



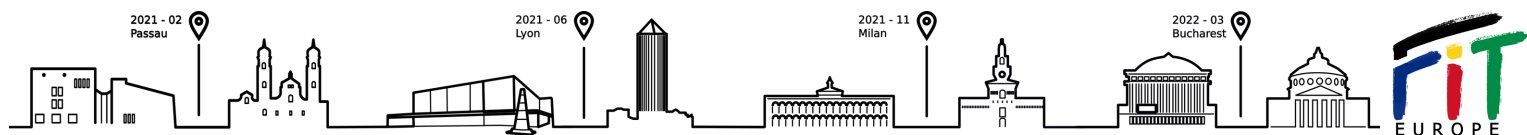
# Fostering Innovation & Internationalisation in Higher Education Curricula through European Industry-Academy Partnership



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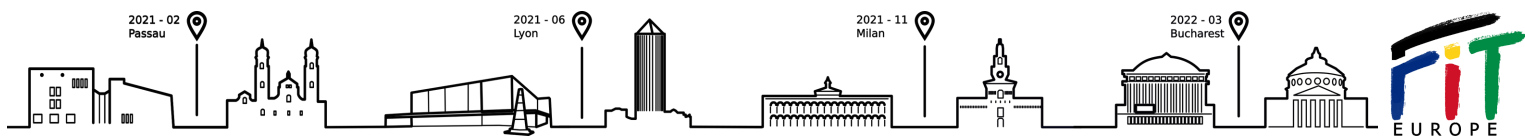
## Introduction

**What can we achieve together that we can't do alone?** This question underpins FIT-Europe as our consortium was built on strong relationship between 4 leading technical universities and their associated corporate partners. Together we tackled the issue of designing and implementing an innovative pedagogy in a hand-in-hand cooperation between industry and academia.

**Is interculturality a game-changer?** Beyond the standard mobility exchanges such as those Erasmus+ offers, FIT Europe explored a different intercultural experience through high-level scientific seminars which involved challenges (proposed by industry partners) which were tackled by international student teams supervised by international mentors, so as to enrich the students' mindset with distinct and multiple ways of thinking.

**Can societal responsibility enhance innovation?** FIT Europe's ambition is to build bridges of comprehension within tomorrow's challenges. We defend that engineering students will be able to influence and to positively make use of the cutting-edge technologies they will deal with, provided we raise their awareness to the societal responsibility they will assume in their professional life through contact with these technologies.

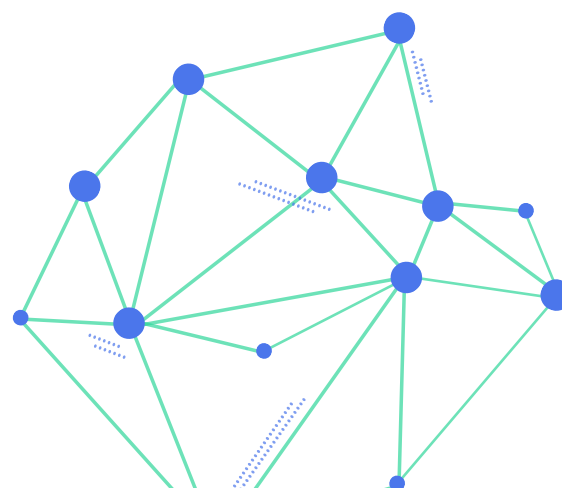
The first part of this document presents the background and context of the FIT Europe project so as to understand better its methodology . This part also provides with detailed descriptions of each of the four seminars designed in the frame of the project, which allows a better appreciation of the results of the project. The second part consists of all the recommendations gathered by the FIT Europe team throughout its valuable experience; they are intended for academia, industry, policy makers and accreditation bodies.



# Section I - The FIT Europe Project

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Future IT Leaders for a  
multicultural, digital Europe



## I.1. Project Background and context

The digitization of society offers an unlimited field for innovation, and, with the support of information and communication technologies (ICT), we are transitioning towards disruptive changes which raise unprecedented challenges that address both ethics, business, industry, innovation, social relationships. Today's graduates in the ICT field will be tomorrow's leaders of IT companies and they must be prepared for these challenges beyond the technical aspect, dealing with the societal and cultural impact of technology.

