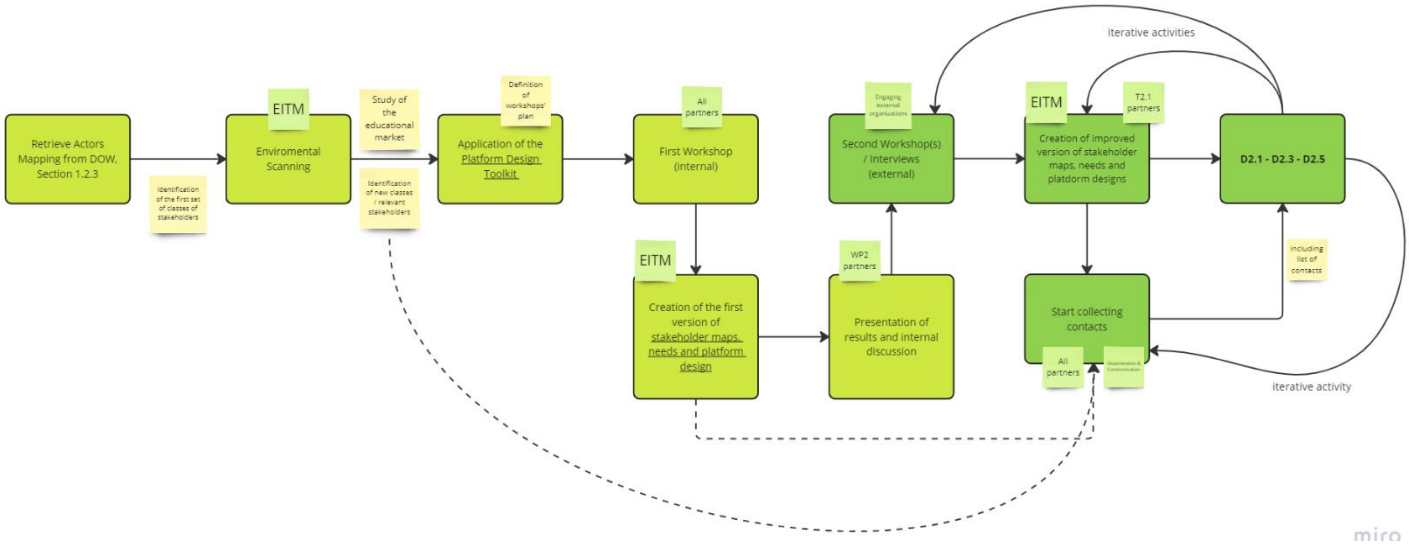

Figure 1 - Ecosystem Analysis overall approach

In Figure 1, the light green boxes represent activities (left boxes) that have been performed only in the first 6 months of the project. The dark green boxes represent the activities that will be continuously iterated till the end of the project to validate, refine, and extend the stakeholder analysis.

The core activities of the first phase of the project involved the application of an existing methodology for the design of modern digital platforms: the Platform Design Toolkit[1], that allows a potential platform owner to define its own platform development strategy by means of a set of canvases that, usually, are collaboratively created during a dedicated workshop/event. The main steps of the methodology are reported below:

- *Mapping the ecosystem*: First, by using the Ecosystem Canvas the platform shaper will reflect on the ecosystem to shape, and organise with its platform strategy. The platform shaper will then map the entities present in this

[1] https://www.boundaryless.io/pdt-toolkit/

ecosystem and will then understand what roles they might play, clustering them if necessary. In the canvas, the following roles are available:

  - PLATFORM OWNERS: Set of players that will be ultimately responsible to ensure that the platform exists in production.

  - PARTNERS: Partners are essentially professional entities that seek to create additional professional value and to *collaborate with platform owners* at a stronger stage of relationship. Typically, partners are *professional value creators* that tend *to specialize* in a niche product/service and become better and better within time. Partners sometimes also facilitate, cater, enhance the value production by acting as broker, facilitators, connectors.

  - PEERS PRODUCERS: Entities interested in *providing value* on the supply side of the ecosystem/marketplace, seeking for opportunities to improve their professionality and honing their capabilities towards better performance.

  - PEERS CONSUMERS: Entities interested in *consuming*, *utilizing*, *accessing* the value that the is created through and on the platform.

  - STAKEHOLDERS: Entities that have a specific interest in platform success or failure, in controlling platform externalities and outcomes, in regulating it or in exercising rights in the platform governance.

- *Portraying ecosystem's entities*: In the Ecosystem Entity Portrait the platform shaper will make a consistent picture of the entities' context: what they're trying to achieve, with whom and how they're trying to connect, what potential they can express, and what kind of experience gains they're looking for – and therefore the shaper should provide – as a platform shaper.

- *Analyzing the potential to exchange value*: With the Ecosystem's Motivation Matrix the platform shaper will then analyse their potential to exchange flows of value: in other words, it will map what kind of value exchanges the entities are performing already (or trying to), and what additional type of value they might exchange if properly enabled.

- *Choosing the core relationships to focus on*: At this point in the design process, it's important that the shaper identifies the focus: what are the entities in the ecosystem we want to focus on? What relationships are going to be the core of our design work (at least for a first iteration?). No specific canvas it used. Selection can be made by highlighting the target entities and the key relationships on the Ecosystem Canvas (created at step 1).

- *Identifying the elementary transactions*: With the Transactions Board, the platform shaper will map how the ecosystem is currently exchanging value (focusing on the entities and the relationships the shaper decided to prioritize), and the platform shaper envisions how the platform strategy can help them transact value in an *easier, cheaper* and *faster* way by providing, and curating channels and contexts that will make interactions and transactions more likely to happen.

- *Designing the learning engine*: With Learning Engine Canvas, the platform shaper will design a step-by-step process made of support/enabling services that will help the entities embrace the platform strategy. These services will help them evolve, emerge from the crowd, become better producers and consumers, and

ultimately to undergo a radical evolution that will have them explore new opportunities, and behaviours not intended initially.

- *Assembling the platform experiences*: With the Platform Experience Canvas, the platform shaper derives an experience that synthesizes the core value proposition(s) arising from the Strategic Design phase and that – more than others – the platform shaper considers essential for its platform strategy. With this canvas, the platform shaper will assemble the elements emerged from the Transactions Board(s) and the ones emerged from Learning Engine Canvas. The platform shaper will then reflect around the sustainability model of this experience, covering the basic elements of Business Modelling. For example, the shaper will have to think at what resources and components the platform will have to put in place and manage in order to deliver this experience, and how the platform shaper will extract value from it.

- *Setting the Minimum Viable Platform*: With the Minimum Viable Platform Canvas, the platform shaper finally *moves out of the building* to test in the real world if all the created design assumptions have a future or not. By looking at the design outputs, especially the Platform Experience Canvas(es), the platform shaper will extract the riskiest assumptions in its strategy, and it will set experiments and metrics to validate them with the target ecosystem.

Additional details on the performed steps have been reported in D2.1, and the resulting analyses are briefly summarized in Section 2.1 of this document.

In the second phase of the project, we iterated on the process and: (i) conducted a deep-dive in the analysis of specific stakeholders, and (ii) arranged a dedicated workshop for OC1 winners, based on some specific steps of the Platform Design Toolkit, with the aim of refining/extending some of the preliminary results. The results obtained in this second phase are collected and reported in Section 3.

In the next phase of the project additional iterations are planned and will be reported in the final version of this document (D2.5) at M42.

2.1 First iteration results (summary)

This section summarizes the first results gathered via an existing methodology - the Platform Design Toolkit (PDT) - adopted for analysing the stakeholders that will be relevant in the XR2Learn ecosystem. The analysis included different aspects, such as the context, needs and potential gains of the involved entities, as well as the existing relationships and potential transactions that can be supported/improved by the XR2Learn platform.

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Ecosystem Canvas

The canvas maps the ecosystem according to the main roles foreseen in the PDT methodology: platform owner, partners, peer producers, peer consumers and external stakeholders.

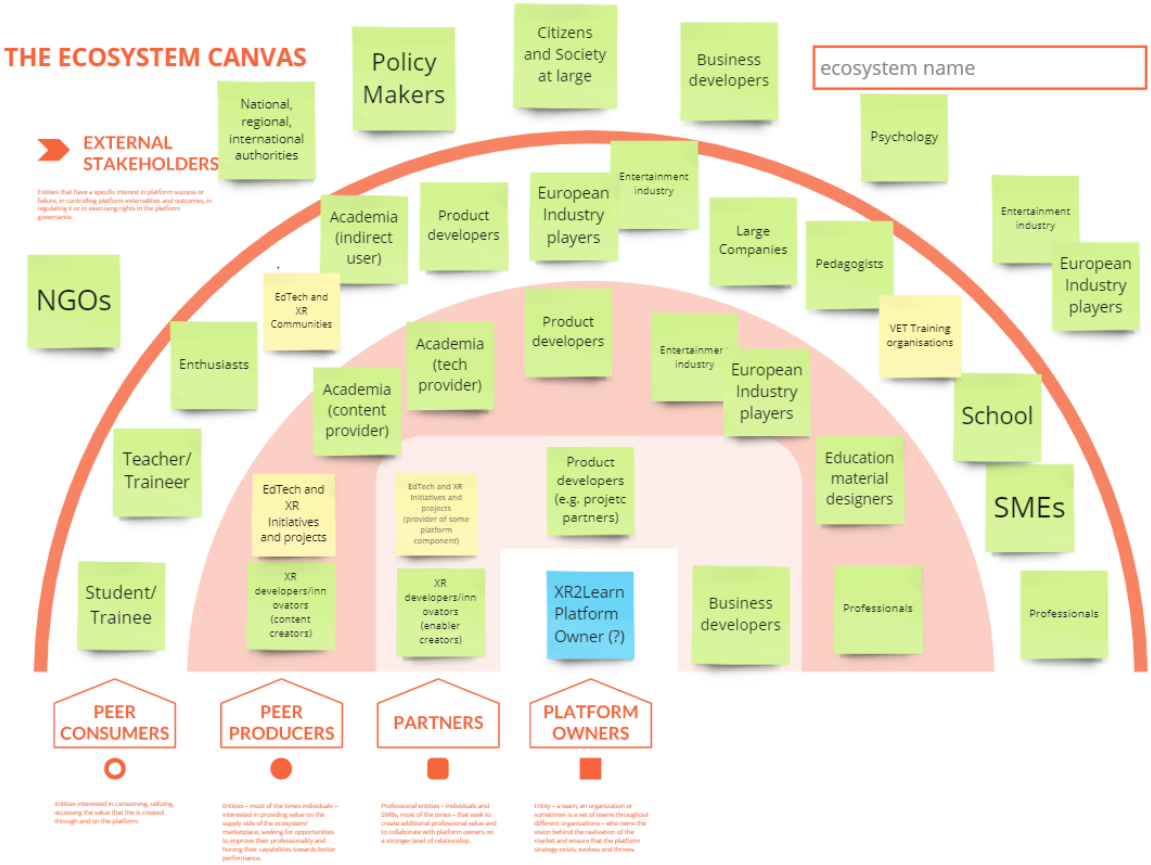

Figure 2 - The Ecosystem Canvas

As expected, the scenario is quite crowded, and many entities could play different roles (in different situations) within the ecosystem. Of course, it was quite ambitious to design and develop a platform that can serve all those entities from the very first moment. Therefore, the following steps have been taken to focus and deepen the description of what were considered the most relevant entities by the XR2Learn consortium.

Ecosystem entity portraits

This step developed a more detailed analysis (portrait) of entities in the ecosystem. Specifically, 12 entities have been identified and detailed:

1. XR developers/innovators (as Partner)
2. Academia (as Peer Producer and Consumer)
3. EdTech and XR Initiatives and projects (as Peer Producer)
4. XR developers/innovators (as Peer Producer)
5. European Industry Player (as Peer Producer and Consumer)
6. Student/Trainee (as Peer Consumer)
7. Product developer (as Peer Consumer)
8. Enthusiast (as Peer Consumer)

9. SMEs (as Peer Consumer)
10. Large Company (as Peer Consumer)
11. NGO – Associations (as Peer Consumer)
12. Policy Maker (as External Stakeholder)

For each of the above-listed entities an entity portrait has been developed, as shown in the example table below that refers to the XR developers/innovators entity. Each entity has been analysed in terms of: a. Potential that can be leveraged (assets and capabilities of the entity); b. Performance pressures; c. Current goals; and d. three types of Gains sought: (i) Convenience (i.e. What are the elements of convenience the role is looking for?), (ii) Access & Reach (i.e. What kind of enhanced access to the ecosystem (supply/demand) is the role seeking for? How is the role looking for augmenting its reach?), (iii) Value (What elements of value is the role looking for?).

Table 2 – XR developers/innovators (as Partner)		
Assets	*Capabilities*	
Numerous existing XR frameworks Human resources (UX designers, developers, 3D artists) Tons of existing 3D / code assets	Using XR tech in innovative way Creating new techs	
Performance Pressures	*Current Goals*	
XR Tech stack limits / constant upgrades	Up-to-date technological knowledge and know-how Improved market position / increased competitiveness	
Convenience Gains	*Access & Reach Gains*	*Value Gains*
Challenge new tech integration with a real-world audience Re-use of technologies available at the marketplace with favourable terms and conditions	Visibility for newly created learning format Networking	If enough visibility on the platform: business may emerge from this partnership

Ecosystem motivation matrix

After portraying the main entities of the XR2Learn ecosystem, we selected the most relevant ones (for this first phase of the XR2Learn project) and then identified the main exchange of values between the different entities (mapping all possible combinations), as reported in the table below.

Table 3 – Motivation Matrix

GIVES TO →	XR Developer Innovator (content creator)	Academia (content and tech provider)	Student / Trainee	Teacher / Trainer	Professional (provider / consumer)	SMEs
XR Developer Innovator (content creator) *Peer Producer*	Technical testing on the backend and frontend Ideas, workflows, and peer help exchange experiences/ solutions to improve the platform UX and functionalities	[content pr.] a platform where to find and share contents [tech pr.] technological solutions i.e. code; programming experience Technology, know-how	Educational content, Introduction to XR New educational experiences, Engagement	A platform where to find OER and content to reuse in their teaching and training activities Educational content, introduction to XR (including how to use it for new courses)	[provider] Inspiration [consumer] code, materials to be used to further upskill	Innovation boost Improvement of processes
Academia (content and tech provider) *Peer Producer*	Revenues Feedback on both content and form	Peer feedback for both	Innovative education materials Enhanced learning experiences	Tools for teaching using immersive technologies Guide on how to use immersive technologies	Innovative technology	Human capital (experienced workforce)
Student / Trainee *Peer Consumer*	Feedback UX Evaluation Learners' and users' needs	Feedback on both content and form Revenues	Discussion and exchange of experience and idea in using the platform Scaffolding	Feedback on the content Voice their need and experience	Feedback on the content	
Teacher / Trainer *Peer Consumer*	Test field Teachers' needs Revenues	Feedback Features requests	Knowledge and know-how Appealing education materials	Ready to use materials Exchange of experiences and co-creation content		Link to real business cases, learning by doing
Professional *Peer Producer* *Peer Consumer*	Revenues	Provide info on the labour market needs	Internship, Experience	Provide info on the labour market needs	[producer->consumer] Tech tools to fast track processes	

SMEs *Peer Consumer*	Tech tools to fast track processes	Feedback Features requests	Internships Scholarships	Feedback Features requests Skills gaps	Tech tools to fast track processes	Exchange of experiences Cross technological capabilities

Ecosystem core relationships

Based on the motivation matrix created in the previous step, we identified the core relationships of the XR2Learn ecosystem, as depicted in a revised version of the Ecosystem Canvas below. The entities are those reported in the motivation matrix, while the relationships are those considered most relevant in the first phases of the platform development.

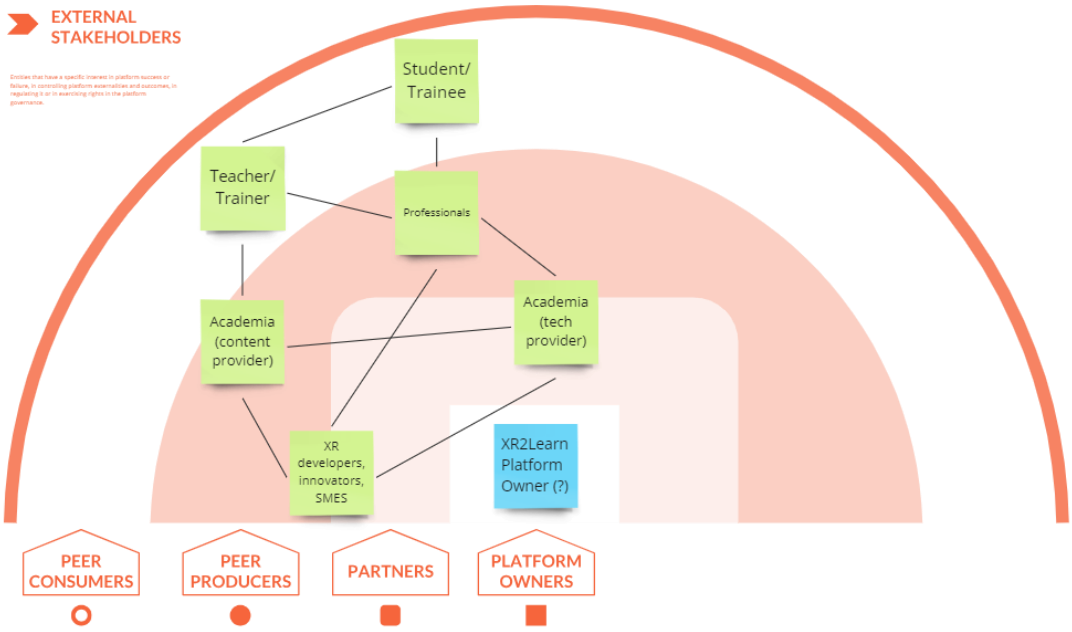

Figure 3 - Ecosystem Core Relationships

Generalization and Transaction Board

The last steps of the previous phase included an activity of generalization and categorization (i.e. abstraction) of the entities by clustering similar stakeholders during the workshop on a specific canvas that lead to a slightly different representation of the ecosystem canvas and the core relationships as depicted in the figure below.

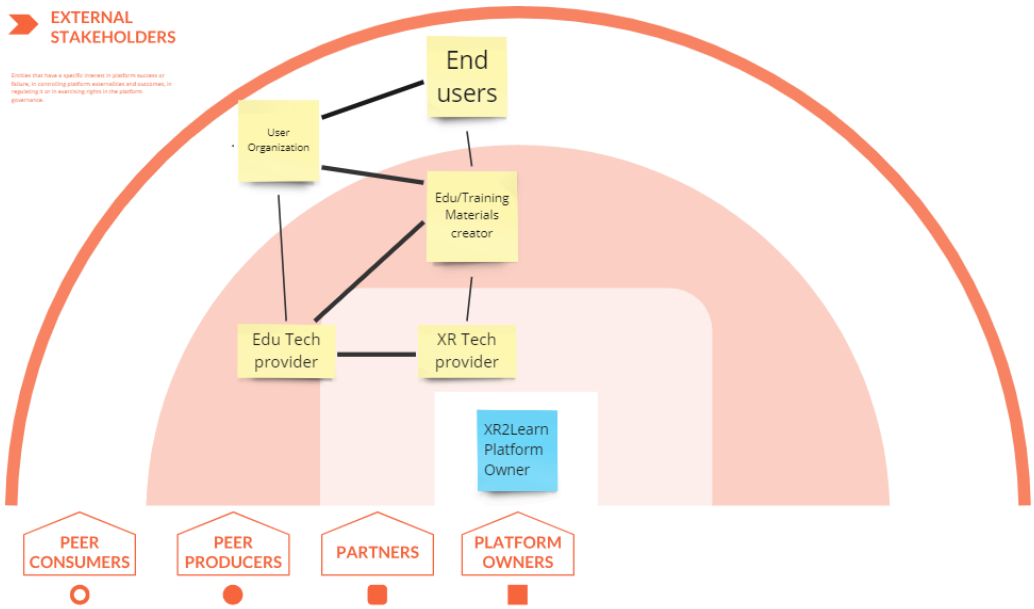

Figure 4 – Revised Ecosystem Core Relationships

Notice that some of the relationships in the radar are highlighted in bold. They have been selected to be reported, as examples, in the Transaction Board of the XR2Learn platform (Figure 5). The resulting transaction board depicts the elementary transactions (bold arrows specify the transaction direction) that the XR2Learn solution could enable, identifies the exchanged values and the respective means.

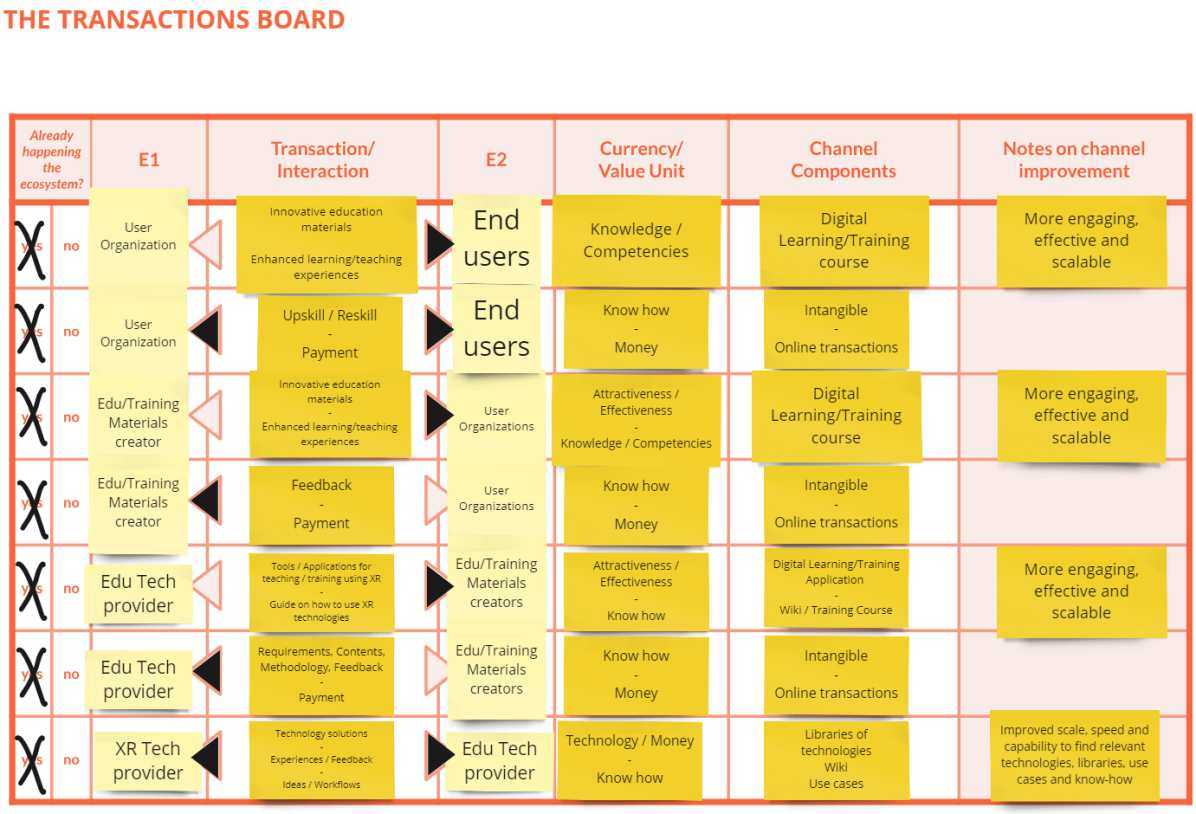

Figure 5 – Transaction Board

3. SECOND ITERATION OF THE STAKEHOLDER ANALYSIS

To validate and fine-tune the analysis developed in the first phase of the project, we mainly carried out two activities:

- In the context of the Horizon Results Booster (service provided by the EC, through an external, specialised company), we requested a stakeholder analysis to identify the key stakeholders and their relevance.

- As part of the face-to-face meeting in Paris the 21st Match 2024 (XR2Learn General Assembly), we arranged a workshop with the Open Call 1 (OC1) winners to collect insights about the stakeholders involved in their XR-based solutions for training.

The obtained results are reported in the following sections 3.1 and 3.2, respectively.

Additional, more general feedback has been acquired as part of the webinars arranged for the ecosystem set-up activities that will be reported in section 4.

3.1 Results from the Horizon Results Booster service

In this section, we report a summary of the main features proposed by the HRB experts strictly related to stakeholders' analysis.

The following table reports an analysis of the general challenges that the stakeholders are currently facing with respect to XR technology and their application to learning/training. Specifically, **those highlighted in bold are closely linked to those that have been also identified as part of the entity portrait analysis in our first stakeholder analysis iteration.**

Table 4 - challenges

Type of Challenge	Complementary Challenge and Description
Societal	**Ensuring fair access to XR-based educational resources across diverse socio-economic backgrounds to prevent widening educational disparities.**
	Addressing ethical dilemmas surrounding the application of XR technologies in domains such as healthcare, education, and entertainment, including issues of data privacy, consent, and potential misuse of immersive experiences. For example, the EU AI Act is posing some challenges in relation to the XR2Learn solutions to sense and analyse users' sentiments.
	Bridging the gap in digital literacy skills, particularly among marginalized communities, to enable effective utilisation and critical understanding of XR technologies in various aspects of life.
Scientific and Technological	**Developing interoperable XR platforms and establishing common standards to facilitate seamless collaboration and data exchange across diverse projects and industries, thereby reducing fragmentation and enhancing scalability**
	Advancing the realism and immersion of XR experiences through innovations in graphics rendering, spatial audio, haptic feedback, and intuitive interaction interfaces to create more compelling and engaging virtual environments.
	Tackling the computational complexities associated with processing and analysing vast datasets generated by XR applications, including real-time sensor data processing, machine learning algorithms for content generation, and data-driven insights for informed decision-making.

Industrial	**Overcoming initial investment costs and scalability hurdles associated with implementing XR technologies in industrial contexts, including expenses related to hardware procurement, software development, infrastructure integration, and widespread deployment.**
	Addressing challenges related to training the existing workforce and fostering widespread adoption of XR technologies within industrial settings, including resistance to change, skills development requirements, and the need for tailored training programmes to ensure smooth integration.
	Ensuring adherence to regulatory frameworks and safety standards when deploying XR solutions in industrial environments, encompassing considerations such as data security protocols, health and safety regulations, and liability issues in the event of accidents or system failures.

The HRB experts have focused on the following stakeholders and analysed them according to several different perspectives including their geographical broadness, domains, type of activity, interest in the portfolio of results, and level of influence.

HRB experts took into consideration the type of stakeholder (namely: research & academia, ICT Operators/Service Providers, Large Enterprises) rather than their possible role (e.g. content or technology provider). However, **similar benefits have been identified and the analysis of engagement and relevance are still valid**.

Researchers & Academia

Description	Researchers & Academia
How stakeholders can benefit from the project results	The prototypes developed by the project offer valuable utility to this group of stakeholders, particularly due to their enhanced features compared to existing market offerings in Extended Reality (XR). The stakeholder group can benefit significantly from the innovative solutions provided by the project's prototypes.
Engagement to date	Researchers and academia hold a significant influence as key stakeholders in this project. In most of the projects involved in the project the researchers are already supportive, aware of projects' impacts they are open to change. Furthermore, researchers and academia are also represented in all the project's network, providing a platform to target and involve them in relevant activities.

ICT Operators/Service Providers

Description	ICT Operators/Service Providers
How stakeholders can benefit from the project results	This stakeholder group has the opportunity to fully harness the innovative potential inherent in project solutions, thus enabling them to forge a substantial and distinctive competitive edge in their respective domains. Simultaneously, ICT Operators and Service Providers can assume a pivotal role in driving forward the momentum of continuous innovation, ensuring that advancements persistently propel the industry into new frontiers.
Engagement to date	The ICT Operators/Service Providers have not been contacted yet; at the moment they are aware of project, but they are neither supportive nor resistant. They need to be involved so to support the project activities.

Large enterprises

Description	Large enterprises

How stakeholders can benefit from the project results	Large enterprises have the opportunity to increase their productivity through the adoption of Extended Reality (XR) prototypes and solutions in their daily activities. This adoption will necessitate training, but ultimately, it will enable faster production at a reduced cost.
Engagement to date	The large enterprises have been contacted, and they are supportive. They are aware of the project's results and open to change. Furthermore, some large enterprises are also represented in the project's network. Building on this example, other large enterprises can be involved as well.

Stakeholder Relevance Analysis

The following chart depicts the influence and interest of each stakeholder group, in order to define their strengths in terms of supporting the uptake of the project's result.

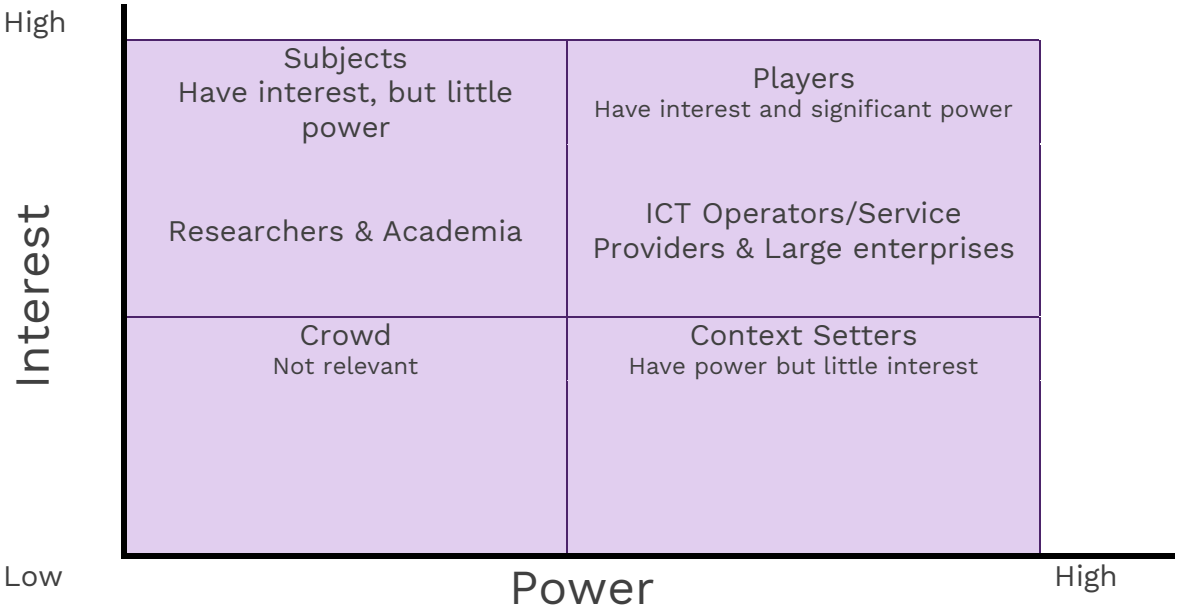

Figure 6 - Influence vs interest grid

The analysis performed by the HRB experts confirmed the analysis performed in our first iteration in terms of stakeholders' challenges and expected benefits (although the HRB analysis is limited to 3 broad stakeholder categories). More interesting for us is the stakeholder relevance analysis that identified the key "Players" to engage first: technical/service providers and large enterprises should be our main target in the ecosystem building.