In this rapidly evolving context, a key issue, for both universities and companies, is the IT graduates' employability and the way to better match their competencies with the needs of a fast-evolving market. Furthermore, aforementioned challenges and transitions will first affect, and will be tackled, by this new generation of digital natives. It is therefore of the uttermost importance for companies to understand and address the mindset and the expectations of young graduates.

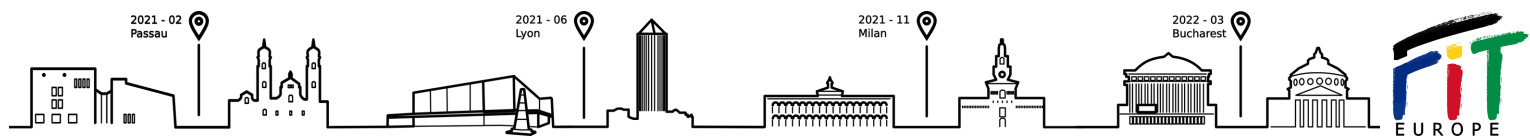
The FIT Europe project was implemented by a European (France, Germany, Italy and Romania) task force comprised of four leading Universities (INSA Lyon, University of Passau, University of Milan, and University Politehnica of Bucharest), and four corporate partners (French Tech One Lyon - St. Etienne, Atos International Germany GmbH, Engineering Ingegneria Informatica S.P.A., and the Bucharest IT Center for Science and Technology (CITST)). It was organised with the support of local authorities and co-funded by the Erasmus+ Programme of the European Commission. The aim of the project was to gather information about the needs and priorities of companies, and to develop and implement a relevant evolutionary process of 4 seminars, going beyond a classical student's exchange framework or a new ICT module. Each seminar focused on an emerging technology that is disrupting the current technological paradigm – Big Data, Blockchain, IoT, Assistive robotics – and one related societal challenge – respectively, ethics, entrepreneurship, privacy, and assisted living.

Seminars gathered Computer Science and Information Technology (CS & IT) master students from the four universities, as well as academic researchers and industrial experts, with a four-fold objective (i) increase the knowledge and expertise of participating students in the target technologies (fundamental concepts, technology, applications); (ii) allow students to have rich exchanges with researchers and experts and to better catch the topics at stake in the companies and the way companies leverage these technologies to create business opportunities, through projects proposed by the corporate partners of the project and co-mentored by corporate experts and academics; (iii) raise the students' awareness of the business and application opportunities each technology offers, as well as the societal (and, if relevant, the environmental) issues it raises; (iv) develop intercultural mindset among the students.

The resources and results of the project have been disseminated via an open resource library<sup>1</sup>, this white paper, and multiplier events in the four European countries, with the goal of increasing awareness among diverse stakeholders.

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<sup>1</sup> <https://library.fit-europe.eu/>



## I.2. Organisation

Considering the 4 major objectives of the seminars (see above), the general preparation of a seminar relies on a methodology based on 6 actions:

1. Build a seminar organisation team comprised of representatives from both the local organiser academic institution and its national corporate partner i.e., University of Milan and Engineering, University of Passau and ATOS Germany, University Politehnica of Bucharest and CITST, INSA Lyon and La French Tech One Lyon-St-Etienne.
2. Make a survey of the expectations of companies involved in the target technology and/or its applications regarding future graduates in terms of skills and competences.
3. Build a pedagogic team composed both of industry experts and academic researchers, all with a strong experience and background in the target technology and/or its applications.
4. Collect, from the national corporate partner which co-organises the seminar, proposals of projects to be performed by a student team in tight collaboration with the company staff.
5. Select students from the four academic partners registered in high-level master programs in computer science, information technology, cybersecurity, and robotics, considering their academic record, and their motivation for the topic and the philosophy developed in the seminar (5 students were selected in each of the 4 academic institutions).
6. Compose the international student teams (5 students per team; at least 1 student from each academic institution in each team), considering their background and personal record.

All seminars were one-week long. Each day consisted of three or four blocks, or sessions. Each block was either an interactive lecture session or a project session. Blocks were separated by lunch meals and by coffee breaks. Usually, the last block in each day was dedicated to project work, developed by the students in international teams, and in interaction with their project mentors (both academic researchers and company experts). The first block on Monday was reserved for the introduction of the seminar week, for making acquaintance of the participants, presenting project topics, and building international student teams; while the last blocks on Friday were dedicated to the presentation of their project work by the students, to the awards ceremony and to closing speeches. The slides used by the speakers, as well as the recordings of most sessions were uploaded to the FIT Europe Multimedia Library<sup>2</sup> after each seminar, together with short introductions of the speakers.

Each interactive lecture session was led by a speaker from academia or from industry, and addressed a specific subject related to the topic of the seminar. The objective of such sessions was to offer a variety of talks to students, given by leading specialists in their fields, as well as to raise questions related to the societal impact of the targeted technology.

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<sup>2</sup> <https://library.fit-europe.eu/>

Project sessions were organised in international teams of students, with between 4 and 7 students in each team, depending on seminar. In each seminar, each team needed to develop a solution to a question put forward by academics or by industry partners. The output of the project work was a presentation by the team, in the last day of the seminar.

We experimented a lot of variety between the seminars regarding the organization of project work.

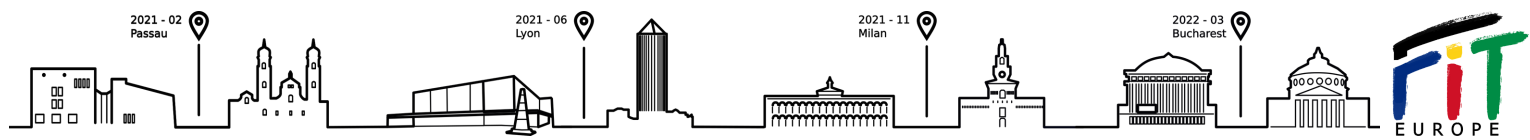
In the Passau seminar, 5 teams of 4 students each answered controversial questions related to Big Data, such as “Data-driven sustainable development: possible or utopic?”. In the Lyon seminar, 4 teams of 5 students each presented solutions to problems posed by start-ups working in Blockchain e.g., “Elaborate a benchmark of blockchain-based decentralized exchange architectures for securing and tracing financial transactions” (Equisafe). In the Milan seminar, 4 teams of 7 students each designed technological solutions addressing real-life projects proposed by Engineering Ingegneria Informatica S.P.A. e.g., “Enjoy green vehicle while preserving privacy in the age of 5G or NFT TOKEN and IoT”. And in the Bucharest seminar 5 teams of 4-6 students discussed questions such as “Are robots better fit for the future than humans?”.

An expected event which strongly affected the seminars was, of course, the COVID-19 pandemic. Thus, though all seminars were originally planned in face to face mode, only the last two of them (Milan (IoT, privacy) and Bucharest (robotics, assisted living) could be actually organised in the premises of the hosting university<sup>3</sup>. The first two (Passau (Big Data, ethics) and Lyon (Blockchain, entrepreneurship)) had to be organised online.

Next sections present more in detail the four seminars, along with the lessons learnt.

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<sup>3</sup> It should be noticed that, due to travel restrictions, some industry experts and academic researchers were not allowed to travel abroad and therefore had to participate online.



### I.3. Seminars' Description

#### Seminar 1 – Passau – Big Data and its ethical/societal implications – “Should data rule tomorrow’s world?”

Due to the COVID-19 pandemic, the first FIT Europe seminar took place online, in February 2021. Enabling interaction and networking among people who had never met in real life, who came from all over Europe, and who were diverse in terms of profile (students, academics or professionals from industry players) was a challenge in the middle of the COVID-19 pandemic. The seminar was initially supposed to take place at the University campus in Passau, where visiting students and professionals would have been welcomed and accommodated for the duration of the one-week seminar. But as the COVID-19 pandemic progressed, new scenarios had to be envisaged, leading also to hybrid solutions depending on the various countries’ limitations: for instance, whereas in Passau, everything had to be digital as students were not allowed to come to the Campus, participants in Lyon could gather in a meeting room at INSA and collectively attend (with masks and respecting social distance) the online event – in a hybrid format.