3.2 OC1 winners workshop

The workshop has been arranged as a dedicated session within the XR2Learn general assembly, on the 21st March 2024 in Paris, where the OC1 team winners have been invited to present their projects.

The objective of the workshop was to collect additional insights about identified XR2Learn stakeholders by involving the OC1 teams' perspectives. In fact, each OC1 project will exploit XR2Learn solutions to implement its XR-based education/training solution and will involve specific stakeholders that indubitably fall into the different stakeholder categories identified in the previous stakeholder analysis phase.

Also in this case, we decided to exploit the PDT methodology, with a specific focus on the following three steps only:

- Ecosystem Canvas: capturing and classifying the main entities that will be involved in their projects.
- Ecosystem Entity-Role Portrait: analysing 1 entity in their ecosystem.
- Transaction board: providing a first description of the main interactions enabled by their solutions.

Each of the following subsections briefly introduces the OC1 project (additional details can be found on the XR2Learn website: ***https://xr2learn.eu/open-call-1/***) and reports the created canvas, highlighting the emerged key/relevant aspects in the respective figure caption.

3.2.1 PROXIMA

Full Title: Proximity Machinery through Distributed Augmented Reality HMI Layers for Empowering Industrial operators in Low Resources Scenarios)

Short description: Based on cognitive ergonomics and human factors research, PROXIMA will bring psychological factors at the heart of education in the industry and will develop an Augmented Reality (AR) training kit for supporting contextual, site-specific, and on-the-job training through technology, methods and materials for both educators and trainees in the industry.

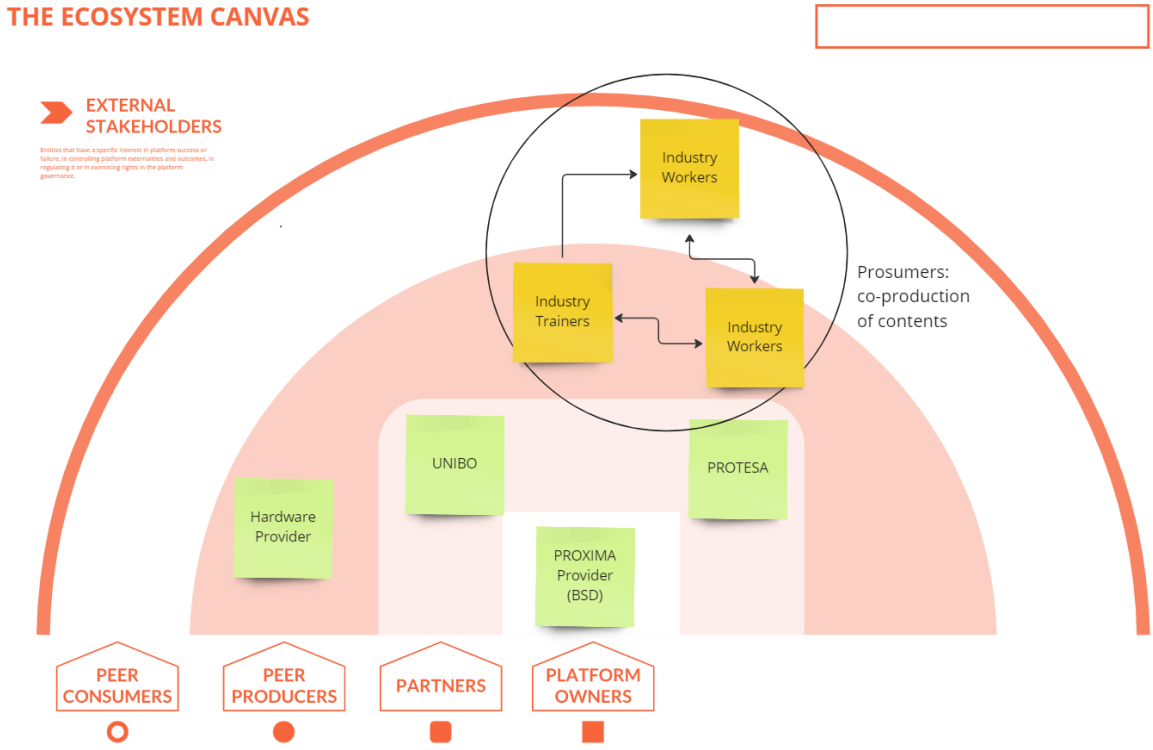

Figure 7 – PROXIMA Ecosystem Stakeholders highlighting the prosumer roles of some of their stakeholders, enabled by the software solution created

THE ECOSYSTEM ENTITY ROLE PORTRAIT

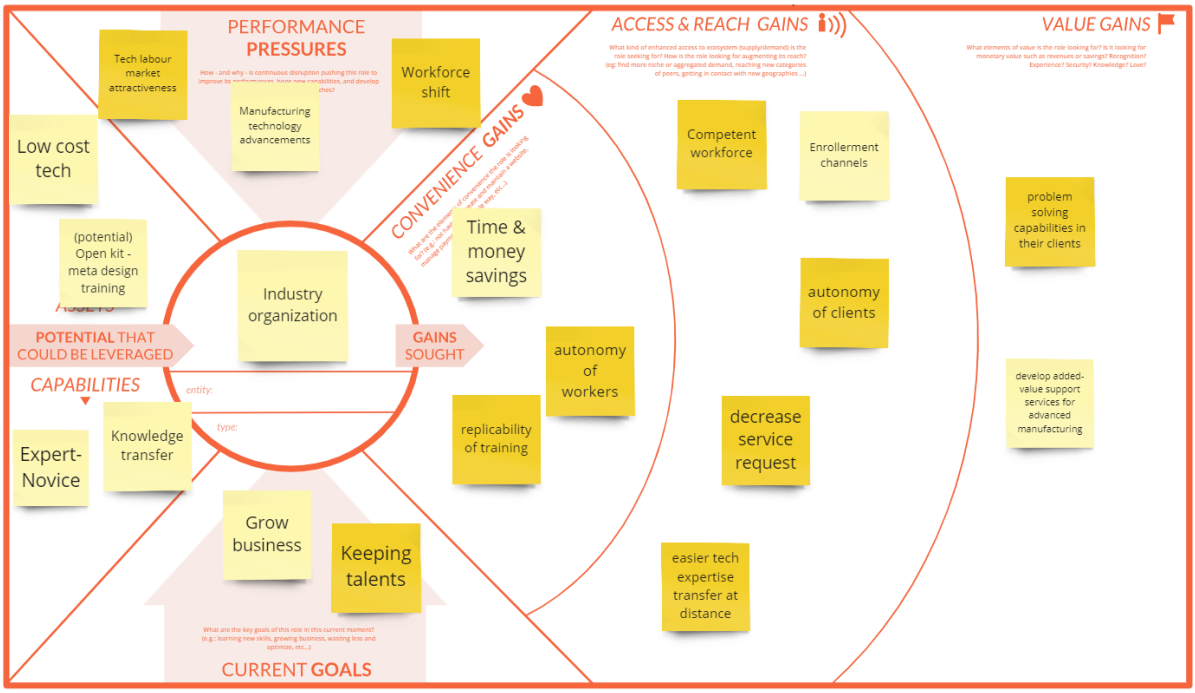

Figure 8 – PROXIMA Ecosystem Entity Role Portrait highlighting key benefits related to attract / form talents and enabling workers / clients in becoming more autonomous (prosumers)

THE TRANSACTIONS BOARD

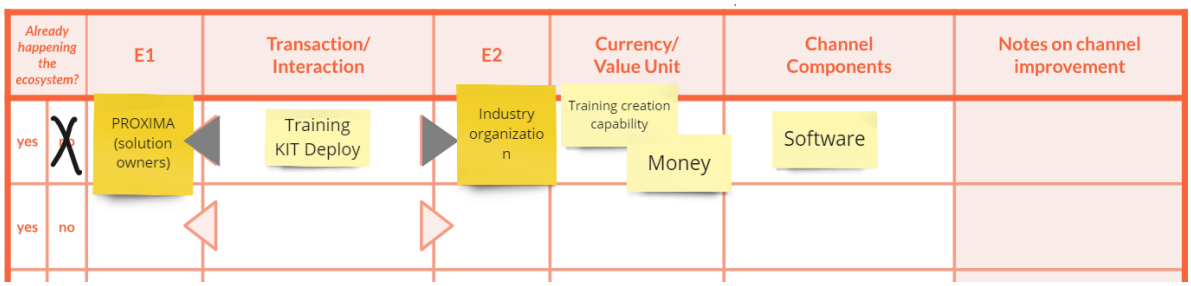

Figure 9 – PROXIMA Transaction Board focused on delivering a training kit that enables customers to create their own, advanced courses.

3.2.2 EVR-OSH-5

Full Title: VR-based Education of Occupational Safety and Health for the era of Industry 5

Short Description: EVR-OSH-5 aims to develop a VR app that makes it possible to practice work at height in safe conditions and teach the maintenance protocol of Industry 5.0 robotic systems, including reaction to sudden events, in safe conditions. Moreover, EVR-OSH-5 aims to address fundamental yet still unmet needs in VR-based education with the development of a new tool: Instructors could observe and supervise the progress of multiple users at the same time in a shared view.

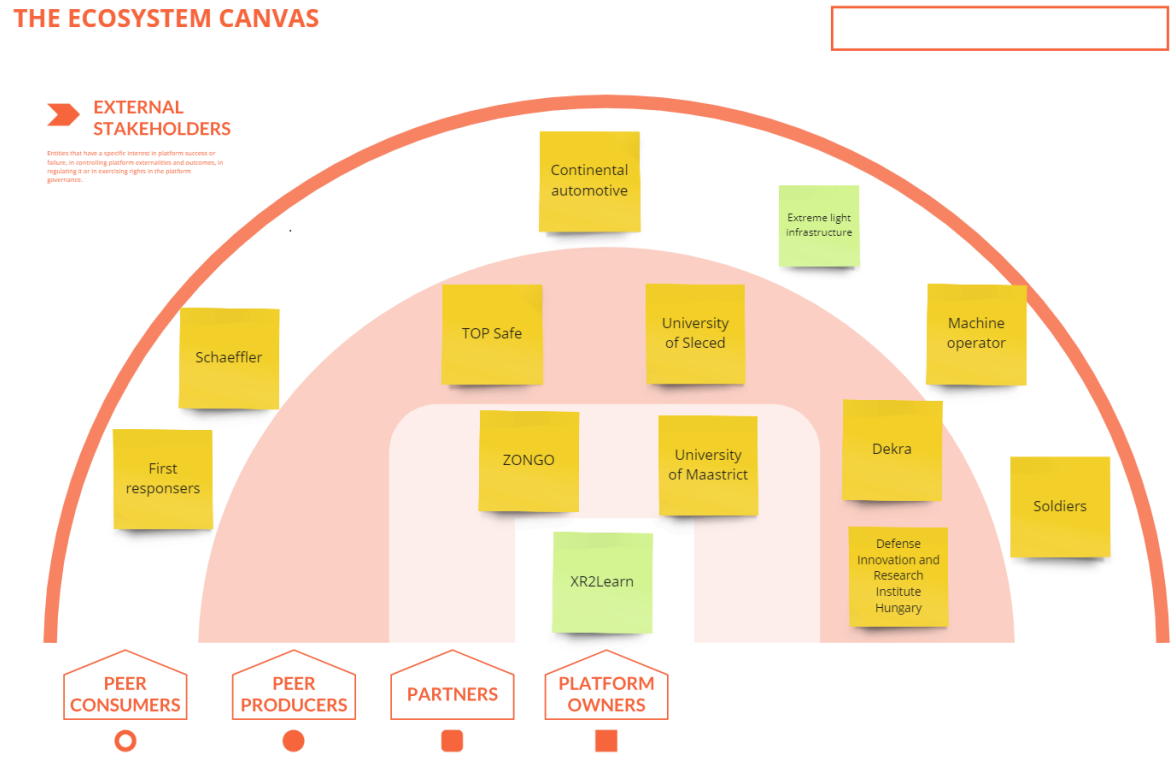

Figure 10 – EVR-OSH-5 Ecosystem Canvas highlighting multiple, concrete stakeholders and in particular potential end-users of their solution.

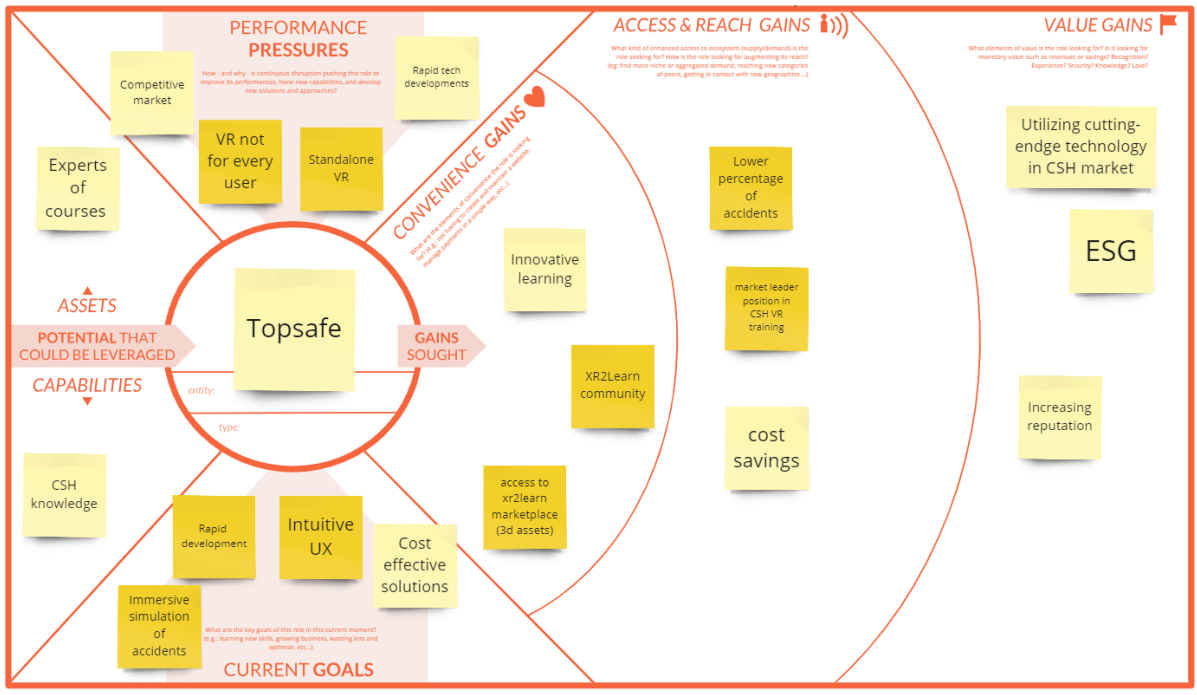

Figure 11 – EVR-OSH-5 Ecosystem Entity Role Portrait reporting specific challenges, needs and gains related to safety (accidents) and highlighting the gains coming from XR2Learn marketplace and community.