In order to ensure the participation, as well as the engagement of students, in a remote setup, a variety of online communication tools were used: Zoom<sup>4</sup> was used for the interactive sessions led by speakers; Wonder<sup>5</sup> was used for the ‘fireside chat’ meeting in the first day, and students used a variety of tools to organise their project work, e.g. Discord<sup>6</sup>.

Indeed, the FIT Europe Passau Seminar was not a usual academic meeting, where students exchange with other students and academic professors, but a one-week package of training on various issues related to Big Data, Machine Learning and Artificial Intelligence, and their impact on society addressed by various professionals. The participants acknowledged this particular feature and there was a resounding success. As the development of data will be a future issue affecting not only the field of the technological development of artificial intelligence and computer science, but the whole society, the Passau seminar was built so as to provide students not only with technological skills related to the latest innovations in artificial intelligence and big data, but also with “soft skills”, through the inputs provided by experts in law, in humanities as well as in human resources and in the development of business strategies. It followed an innovative and interactive format that combined presentations including a real exchange and debate between students and experts.

Thanks to this diversity of approaches, a lot of different fields and questions were discussed, hence widening the academic approach usually offered to computer science Master students, and opening their knowledge and skills to ethical, societal, legal, and even business and human resources management issues. In all, a total of 11 speakers interacted with the students, over the course of 8 blocks.

<sup>4</sup> Zoom – Video Conferencing, Cloud Phone, Webinars, Chat, Virtual Events. <https://zoom.us>

<sup>5</sup> Wonder – Host Virtual Events that Leave You Energized. <https://www.wonder.me>

<sup>6</sup> Discord – Your Place to Talk and Hang Out. <https://discord.com>

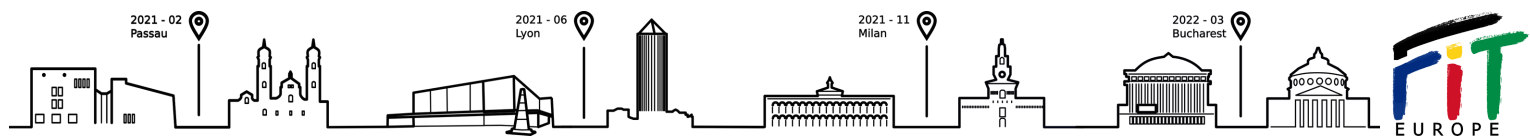
Gathered in 5 international teams (each team included one student per participating higher education institution), participating students also worked the whole week to develop a project answering the overarching seminar question of “Should Big Data rule tomorrow’s world?”. For this task, the students were not left alone: each team was helped by a pair of two “mentors” who guided them in their project. These mentors included academics from the 4 participating institutions and experts from ATOS and La French Tech One Lyon St-Etienne, the two industry partners deeply involved in this seminar. The five project topics were:

- Data-driven sustainable development: possible or utopic?
- How do filter bubbles influence people’s opinions during the corona pandemic?
- Is Digitization a Poisoned Gift for the Environment?
- Power to the People: Big Data for Government Transparency
- A Data Immunization Program

At the end of the week, all students’ teams presented their work in front of the FIT Europe participants in a friendly and joyful atmosphere. A jury comprising researchers and experts from external universities and companies assessed the team works on the last day of the event.

This seminar demonstrated the pertinence of the methodology and of the model of seminar FIT-Europe proposed e.g., mixed pedagogic team (industry experts, academic researchers); addressing both technology fundamentals, technology applications, and societal and environmental impacts of the technology; integrating international team projects. It served as a reference for the next seminars.





## Seminar 2 – Lyon – Blockchain & Innovation for Digital Society

Held in June 2021, the second FIT Europe seminar was focused on the topic “Blockchain & Innovation for Digital Society”.