3.2.3 CARATE

Full Title: Collaborative Augmented Reality Astronaut Training Experience

Short Description: CARATE seeks to introduce XR learning for Industry 5.0 to the aerospace industry, focusing on scaffolding humans with Augmented Reality and wearable technology to achieve higher levels of performance. CARATE strives to innovate XR learning in Industry 5.0 to meet these expectations by focusing on three areas: (a) making XR content creation faster, more collaborative, and more automated, (b) seamlessly integrating human instruction and AR guidance for highly engaging, blended learning, and (c) developing skills and XR literacy for European astronauts and their trainers.

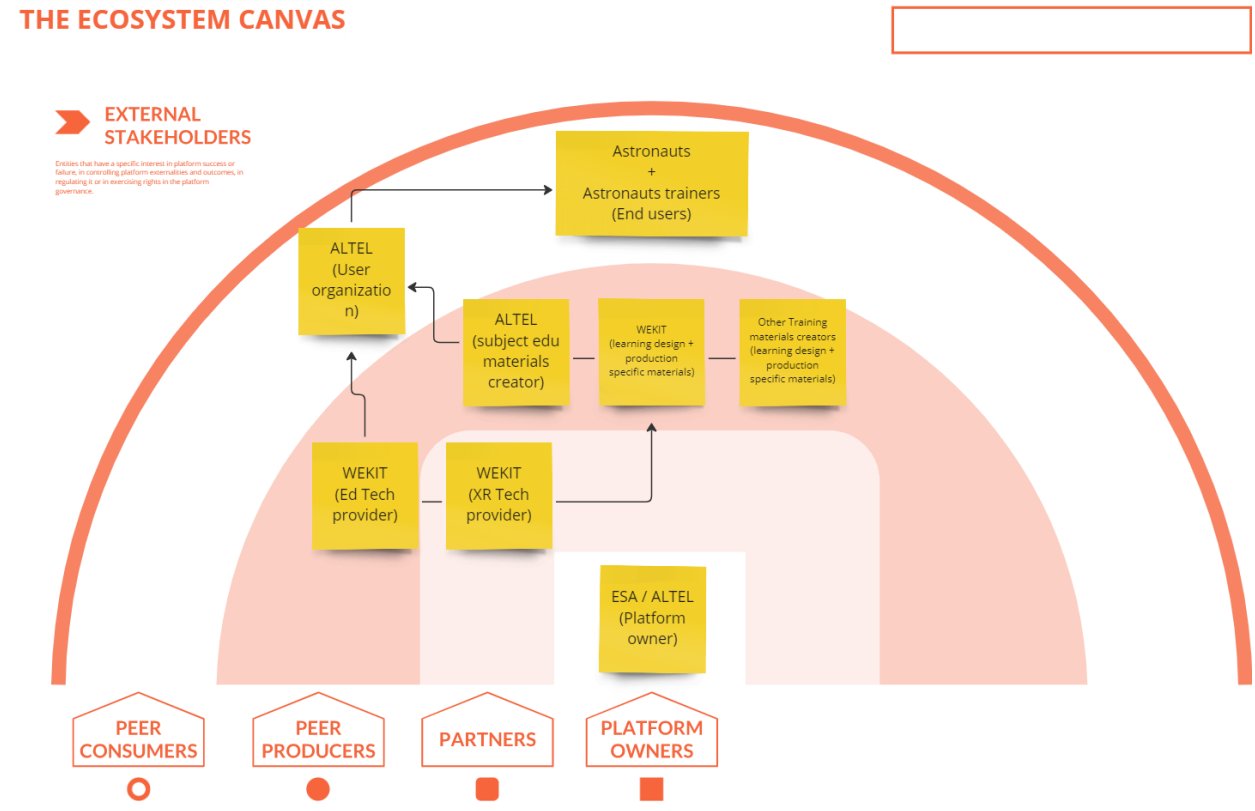

Figure 12 – CARATE Ecosystem Canvas proving a clear specification of the involved stakeholders and their key interactions.

THE ECOSYSTEM ENTITY ROLE PORTRAIT

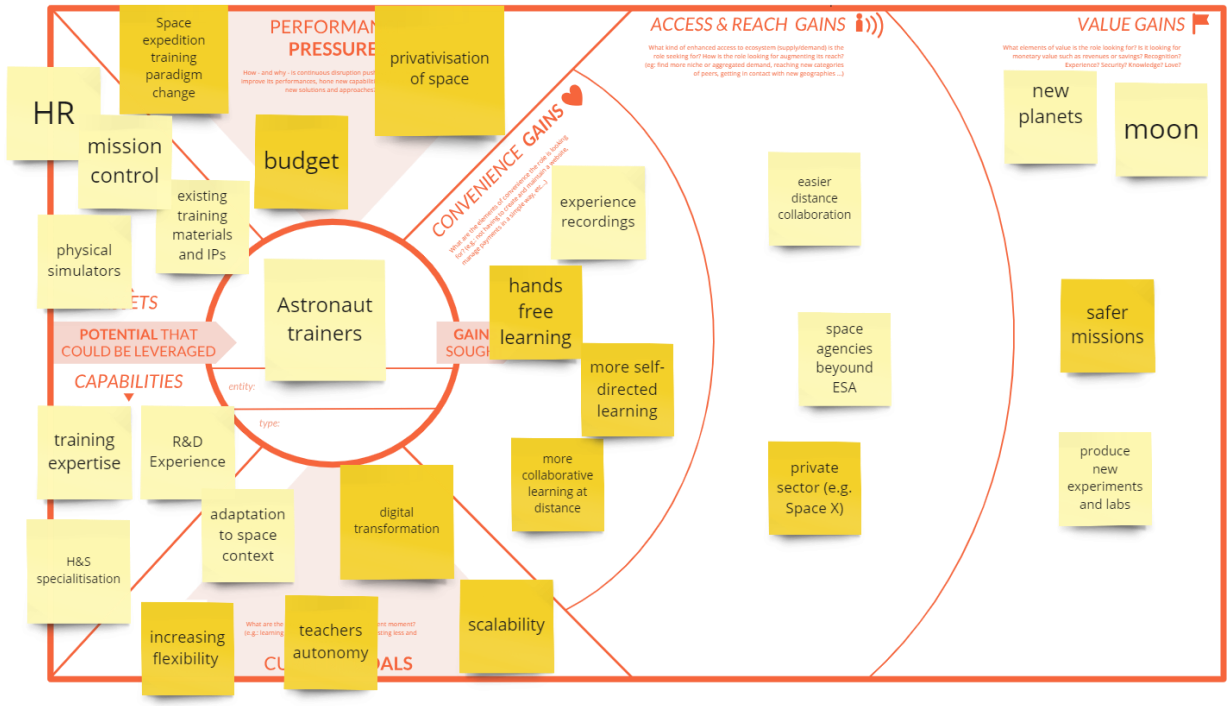

Figure 13 – CARATE Ecosystem Entity Role Portrait providing a clear definition of the current performance pressures and goals leading to clear gains related to improved learning and adaptation to the market changes (i.e. private sector in the space missions).

THE TRANSACTIONS BOARD

Already happening the ecosystem?	E1	Transaction/ Interaction	E2	Currency/ Value Unit	Channel Components	Notes on channel improvement
yes	user organizatio n	AR Learning experience	end user	knowledge / skills; competencies	LMS + collections	gamified progress training
yes	user organizatio n	upskilling / referesh	end user	Know how; Time	Training in person	Digital transformation
yes	Learning experience creator	materials / recordings collaboration	user organizatio n	knowledge / competencies; IEEE 1589		UX, learning gain, efficiency
yes	Learning experience creator	feedback time budget	user organizatio n	competency framework; resources		
yes	Ed Tech provider	tool / methodologies	Learning experience creator			
yes	Ed Tech provider	requirements, assets, resources	Learning experience creator			
yes	XR Tech provider	middleware, components, ideas / case studies	Ed Tech provider			
yes	XR Tech provider	requirements, scenarios, resources	Ed Tech provider			

Figure 14 – CARATE Transaction Board reporting additional details about the main interactions identified in the respective ecosystem canvas. Notice the provisioning of tools/methodologies for enabling clients (learning experience creators) to define relevant courses.

3.2.4 XR4HRC

Full Title: Excellence in Extended Reality for Human-Robot Collaboration

Short Description: The XR4HRC initiative is a groundbreaking effort within vocational education and quality control for robotics-driven industries, leveraging extended reality (XR) technology. Its goals include empowering the workforce, enhancing quality control, and promoting human-robot collaboration within the XR2Learn framework.

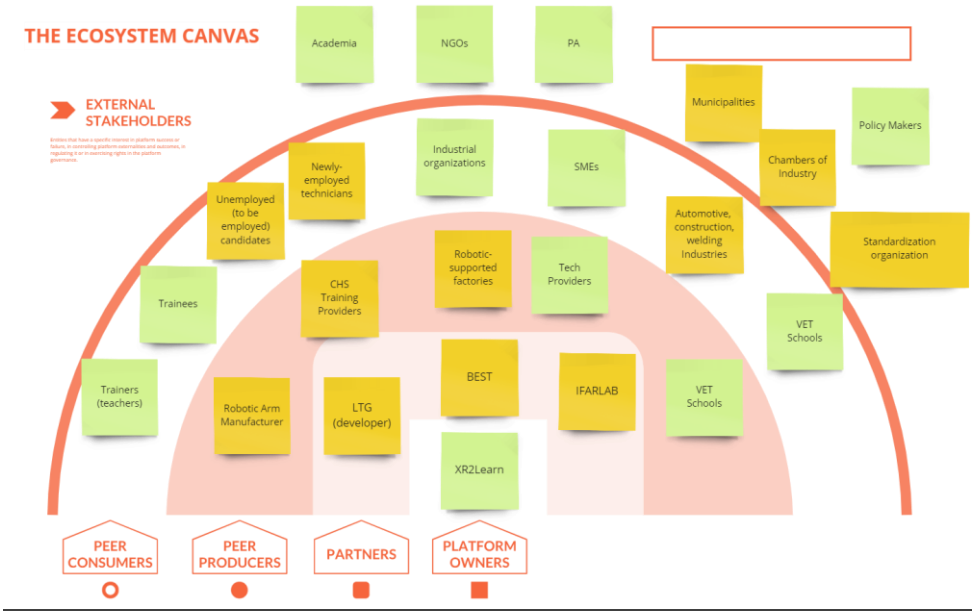

Figure 15 – XR4HRC Ecosystem Canvas providing a quite complete overview of the relevant stakeholders and highlighting those more specific to their project results.

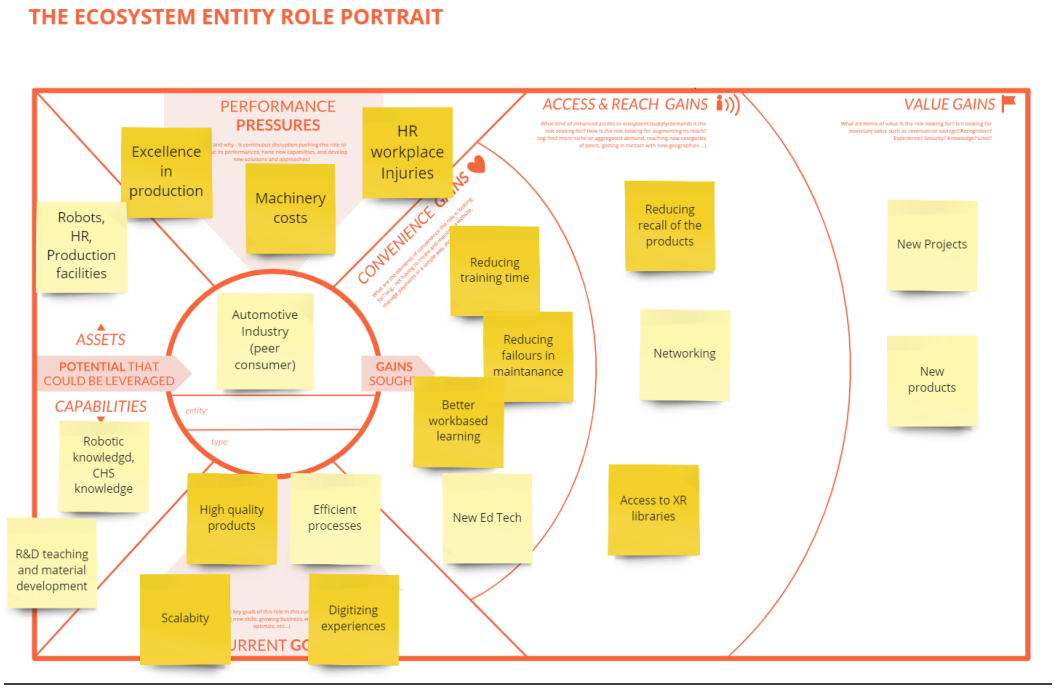

Figure 16 – XR4HRC Ecosystem Entity Role Portrait focusing on a potential user organization and highlighting how pressures, goals and expected gains are quite aligned to those identified by XR2Learn in the first stakeholder analysis iteration.

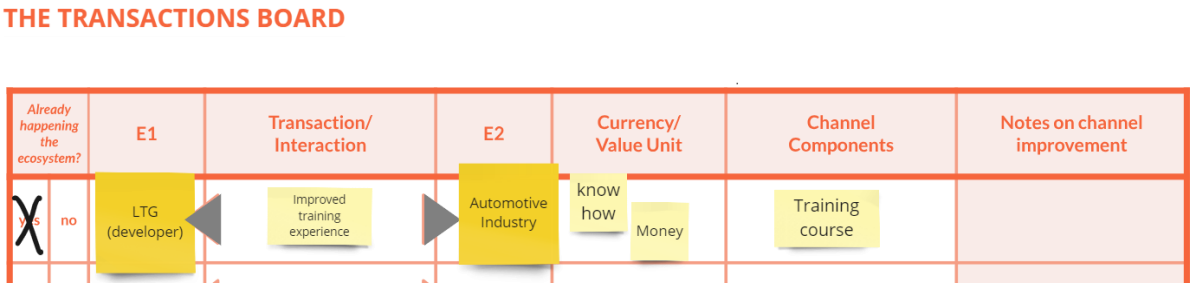

Figure 17 – XR4HRC Transaction Board just reporting the main interaction (creation of a more advanced training course) between the technology provider and the target user organization.

3.2.5 PaperXR

Full Title: PAper Printing workEr tRaining using eXtended Reality

Short Description: PaperXR aims to revolutionize training in the context of the printing sector. PaperXR uses Extended Reality (XR) tools to create a lifelike training environment that replicates printing production procedures and machine operations, addressing challenges like modeling tasks, virtual hardware design, and real-time interaction.

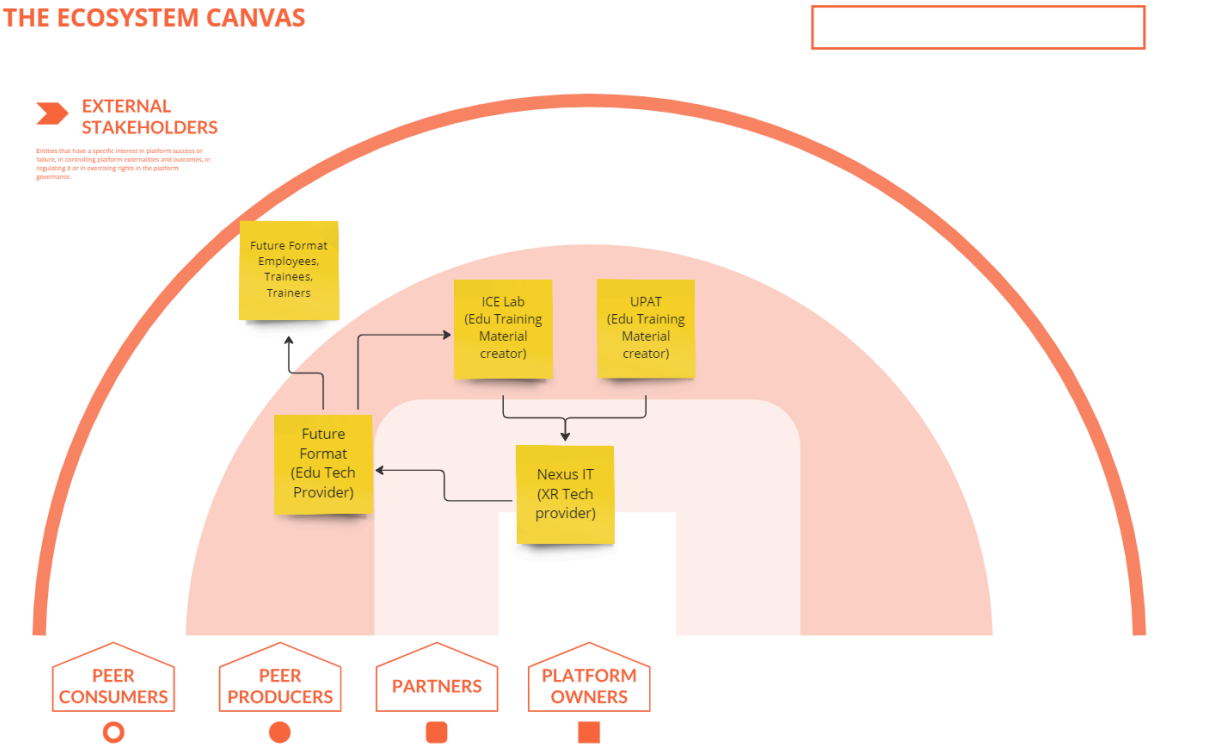

Figure 18 – PaperXR Ecosystem Canvas offering a clear description of the key stakeholder involved in their project and the main interaction between them.

THE ECOSYSTEM ENTITY ROLE PORTRAIT

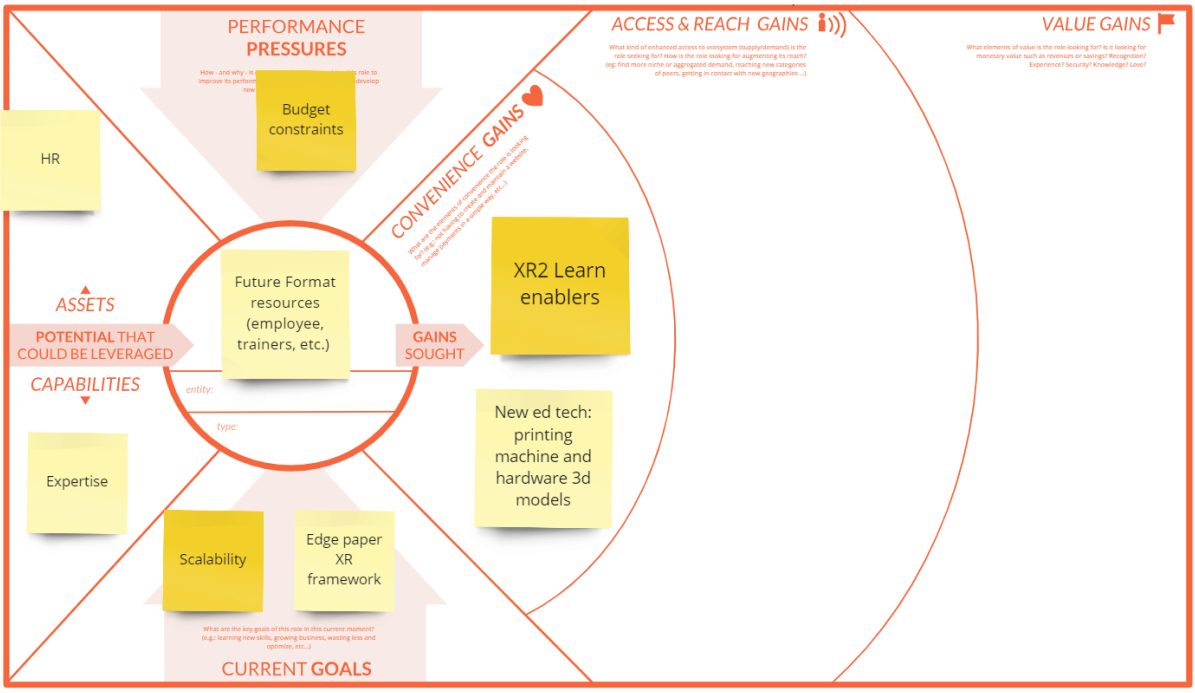

Figure 19 – PaperXR Ecosystem Entity Role Portrait highlighting some key aspects already identified by other OC1 teams: need to overcome budget constraints, develop scalable solutions to produce advanced learning materials, possibility to reuse code (enablers) from XR2Learn to speed up the processes.

THE TRANSACTIONS BOARD

Already happening the ecosystem?	E1	Transaction/ Interaction	E2	Currency/ Value Unit	Channel Components	Notes on channel improvement
X / no	Future format	Provide the printing machine specs	ICE Lab	specs	cloud storage	
yes / X	ICE Lab	3d models	Nexus IT	models	cloud datalake	
yes / X	Nexus IT	build the learning DB	Future format	learning DB	paperXR storage component	
yes / X	Nexus IT	provide the paperXR framework	Future format	paperXR framework	XR HW and SW delivery	
yes / X	XR2Learn	XRKnowledge and enablers	NexusIT		XR2Learn marketplace	

Figure 20 – PaperXR Transaction Board providing additional details about the main interaction identified in the respective Ecosystem Canvas.

3.2.6 XR2IND

Full Title: XR technologies to empower immersive industrial 5.0 training

Short Description: XR2IND will empower immersive industrial 5.0 training leveraging 3 state-of-the-art domains: a) generative AI libraries, b) XR tools, and c) Industry 5.0 educational

knowledge/ content. XR2IND project will develop a novel, ergonomic, and user-friendly XR-AI chat training/learning application to enable industrial users to interact with the training material in personalized, human-centric, and trustworthy ways, which is fully in line with the promises and mandates of the Industry 5.0 concept.

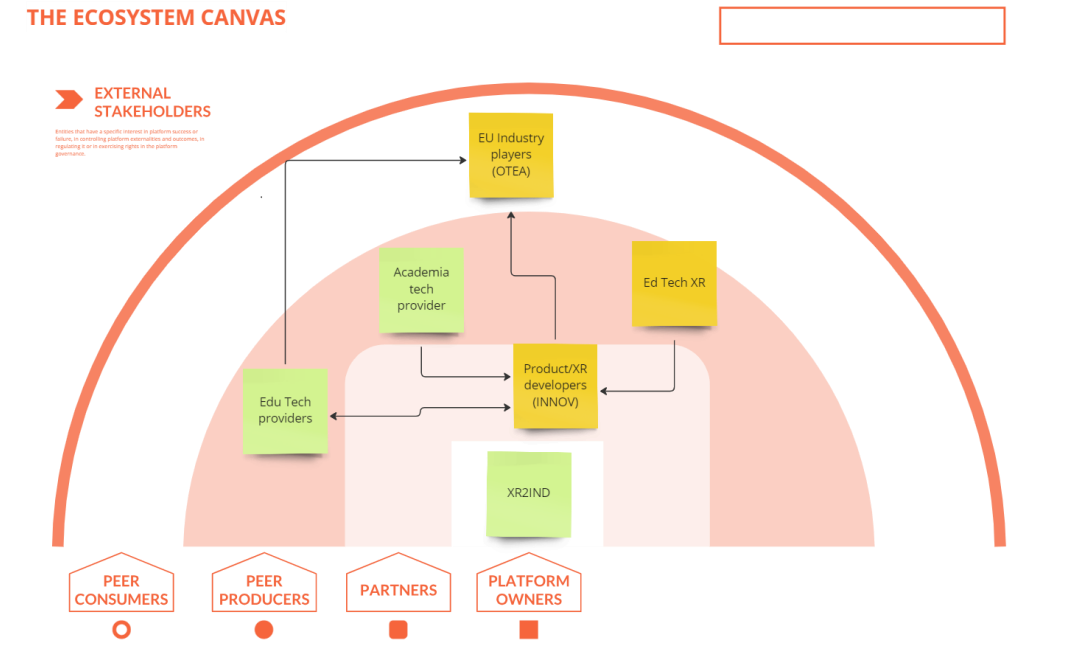

Figure 21 – XR2IND Ecosystem Canvas highlighting the key stakeholders in their ecosystem and the main interactions among them.

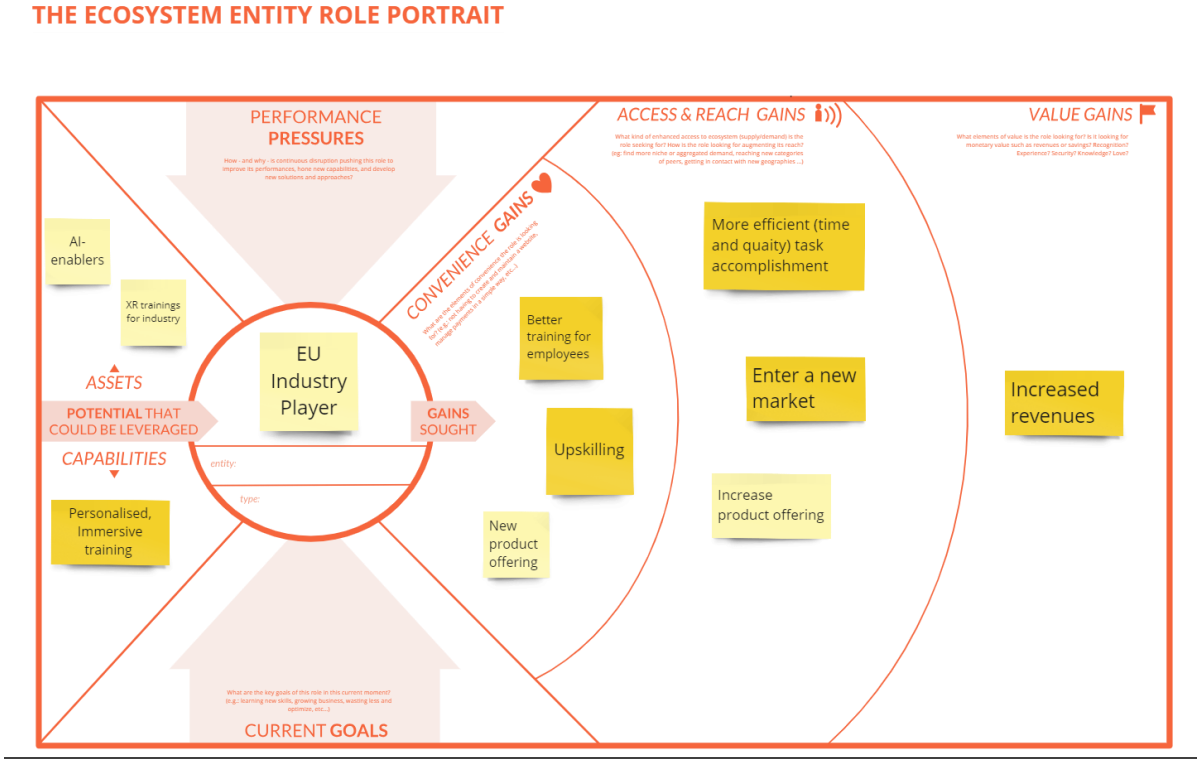

Figure 22 – XR2IND Ecosystem Entity Role Portrait describing a potential consumer of the developed solution (EU Industry Player) with the possibility to offer better, more personalised training courses for their employee (e.g. for upskilling) and obtain gains in task efficiency and competitiveness (possibility to enter new market and get new revenues).

THE TRANSACTIONS BOARD

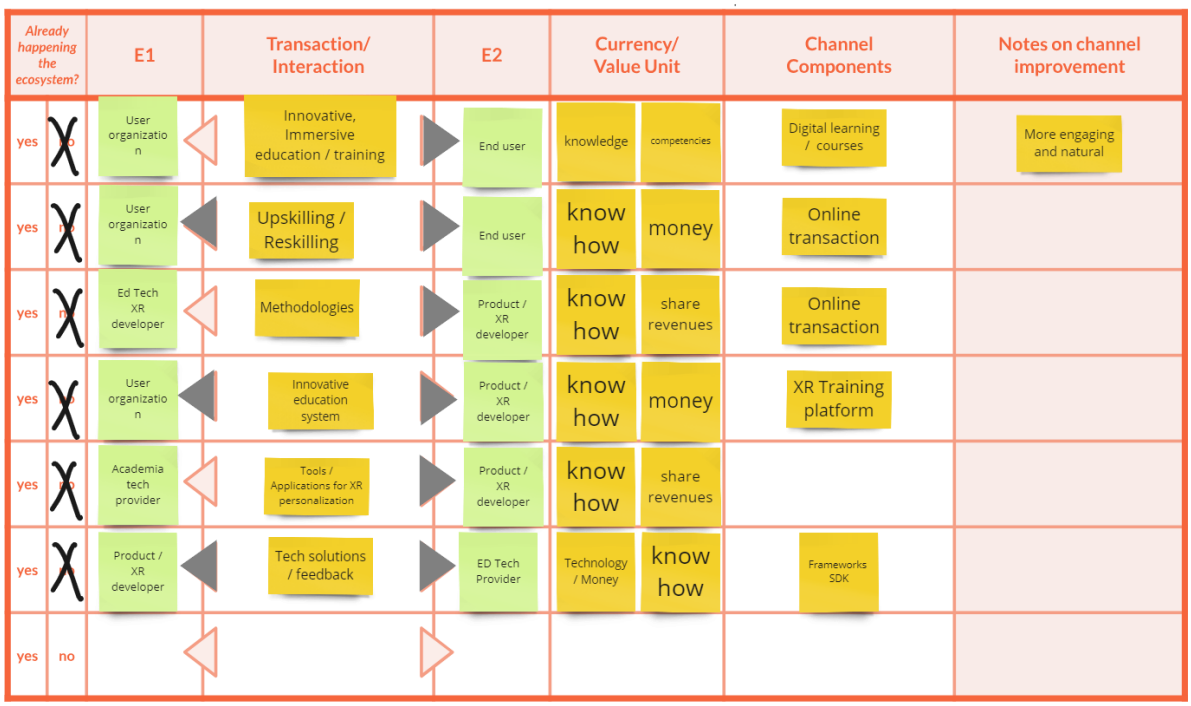

Figure 23 – XR2IND Transaction boards providing additional details about the main interaction identified in the respective Ecosystem Canvas. Notice the role of academia that can provide specific advanced solutions/modules to XR tech providers (in this case for the personalisation of training).

3.2.7 X-Alfy

Full Title: eXtended reality for Awareness and Learning in Forestry 5.0

Short Description: Forestry 5.0 stands for a new generation of efficient and sustainable forest management and exploitation in which climate change aspects are addressed and actions to create new forest values for the development and social transformation are promoted. The overarching aim of this project is to provide advanced AI-based XR tools for Forestry 5.0, addressing three different yet complementary application areas: Teaching, Learning and Environmental Awareness.