The key objectives of this seminar were four-fold: (i) increase the knowledge and expertise of participating students in blockchain (concepts, technology concepts); (ii) allow students to exchange with industry experts and academic researchers about the business and application opportunities offered by blockchain as well as its societal and environmental issues; (iii) allow students to experience and “feel” the life of a start-up and create the conditions for students and start-up staff to exchange and work together, through projects proposed by the start-ups, so as to raise students’ awareness about entrepreneurship, innovation, and start-up creation; (iv) develop intercultural mindset among the students.

Though originally planned in face to face mode, due to COVID-19 restrictions, the seminar had to be carried out online. With one year of experience of distance learning and remote work, members of the pedagogic team and students were used to practice videoconference and collaboration tools. However, the challenges were, in the specific context of this seminar, much harder than in “classical” settings: (i) students did not know each other and had various cultural backgrounds and skills; (ii) they had to work as a team on a complex challenge ; (iii) they had to exchange with the start-up staff; (iv) one of the objective of the seminar was to “embed” them in the start-up to discover and live the life of a start-up, which was not actually any more possible as expected.

To address these challenges:

- We developed a program of online social activities (online challenges, quizz, games...)
  - We leveraged the collaboration tools and features proposed by Glowbl, a Lyon start-up
  - We rearranged the schedule of the seminar so as to dedicate regular time slots to the exchanges between the start-up staff and the student team, and so create a strong link between start-up staff and student team
- Once the decision to held the seminar online was made, we followed the 6-steps preparation process described above (section I.2.).

First, start-ups were selected by La French Tech One Lyon-Saint-Etienne, Lyon corporate partner which co-organised, along with INSA Lyon, this seminar.

La French Tech One Lyon St-Étienne leveraged its unique network of start-ups to select a set of 4 of them, both very innovative, at different stage of their development, and motivated to participate in the seminar and welcome student teams in their premises (remember the project was planned to be held in face to face): Equisafe, Kresus, iExec, and AiTenders.

Second, a series of meeting was organized in order to collect, aggregate, and synthesize the expectations of the start-ups regarding future graduates’ skills and expectations. We refer the reader to a paper written within the project and that acts as a global state **[1]** of the art and to another paper specifically focused on key competences for future IT leaders which includes an analysis of this survey **[2]**.

15 skills were particularly underscored by start-ups: strong learning ability, constant technological watch, fundamental scientific and technological competences, knowledge and mastery of technological standards, critical thinking, ability to understand strong trends, ability to understand weak signals, curiosity, global and transversal understanding, ability to work in a team, flexibility and agility, practical experience and implementation skills, ability to seek information, being resourceful, and finally, ability to integrate and participate in a new community.

Based on these expectations and the core objectives of the seminar, we built the pedagogic team. The team was composed of both very high-level industry experts and internationally-recognized academic researchers. Our aim was indeed to propose an advanced programme addressing both theoretical fundamentals, advanced technology, open scientific issues, applications, and integration of blockchain technology in corporate information systems and complex digital ecosystems. For this purpose, we needed a rich pedagogic team mixing talents from all the stakeholders of the blockchain ecosystem.

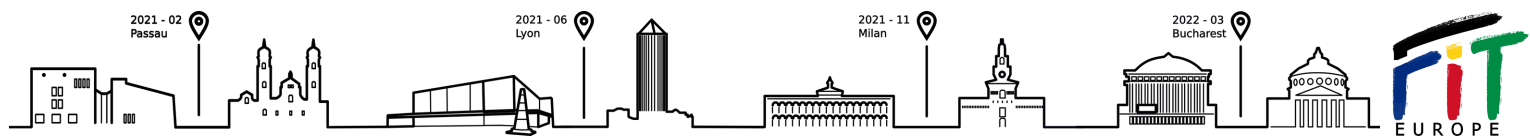
The size, composition, and diversity of the consortium allowed us to identify high-level industry experts and scientists from the consortium but also outside the consortium, so as to build the both advanced, in-line with target skills and competences (see above), and balanced program we intended to propose [3].

The program of the seminar was composed of three types of activities.