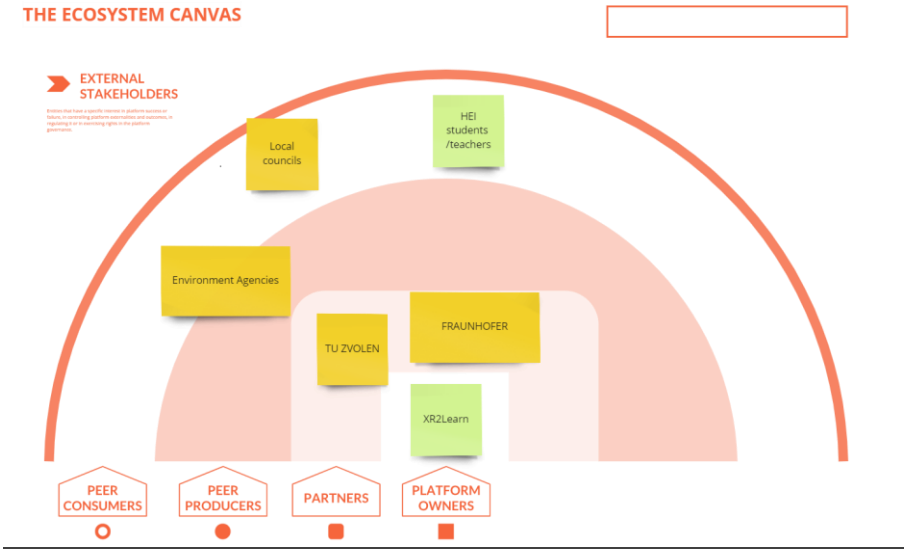

Figure 24 – X-Alfy Ecosystem Canvas highlighting the key, specific stakeholder for this project. Notice the role of environmental agencies that can be both producer of contents (to create the courses) and also consumer of resulting training materials. PAs (local councils) are also taken into consideration as training consumers.

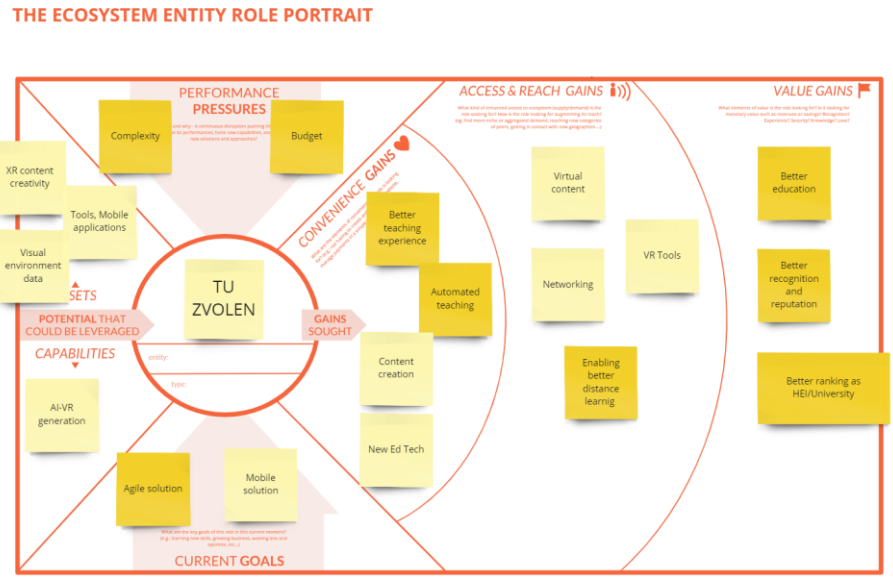

Figure 25 – X-Alfy Ecosystem Entity Role Portrait highlighting pressures and goals also emerged from other OC1 teams, as well as expected gains. Notice the value gains for the described university that indeed can achieve better positioning in terms of education, recognition, and reputation.

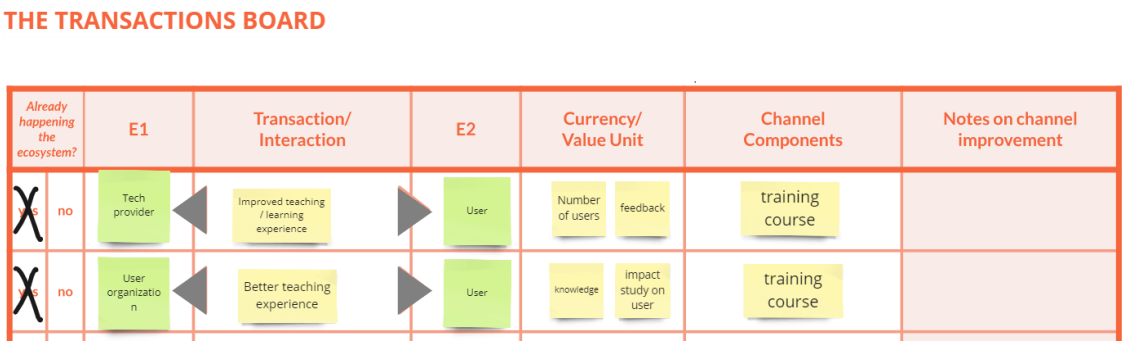

Figure 26 – X-Alfy Transaction Board highlighting two key transactions related to the offering of improved teaching/learning experiences.

3.2.8 Key Takeaways

Among the different insights emerged from the analysis of the OC1 teams' perspectives, we can highlight the followings:

- XR2Learn can enable/exploit the "prosumer roles" of some of their stakeholders. For example, academia can provide specific advanced solutions/modules to XR tech providers (in this case for the personalisation of training), as well as becoming a beneficiary of novel XR-based education/training courses. Similarly, other public/private organizations (e.g. environmental agencies in XAlfy project) can be both producer of contents (to create the courses) and also consumer of resulting training materials.
- XR2Learn platform and solutions can be very useful in terms of:
    - Offering a community for getting inspiration and finding collaborations.
    - Overcoming budget constraints by re-using code (e.g. XR2Learn enablers) from XR2Learn marketplace to speed up the processes.
    - Accessing tools/methodologies for enabling clients (learning experience creators) to develop their courses in autonomy.
- Main benefits related to implementing XR-based learning/training courses are:
    - Developing more engaging, personalised and effective education/training courses.
    - Introducing solutions to make more flexible and scalable the creation of education/training courses.
    - Addressing in a more effective way some specific subjects, such the issues of preventing accidents (i.e. workforce safety).
    - Attract / form talents.
    - By becoming experts in XR-based education/training courses and solutions:
        - obtain gains in task efficiency and competitiveness (possibility to enter new market and get new revenues)
        - achieve better positioning in terms of education, recognition, and reputation.

4. ECOSYSTEM AND GROWTH STRATEGY STATUS

Whereas the previous two sections focus on the stakeholder analysis activities performed so far, this section focuses on reporting the overall strategy for engaging and retaining actors of the identified XR2Learn ecosystem and the first results of its implementation.

The strategy has been initially reported in D2.1 and it serves as baseline information regarding community building, programmes, targets, activities, and tools. Based on such a strategy, WP2, in close collaboration with WP5, carried out a set of engagement activities to explain the project's idea, developments, and findings in a step-by-step manner.

The next section 4.1 summarizes the different elements of the devised strategy, while the remaining sections of chapter 4 reports about the results of the performed activities and the focus and planning for the next period.

4.1 Ecosystem building strategy

The actual goal of the XR2Learn ecosystem building strategy in WP2 is to sustain the creation of a community around the XR2Learn platform, by leveraging partners' existing programs, related communities, and experience in organizing specific events. The community-building activities will recruit as many organizations as possible to the platform created and build an active community within the project.

The **key objectives of the ecosystem-building** activity can be summarised as follows:

- Meeting and engaging with potential early adopters of the XR2Learn platform. According to the performed stakeholder analysis, it is expected to engage with:

		Expected roles			
Main Category:	Including:	*Partner*	*Peer Producer*	*Peer Consumer*	*Ext. Stakeholder*
XR Tech Providers	SMEs, Developers, Innovators, Accademia (tech provider)	☑	☑	☐	☐
Edu Tech Providers	SMEs, Accademia (tech provider)	☐	☑	☐	☐
Edu/Training Materials Creators	Academia (content provider), Professionals, Schools	☐	☑	☑	☐
Users Organizations	SMEs, Corporates, Schools, Universities, VET Organizations, Online Edu Platforms	☐	☐	☑	☐
End Users	Teachers/Trainer, Student/Trainee	☐	☐	☑	☐
Ext Stakeholders	Policy Makers, National/Regional authorities, NGOs	☐	☐	☐	☑

Figure 27 – Summary of stakeholders in the XR2Learn ecosystem

According to the KPIs reported in the project DoW, we plan to have:

  - 1600 potential early adopters in our ecosystem by M18 (June 2024).
  - 2200 potential early adopters in our ecosystem by M42 (June 2026).

- Providing evidence of the benefits of collaborative usage of the platform.
- Creating incentives for the potential early adopters to recruit their own partner networks and make the ecosystem growth process self-sustaining.

The consortium plans to **engage early adopters of the XR2Learn platform through a series of tailored workshops and activities**. The main objectives are to demonstrate the platform's benefits, attract organizations for testing, and gather feedback.

The engagement strategy is divided into two main phases:

1. Before the first release of the XR2Learn platform: The focus is on creating awareness about the platform, collecting needs and suggestions on functionalities, and gathering contacts of potential users. Webinars and workshops will cover topics such as the platform's objectives, targeted end-users, expected value, functionalities, business models, launch schedule, and opportunities for third parties. Additional outreach methods might include direct interviews and online surveys.

2. After the first release of the XR2Learn platform: The focus shifts to showcasing the platform's core functionalities and enabling early adopters to start using it. Webinars and workshops will provide an overview of the project, describe services, offer platform demos, highlight business cases, and conduct training sessions. Special workshops will be organized to identify different application scenarios and engage with intermediaries and other third parties interested in the platform.

When relevant, the consortium will possibly co-organize webinars and workshops with relevant organizations from other projects, engage with existing education/training platforms at various levels, and work with intermediaries in their networks.

The **timing and settings** of the webinars, workshops and activities will be coordinated with WP5 leaders, with a minimum of 2 events (either online or physical) planned per year. The number of events may increase once the first version of the platform is released. All the content to support the ecosystem-building activities will be **disseminated** using different tools, in order to reach out to a broader audience and attract more people to participate in the workshop/webinar and also to register to the platform. This would closely link to the WP5 on **communication** with the audience the promotional of the events, the outcomes and updates related to the webinars and workshops.

Finally, a key aspect of this strategy is the possibility of exploiting the recruitment of new organizations by those already engaged with the platform. In fact, XR2Learn recognizes the important role of early adopters and intermediaries for the concrete commercial exploitation of the envisioned platform. The early adopters will validate XR2Learn ideas, engage, give feedback and embrace the different versions (MVPs) of the platform. The intermediaries will sustain the ecosystem building and market launch of the platform by giving XR2Learn the access to their networks. All of this should be incentivized and rewarded.

In D2.1 different types of **rewarding schemas** have been identified. The most straightforward to implement in the next months are those related to recognition (e.g. expertise badges, speak testimonials, dedicated mention to the partner) that can be easily implemented within the just launched XR2Learn Community Forum (see Section 4.4). Other rewarding schemas could be related to discounts or credits on e.g. platform fees and paying services (e.g. technical or commercial support); but, they can be defined only once the actual business model of the platform will be finalised.

4.2 Ecosystem building activities

Following the devised overall strategy, **during 2023** we mainly focused on creating awareness about the project objectives/activities and the 1st open call of the project.

In this phase, we make largely use of the dissemination and communication tools (WP5), including the participation to relevant physical events, such as: Annual GFOSS general assembly, IMPACT2024 Workshop, MANUFACTURING PERFORMANCE DAYS 2023 (June 2023); WebIt (July 2023); MobileHCI 2023 - ACM International Conference on Mobile Human-Computer Interaction (Sept 2023); Immersive Tech Week 2023 (Nov 2023). Additional details on these activities will be reported in the project dissemination report.

More related to the community building activities, we arranged and run the following webinars, that allowed us to generate attention to the project and start registering the first contacts.

Table 5 – Arranged webinars in 2023

Date	Type	Title	Focus	Registered persons
30/06/2023	Webinar	Open Call Webinar XR2Learrn / XR4ED / MASTER	Start up the eXtended Reality Learning joint communication initiative of the three sister projects XR2Learn, XR4ED and MASTER, funded by the European Union under the topic "eXtended Reality Learning - Engage and Interact".	62
10/07/2023	Webinar	France Immersive Learning Lab - XR2Learn OpenCall presentation	XR2Learn objectives and target results Open call presentation	18
24/07/2023	Webinar	First Open Call Promotion Webinar	XR2Learn objectives and target results Open call presentation How to apply to the open call	23
07/09/2023	Webinar	Open Call 1 Info Webinar	XR2Learn objectives and target results Open call presentation How to apply to the open call	59

Starting from January 2024, a first, internal version of the XR2Learn platform has been released by WP2, as well as additional technology results from WP3 activities were available to be showcased during the events. Therefore, we decided to have a more structured plan that will progressively move from the pure creation of awareness about the project to an actual engagement of potential users with the project solutions. This involves the introduction of concrete demo showcases, training on how to use/interact with the project's technology solutions and hands on sessions.

Overall, the idea was to have at least one event (either webinar, physical event, or other type of meeting) per month with the possibility of engaging different classes of stakeholders.

The following table reports the activities performed between January and April 2024.

Table 6 – Arranged events up to April 2024

Date	Type	Title	Focus	Audience	Registered persons
17/01/2024	Webinar	1st Community Building Webinar	XR2Learn community building activities	Both technical, education and industry organizations	52

			Introduction to the XR2Learn platform Demo of XR2Learn enablers		
15/02/2024	Panel at Fair	XR e Industria: nuove frontiere nella manifattura (A&T Torino 2024)	XR2Learn objectives and target results Introduction to the XR2Learn platform Demo of XR2Learn enablers	XR Tech Providers Industrial end users	77
28/02/2024	Webinar	SURE5.0 Project Webinar	XR2Learn objectives and target results Demo of XR2Learn enablers	XR Tech Providers Industrial end users Accademia	37
21/03/2024	Workshop	Workshop with OC1 winners	Stakeholder analysis Hands on session with XR2Learn marketplace and enablers	Both technical, education and industry organizations	17
10-12/04/2024	Presence at Fair	Laval Virtual Fair	Booth and demo of the INTERACT enabler and its beacon apps	XR Tech Providers Industrial end users	N/A

By analysing the registered contacts, we can provide an **overall distribution of class of stakeholders** (as identified in the stakeholder analysis) that have expressed interested to XR2Learn solutions so far:

- XR Tech Provider: 40%
- Education/Training organization: 30%
- Education/Training Tech Provider: 20%
- Education/Training materials creator: 6%
- Enthusiast: 2%
- Student/Trainee: 2%

Moreover, during the 1st community building webinar (17/01/2024) we performed a survey (while the different project solutions were presented by using the Slido application) and main analytics are summarized below.

The webinar session was quite participatory since 77% of the participants have answered to the posted polls (see below).

The first poll aimed at highlighting the perceived benefits or challenges in adopting XR technologies for training and learning.

Figure 28 – Community Webinar Survey: Poll 1

The second poll was launched once the different key demonstrations were performed with the aim to identify the most interesting ones.

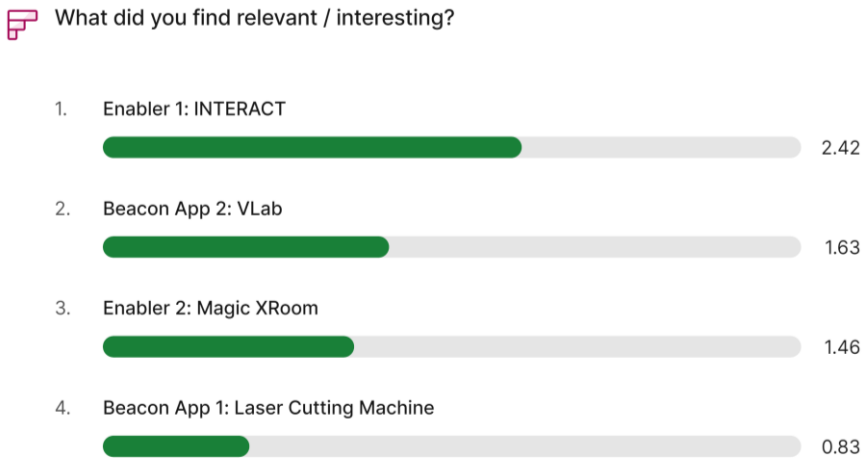

Figure 29 – Community Webinar Survey: Poll 2

The third poll explicitly asked the participants to express their interest to be involved in XR2Learn solutions.

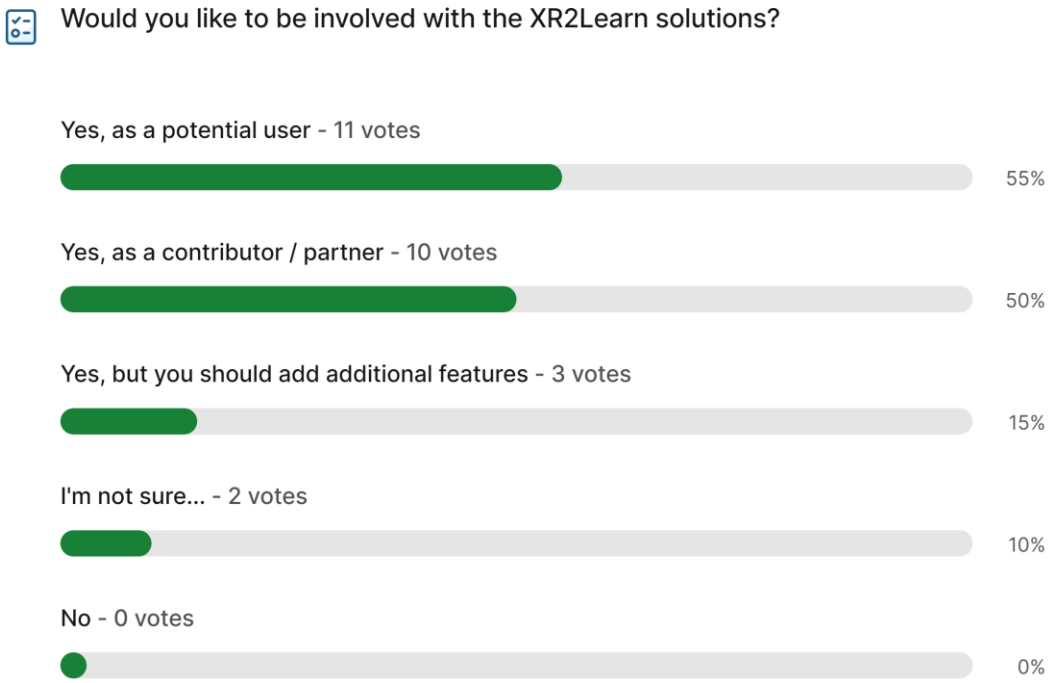

Figure 30 – Community Webinar Survey: Poll 3

Moreover, 21% of the participants have posted questions to the speakers in order to obtain additional information. Some of them were specific technical questions (e.g. support standalone headsets of the Interact enabler), others were related to e.g. the timing for developing a beacon app based on the presented enablers or the availability of the showcased technologies through the XR2Learn marketplace.

Regarding the **future ecosystem building activities**, we maintain a list of all planned / possible events that can generate contacts to be included in our ecosystem. This list is continually updated and discussed during the project monthly sync calls.

The table below report the planning for the next months.

Table 7 – Planned events up to December 2024

Date	Type	Title	Focus	Expected Audience
May 2024	Fair	VivaTech 2024	Booth and demo of the INTERACT enabler and its beacon apps	XR Tech Providers Industrial end users
May 2024	Fair	SPS Italy 2024	Booth including presentation of XR2Learn solutions	XR Tech Providers Industrial end users
May 2024	Webinar/ Workshop	XR2Learn Emotions Enabler	Demo and training of the emotion enabler	XR Tech Providers

			Demo of XR2Learn enablers	
June/July 2024	Webinar	XR2Learn for education / training (tentative title)	Training module for adopting XR technologies	Education and Industry end users
June 2024	Webinar	Brokerage event	Presentation of the XR2Learn solutions and support in use them	XR Tech Providers Education and Industry end users
July 2024	Webinar	First webinar for the second open call	Presentation of the XR2Learn solutions and support in use them	Both technical, education and industry organizations
Sept 2024	Webinar	Second webinar for the second open call	Presentation of the call and details on how to apply	Both technical, education and industry organizations
Sept 2024	Conference	ECTEL 2024	TBD	Education organizations
Oct 2024	Webinar/ Workshop	Third webinar for the second open call	Hands on session for getting inspiration for preparing OC applications	Both technical, education and industry organizations
Oct 2024	Exhibition/ Workshop	3DBodyTech	Presentation and hands on the XR2Learn solutions	XR Tech Providers Technology providers
Oct 2024	Exhibition/ Conference	AWE EU 2024	TBD	XR Tech Providers Technology providers

In addition to the already planned activities, we are **setting up a collaboration between other projects in the same area** (currently the EU project XR5.0) to build synergies in creating a reference community of stakeholders around all projects and develop joint activities, such as common publications/whitepapers, webinars on the same topic, cross-marketing actions.

4.3 Status of the Ecosystem

Capitalising on the ecosystem building activities (reported in the previous section) and the dissemination and communication activities lead by WP5, we can state that the **XR2Learn ecosystem is taking shape**.

Given that the XR2Learn marketplace has been released in Q1 2024, at this stage we cannot count on the number of registered users to quantify the dimensions of the XR2Learn ecosystem.

Instead, *we can define the XR2Learn ecosystem as the set of all contacts that have expressed an interest to the XR2Learn technologies by registering to one of our digital channels*. In our view, these contacts are all potential early adopters of the XR2Learn solutions.

We report below the map of the XR2Learn ecosystem in April 2024.

Table 8 – Map of the XR2Learn ecosystem in April 2024

Channel	Number of registered users	Note
LinkedIn group	723	
Twitter/X	121	
YouTube	29	
F6S Platform	285	
Newsletter	108	
Webinars/Events	308	Considering only the events arranged by XR2Learn and, thus, we have the list of registered participants

Based on this map, **we can assume that the XR2Learn ecosystem currently includes about 1.574 contacts.**

Disclaimer: we are aware that this is a first, rough estimation of the current dimension, since there could be some double counting between the different channels (e.g. one subscribed in LinkedIn and have also participated to one of our webinars). However, according to the GDPR regulations, no personal data (name, email, etc) can be shared when creating a list of stakeholders unless you collected consent from the persons (data subjects) specifically for that purpose. Therefore, now we cannot directly merge/compare the different lists to create a more precise number.

We plan to overcome this problem by launching the Community Forum Tool (see next section) that could progressively become our reference tool for assessing the XR2Learn ecosystem. The plan is to ask to all our registered contacts to register to the Community Forum too and start contributing to it.

Finally, to give **an idea of the presence of key stakeholders in our ecosystem**, we can report the following charts that depicts the distribution of LinkedIn followers among the main stakeholder categories relevant to XR2Learn.

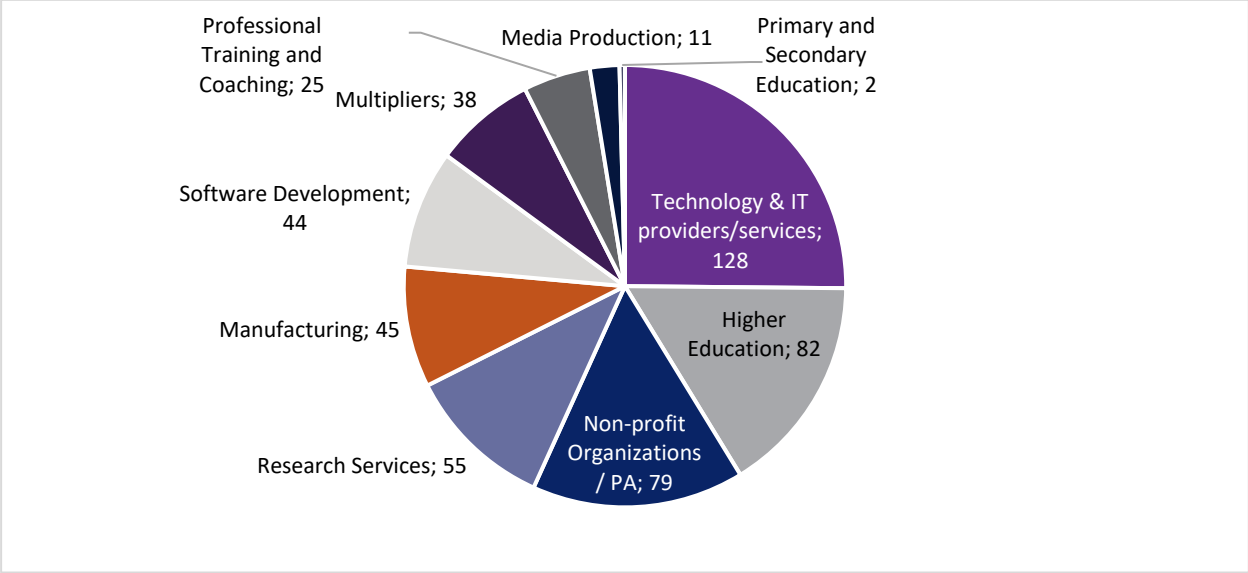

Figure 31 – Distribution of LinkedIn followers among the main, XR2Learn stakeholder categories

4.4 Community Forum Tool

As part of the XR2Learn Platform solution, in March 2024, a tool has been released that can act as common, digital space for target stakeholders to interact and share XR-related experiences in education and training.

As anticipated in the previous section, the forum aims to become the reference channel for the XR2Learn community. It is available at: ***https://forum.xr2learn-marketplace.eu/***

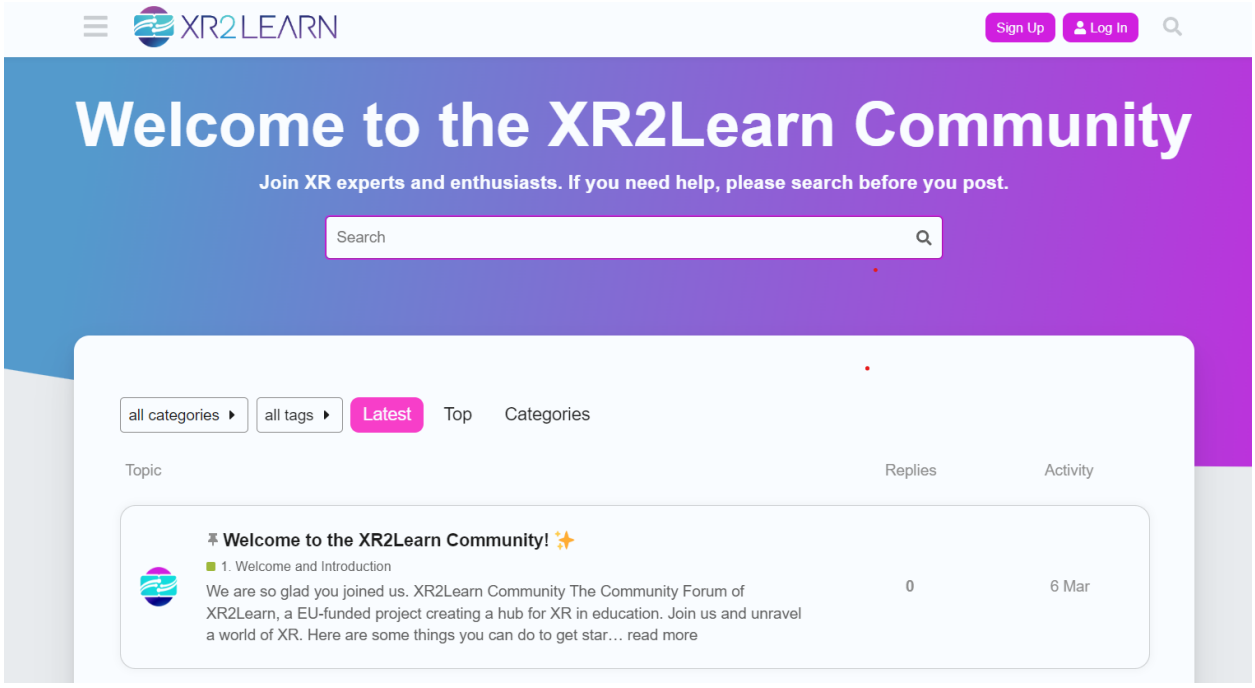

Figure 32 – Landing page of the XR2Learn Community forum.

Users should be registered to the platform (they can use the same credentials of the XR2Learn marketplace) to access to the forum.

The structure of the forum includes the following sections:

1. *Welcome and Introduction:* the space for introducing new members to the forum's purpose, guidelines, and community norms.

2. *Content Creation*: the space for sharing discussions on creating training materials, courses, and educational resources.

3. *Technical Aspects*: the space for sharing discussions on XR technology issues and problem-solving.

4. *Showcase*: the space for highlighting work, projects, and success stories related to XR learning/training.

5. *General Discussion*: the space for broad discussions on XR and advanced learning news, markets and trends.

6. *Announcements*: the space for sharing updates on XR2Learn project progress, events, and forum guidelines.

7. *Networking*: the space for creating connections among forum members for collaboration, mentorship, and knowledge sharing.

8. *Feedback and Suggestions*: the space for collecting inputs from members to improve the forum experience and content offerings

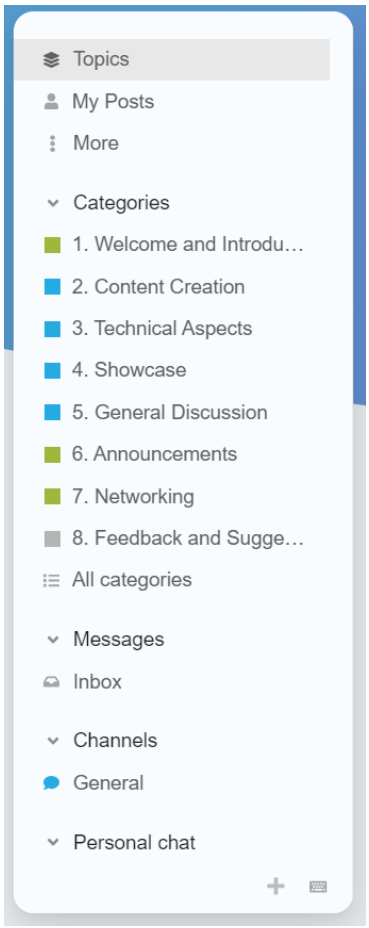

Figure 33 -Forum Categories

The current objective is to start populating the forum with initial contents and exemplary posts based on the partner's activities and the interactions with OC1 winners and their stakeholders. For example, partners will use the forum to present the developed demo cases and open threads of discussions about their technology solutions, whereas OC1 teams will use the forum to present their projects and report new developments and achievements. Moreover, all new activities, webinars and announcements will be channelled through the forum.