The first activity was high-level scientific keynotes on the technical and fundamental aspects of the blockchain given by academic and industrial experts in order to provide students with strong scientific bases. The second one consisted of presentations given by industry experts (from company of various sizes, from start-ups to large companies) that dealt with the actual implementation of blockchain, its integration in complex digital ecosystems, and application domains of blockchain technology, so that students could understand the actual business impact of blockchain and the issues to be addressed in order to integrate blockchain in an already existing ecosystem. These two activities were held every day, in the morning and beginning of the afternoon.

Finally, the third activity consisted of four projects ("challenges") proposed by the four start-ups selected by La French Tech One Lyon-St-Etienne. These challenges were addressed by international student teams (5 students per team; at least one student from each academic institution):

- Assess how Distributed Ledger Technology (DLT) can be leveraged in order to secure and trace the exchange of data and information between authorities and contractors, and compare and assess existing solutions (proposed by AITenders)
- Study how blockchain technology can be used to model and operate IoT-based sensitive applications (proposed by iExec)
- Study the relevance of blockchain technology to support the management of invoices and payments and, more generally, the financial relationship between a customer and a supplier, and propose a target support infrastructure (proposed by Kresus)
- Elaborate a benchmark of blockchain-based decentralized exchange architectures for securing and tracing financial transactions (proposed by Equisafe)



Time slots were dedicated every day to the exchanges between the start-up staff and the student team, so as to create a strong link between start-up staff and student team.

These projects actually allowed students:

- intensively exchanging over the seminar week with start-up technological experts, start-up CEOs and CTOs, and actually participating, during one week, in the life of the start-up they were assigned to
- addressing scenarios and issues actually faced, at the time of the seminar, by the start-ups
- improving their intercultural skills, as projects were performed as international teams.

Beyond the study of the projects, students and start-up staff had the opportunity to talk together about the qualities required to create a start-up as well as the important steps in the process of starting a new business, and the issues to be addressed.

Throughout the seminar, participants had the opportunity to meet and network in a virtual coffee room on Glowbl<sup>7</sup>. The platform, laureate of the “Scale-up Excellence” programme supported by La French Tech, offered us more than a typical digital seminar. Indeed, students and experts could virtually navigate between rooms in which they could participate in discussions around different tables just like if they were attending an in-person event. This innovative videoconferencing tool enabled networking among people located all over Europe in a period in which traveling was not possible.



On the last day, the students' teams presented their project to the FIT Europe participants. After the presentations, a time was dedicated to debriefing and discussions when students and experts debated on a variety of topics, such as the future of blockchain, technology's sustainability, or the start-up ecosystem. It is noticeable that, in a survey conducted at the end of the week, 50% of the participating students declared that they consider creating or participating in the creation of a start-up in the next years, while only a few of them had this intention at the beginning of the seminar. This illustrates the important impact of the exchanges between start-up collaborators and students, and of the seminar as a whole, on the student's vision on innovation and start-up creation.

For more details about the methodology we followed and the lessons learnt, we refer the reader to the paper we wrote and published based on the experience of this seminar [3].

<sup>7</sup> Glowbl. <https://www.glowbl.com>

## Seminar 3 - Milano - Preserving Privacy and Trust in IoT

In November 2021, students from the four countries participating in the project (i.e., France, Germany, Italy and Romania) met together in Milan in order to attend the 3rd seminar, which was focused on the topic “Preserving Privacy and Trust in IoT”.

The Milan seminar involved 35 students and was the first one where they had the opportunity to interact in presence, since, due to the COVID-19 pandemic, the previous seminars had been provided remotely. Like Passau and Lyon seminars, this seminar aimed to support the same 4 objectives (see Section I.1.) and its preparation followed the same 6-step methodology, that we developed in the analysis of the first two seminars. Therefore, in order to avoid redundancies, we focus in this section on the specific and topical features of the seminar.

As in the previous weeks, the seminar was organised with the goal of advancing students' competencies and soft skills by making them participate in scientific keynotes given by academic researchers and industry experts on scientific and technical issues related to Internet of Things.