Once a first set of data will be available in the forum, we will communicate the presence of this new tool and invite all our registered contacts to join the forum and start to contribute to it.

Then, the actual challenge will be the continuous growth and animation of the forum: regularly interact with the users, respond to their posts, and show appreciation for their contributions will help foster a positive and collaborative community. To achieve this there will be a shared effort between all partners, each responsible of specific sections. Different approaches/strategies can be implemented; for example:

1. *Welcome and Introduction*: Encourage new members to introduce themselves and share their interests. This can be facilitated by sending automated welcome messages with prompts for introduction. Regularly update the forum's purpose, guidelines, and community norms to ensure they are clear and relevant.

2. *Content Creation*: Organize regular challenges or competitions related to creating training materials, courses, and educational resources. This can

stimulate creativity and engagement. Recognize and reward quality contributions to motivate members.

3. *Technical Aspects*: Create a system for users to easily report technical issues and get support. This will be strictly linked/forwarded to the XR2Learn Wiki of the project if the technical aspects are related to the project outcomes. Moreover, hosting Q&A sessions with experts in XR technology can be a way to engage users.

4. *Showcase*: Regularly feature outstanding work, projects, and success stories in a dedicated "spotlight" section (starting from the solutions developed in the projects). This can inspire other members and give recognition to the creators.

5. *General Discussion*: Keep this section lively by posting news updates, thought-provoking questions, and trend analyses related to XR and advanced learning. Encourage open discussions and respectful debates.

6. *Announcements*: Use this section not only for sharing updates on the XR2Learn project but also for highlighting important threads, upcoming events, and changes to forum guidelines. Make sure to keep this section updated and use clear, concise language for your announcements.

7. *Networking*: Facilitate networking by organizing virtual meetups or webinars. Encourage members to share their professional backgrounds and areas of interest/expertise. This can help members find potential collaborators, mentors, or mentees.

8. *Feedback and Suggestions*: Regularly solicit feedback and suggestions from members. This could be done through surveys or dedicated feedback threads. Show that you value member input by acknowledging good suggestions and implementing changes based on feedback.

5. BUSINESS MODELS

The current section investigates the widely used business models in the XR market as well as the possible business models enabled by the NFT technology and how they can be effectively utilized in the XR-based educational application space. It studies the existing educational platforms and their features and makes an overview of the established NFT-based marketplaces and XR-based business models.

5.1 Educational Platform Business Models

Educational and learning platforms are at the forefront of a rapidly expanding e-learning sector, especially in the wake of a global pandemic like Covid-19. The fact that more and more people are getting interested in online learning for both studying and teaching purposes - either to learn a new skill or to teach online - is unflinching proof. Fortunately, there are lots of online learning and course platforms that allow one to create, market, and learn from courses online. This is also a positive development for online educators, trainers, and aspiring "edupreneurs".

An online educational platform can be defined as an information system that offers a secure learning environment so that students can take online courses. Because they enable students to directly search for and purchase online courses, these online learning platforms

are frequently referred to as "online course marketplaces." The market distinguishes also online course platforms, which mainly take the perspective of the online instructor/teacher.

- With over 82 million members, the online education platform **Coursera** is dedicated to providing top-notch online training courses all around the world. It gives students the chance to enroll in their paid courses and get certifications from prestigious institutions by collaborating with leading colleges and companies. For bachelor's and master's degree programs, Coursera offers individual courses, specializations, certifications, and degree programs that enable on-demand video lectures, homework activities, peer-reviewed assignments, and online discussion boards. Coursera's business model offers a "Coursera Plus" version where students can subscribe on a yearly or monthly basis and gain unrestricted access to 90% of the educational programs in the Coursera catalog.
- **Udemy** is one of the most well-known online course marketplaces having more than 213,000 online video courses available. Over 40 million students use this educational platform, and 50,000 professors and subject-matter specialists are producing online courses. Udemy's model offers everyone to create courses on Udemy, giving them the chance to learn new skills. As a result, it provides a selection of online learning resources, including text, PowerPoint presentations, PDF files, and a variety of other types of content. Udemy allows instructors to sign up and begin teaching online, but it also controls the course pricing and discounts and gets a substantial chunk of the money.
- The educational platform **LinkedIn Learning**, originally known as Lynda.com, provides professional courses in a variety of areas in the form of video lessons, including business, digital marketing, web development, and more artistic fields like design. The platform, which is available as a premium service to LinkedIn users, focuses on assisting people in making investments in their professional growth and provides more than 16,000 courses in 11 languages. Additionally, LinkedIn Learning collaborates with leading corporations to offer its students the most sought-after professional certifications. LinkedIn Learning educational platform established as highly recognizable and valued in the B2B community, providing personalized course recommendations for users.
- Another well-known online course marketplace is **Skillshare**, which contains up to 35,000 lessons in a variety of creative industries and more than 5 million students. Lessons for courses span between 20 and 60 minutes and are composed of a number of brief films, group assignments, and a student community that promotes engagement through discussion boards. The four categories of classes on Skillshare are taught by experts, everyday creatives, and business leaders: graphic design, visual art, culinary, and music creation are all examples of creative arts; data science, web design, and e-commerce are all examples of technology; business terms include accounting, project management, and finance and lifestyle: language learning, gaming, and health. Skillshare's business model offers easily digestible and bite-sized learning, however, no certificate of completion or any other formal recognition can be provided when completing a course.
- **Open-edX** and **EdX.org** (course marketplace) are two sides of the same coin. Open-edX is an open-source content management system, and EdX is a learning portal where students may access online courses from various universities. Both were developed by a team of scientists from Harvard and MIT with the purpose of giving online university-level education to people all around the world. EdX.org provides

over 3,500 online courses from 160 major organizations and universities on a variety of topics. Engineering, computer science, data science, math, humanities, business, and management are the most common specializations. EdX.org's business model Provides in-depth knowledge, added value and open-source information in specialized science with respected instructors.

The educational platforms' business models include also online course platforms such as LearnWorlds, Teachable, Thinkific, Kajabi, and Podia in addition to online learning platforms that offer mainly one-way communication between instructor and student. This business model also had a blast in the time of the Covid-19 pandemic and has enjoyed increased interest levels in recent years.

Educational platforms use different business models, aiming to adapt them to the target audience, content, and market dynamics of each platform. These are a few typical business models for educational platforms:

- Freemium model: Users can pay for premium material or more features, but the core functionality and content are always free. With this arrangement, customers can test out the platform before deciding to sign up for a premium membership.
- Subscription Model: In order to access the platform's services and content, users must pay a regular charge, either monthly or annually. This approach frequently provides several subscription tiers with various levels of access and functionality.
- Pay-Per-Course: Learners make one-time or ongoing payments for individual courses or resources. This strategy targets mainly students who have particular interests in certain topics or who just wish to pay for the content they use.
- Corporate Model: For academic, professional, or staff development, educational platforms provide their services to companies or other educational establishments. Usually, license fees or the quantity of users determine pricing.
- Ad-Supported Model: The platform provides free access to services and content in exchange for the display of adverts, which brings in money for the platform. However, to attract advertisers, this strategy needs a sizable user base.
- Sponsorship Model: To pay for the creation of content or particular features, educational platforms collaborate with sponsors or marketers. Sponsors gain visibility and branding opportunities on the platform in exchange.
- Crowdfunding Model: Websites raise donations or investments from private citizens in order to finance the creation of educational features or material. Contributors occasionally might be granted special access or benefits.

5.2 NFT-Based Business Models

A brief definition of an NFT marketplace could be a blockchain-based digital platform for purchasing and selling NFTs. These sites allow users to sell their NFTs to other users in exchange for cryptocurrencies or cash, as well as store and exhibit them. The NFT marketplace handles typically the transfer of an NFT from one party to another in exchange for a charge. A comprehensive analysis of the existing NFT-based business models shows that each NFT market works according to its own set of rules and has its features. Depending

on the used platform, different types of NFTs may be available, including fees, payment methods, approved blockchains, and other rules.

They are based on the cutting-edge technology known as blockchains, which powers cryptocurrencies like Bitcoin. The value of the NFT market increased to more than $40 billion in 2021, according to The 2021 NFT Market Report published by blockchain intelligence company Chainalysis. The NFT market's worth is currently only a small portion of that. Nevertheless, many investors are still interested in NFTs despite the small market share of this asset class. These NFT marketplaces are among the most well-liked and rated sites to purchase and trade these digital assets.

- **OpenSea** is a pioneer in the NFT market being launched in 2017. According to the NFT standards, however, it is largely outdated. In the past, it has hosted a number of well-known NFTs, including those related to art, music, photography, trading cards, and virtual worlds. On OpenSea, the primary cryptocurrencies are Ethereum, Solana, Polygon, Avalanche, and BNB. However, there are additional cryptos available as payment choices. The platform does not allow fiat currencies like dollars and euros. OpenSea is incredibly beginner-friendly allowing users to construct NFTs on their platform and browse NFTs right away after creating a free account, which only takes a few minutes.

- **Rarible** is a popular NFT platform that facilitates the purchase and sale of artwork, collectibles, video game assets, and NFTs. Rarible accepts transactions in Ethereum, Polygon, Tezos, and Immutable X. However, there will be fees. It has an intriguing feature: Rarible built its own native coin called RARI rather than letting internal management make all decisions. Owners of RARI may vote on corporate decisions, such as alterations to corporate policy. Rarible and Adobe established cooperation in 2021 to simplify the verification and security of metadata for digital content, including NFTs. Rarible might be the greatest NFT market for anyone who desires access to a vast network with strong connections. In addition, it continues to operate with a decentralized attitude.

- In 2021, one of the biggest cryptocurrency exchanges, **Binance**, introduced an NFT market. The normal digital goods featured on other big platforms, including artwork, games, and collectibles, are available on Binance NFT. The fact that Binance NFT has extremely cheap fees is a significant benefit. Only 1% of each trade is deducted by the site. Additionally, it is a user-friendly platform created with the same technologies and designs as its exchange. Binance has an advantage over other major players in the cryptocurrency market since it operates on its own blockchain.

- **SuperRare** is a premium NFT art marketplace that offers itself as an art gallery within the NFT ecosystem. This market is quite picky about NFT submissions and does not accept "meme-style" NFTs. Investors can have greater confidence in the quality of the work because SuperRare spends so much time examining it before it is made available for purchase. When an NFT is first sold on the primary market, SuperRare charges 15% as compensation for its services. The buyer additionally pays a fixed fee of 3% of each transaction.

- **Stylish Gateway Digital** artist Pak's "The Merge," which sold for $91.8 million, was one of the pricey and exclusive NFT transactions that Nifty Gateway is renowned for

staging. The platform's acquisition by Gemini, which is led by the Winklevoss twins Cameron and Tyler Winklevoss, in late 2019 garnered media attention. This market specializes in art, particularly works by well-known painters and celebrities. Nifty Gateway employs an "open editions" strategy to increase demand. One can only purchase editions of a new type of NFT for a brief period of time using a credit card to make purchases there.

In the digital sphere, NFTs are becoming increasingly popular as a way to symbolize ownership but also individuality. NFTs have given rise to a number of business models that take advantage of their attributes in different ways:

- Marketplaces for digital art: Online stores that let people trade, buy, and sell NFTs of digital art. Artists produce limited edition digital assets (NFTs) that collectors can buy and possess. Rarible, Foundation, and OpenSea are a few examples of such systems.

- Digital Fashion: As NFTs, fashion designers and brands produce virtual apparel, accessories, and wearables. To personalize their avatars or display them in virtual spaces, users can buy these digital fashion items. Platforms like The Dematerialised and Nike's CryptoKicks are two examples.

- Gaming and Virtual Assets: NFTs can be used to symbolize virtual real estate, characters, or in-game goods. These digital assets are available for purchase, sale, and trade by players both inside and outside the game ecosystem. NFT-based economies have been included in games such as Axie Infinity and Decentraland.

- Music and Entertainment: Performers, artists, and hosts offer NFTs that are exclusive access to their albums, concert passes, or virtual meet-and-greets. NFTs give artists the opportunity to earn money from their creations and interact with fans directly. The album release by Kings of Leon under the NFTs is one such instance.

- Intellectual Property and Licensing: Patents, trademarks, and digital copyrights are examples of the types of intellectual property that NFTs are used to indicate ownership or rights to. An unchangeable, transparent record of ownership and license agreements can be obtained with NFTs.

5.3 XR-Based Applications Business Models

Creating a 3D model or other XR-based product is just the first step of a long and complicated process. The crucial task is the selection of a platform to sell it. Currently, the internet offers various marketplaces specialized in selling and buying such models. Some of them are listed below:

- **Sketchfab** is one of the leading platforms for 3D & AR on the web for offering management of 3D assets, distribution of 3D & AR experiences and collaboration opportunities. It is a marketplace with over 1.3 million members. Models hosted on Sketchfab's site, now have a "paid download" option. Users who want to start selling their models and have them listed in the Sketchfab shop need to fill out a seller application. Sketchfab takes a 30% commission on all sales.
- **CGTrader** is one of the world's most preferred sources for 3D content and a marketplace for professional 3D models. Behind CGTrader, the world's largest 3D

model marketplace for computer graphics, VR, AR, and gaming, lies a significant professional designer community. Large enterprises and businesses seeking high-quality 3D models for use in their projects can be found there. If the model they seek is not available on the platform, they may pay you as a designer to create it from scratch. Royalties on sales can reach up to 90%, making it the most profitable business on the market today.

- **TurboSquid** is a marketplace for high-quality 3D models with over 500,000 models in its library and is perhaps the most well-known and largest marketplace for high-quality 3D models. Because the site attracts a large number of visitors, it is an ideal location for gaining awareness and sales. TurboSquid allows you to earn up to 80% of royalties from the sale of your work. You can get the best royalty rates by selling exclusively here. You will also be mentioned in their emails and on their website pages, and you will be given information on the most popular categories and keywords to advertise.

The XR domain offers a wide range of business opportunities in various industries - software and hardware development, marketing and advertising, healthcare and entertainment. In the field of education and training, innovative organizations and schools already create and use XR-based courses and training for professionals, workers, and students, making it a successful business model through course fees, license contracts, and subscription-based access as revenue streams.

6. CONCLUSIONS

This document is the updated version of D2.1 reporting the work carried out in Task 2.1 and 2.2 in the first 16 months of the project. Specifically, the document reports additional analysis about the entities that will be relevant in the XR2Learn ecosystem. The results include the outcomes of the Horizon Results Boosting service and an additional iteration of the PDT methodology focused on the projects winners of the 1st XR2Learn Open Call.

After describing the target ecosystem, the document summarizes the overall strategy to populate the XR2Learn ecosystem and then reports the performed activities and the obtained results. At this stage, we reported a preliminary analysis of the dimensions and composition of the registered contacts (among the different channels of the project). The next step will be to convert such contacts, as well as other contacts that will be created by the ecosystem-building activities, into members of a dedicated, reference digital space: the XR2Learn Community forum, which has been recently released by the project.

Finally, the document reports an updated analysis of existing business models in the fields of educational platforms, NFT-based applications and XR-based applications. All the analysis reported in this document are the basis for driving the XR2Learn platform development (in WP2) and the definition of its business model and, thus, the exploitation plans (in WP5).

It is worth noting that this is an iterative, continuous work; therefore, the results achieved so will be refined/extended in the next moths. In fact, it is expected to release a final version of this report at M42 (end of the WP2).