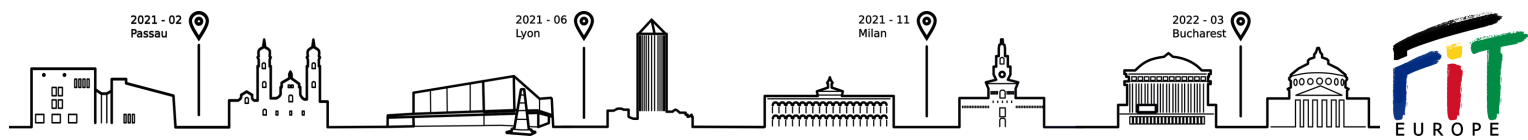
In addition, presentations were provided by company research teams, where practical issues related to the implementation of IoT-based solutions and use-cases were analyzed and discussed.

Throughout the week, discussions were raised on the target societal issue of the seminar, i.e., the preservation of privacy and trust. These discussions addressed both examples of situation where privacy and trust were at stake, risks generated by IoT-based solutions regarding privacy and trust, and possible solutions to identify and mitigate these risks.

Finally, students had the opportunity to cooperate in the solution of some challenges, related to the application of IoT solutions to real case studies, working in international teams (see below).

Every day, students participated in 2 or 3 sessions focused on different topics related to IoT fundamental concepts and the deployment of IoT-based solutions. Most of sessions dealt with the problem of addressing security and privacy concerns for IoT in different contexts, through multi-agent systems, when interfacing with augmented reality, or in collaborative learning. Security of some IoT devices was deeply analyzed, as in the case of smart assistants such as Alexa. The other sessions addressed the application of IoT in different scenarios, such as assisted living, smart cities, and blockchain-based trust management. In addition, as in all FIT Europe seminars, questions about ethics and legal aspects of IoT deployment were presented and discussed among participants.

During the entire duration of the seminar, the second part of the day was characterised by the active involvement of students in a sort of role-playing game to test their problem-solving skills by applying the academic notions acquired, and searching for new ones among the sources available on the web. The students had been previously divided into four teams associated to specific colors (orange, blue, green, red) and before the seminar had been solicited to study some specific topics in IoT, such as Blockchain, Security and Machine Learning (ML) to be ready for the shared work activity (pointers to online materials had been shared among the participants).



Four use cases inherent to the previously mentioned topics were presented by three experts of Engineering Ingegneria Informatica (the Italian corporate partner which co-organised, along with University of Milan, the seminar) and student teams were asked to work and prepare a presentation where each team could describe its findings and the proposed solution to solve the question presented in each use case. Specifically, the use cases titles were:

- Federated Machine Learning Challenges in IoT.
- Atomic Swap Privacy Preserving
- Enjoy green vehicle preserving privacy in the age of 5G
- NFT token and IoT

During the entire study and preparation period, each team met in separate rooms, having the opportunity to openly discuss and interact with the experts to get suggestions and share possible solutions. On the last day, each team chose one or more representatives to present their work and answer questions from the experts and professors as if it were a standard review phase for a European project. At the end of the presentations, the experts and professors gathered to decide the winning team in light of all the excellent presentations. The winner team was selected for the goodness of the paper, presentation and ability to support their arguments. The team was awarded during the final ceremony with a certificate as "Best project of the seminar".

At the end of the seminar, the students and the FIT Europe team scheduled the participation to the next seminar in their agenda that will be held in March 2022 at Politehnica Bucharest.

Like for all FIT Europe seminars, as final output of the week, all the materials including the registrations of the presentations have been made available on FIT Europe media library, that represents one of the final products of the project.

In summary, students were successfully involved in a rich program, being deeply involved in passionate technical discussions, and enjoying the possibility to share an international and multi-cultural environment, where future they could discuss under different points of view, fully achieving the objective of the FIT Europe programme.

For more details about the methodology we followed and the lessons learnt, we refer the reader to the paper we wrote and published based on the experience of this seminar [4].

## Seminar 4 - Bucharest - Integrating Assistive Robots in a Multicultural and Multigenerational Society

Beginning March 21th, students from INSA Lyon (France), University Politehnica of Bucharest (Romania), University of Milan (Italy) and University of Passau (Germany) were immersed for a week in the field of assistive robotics through the fourth FIT Europe seminar.

During this seminar, the 28 participating students addressed the topic of "Integrating Assistive Robots, in a Multicultural and Multigenerational Society".

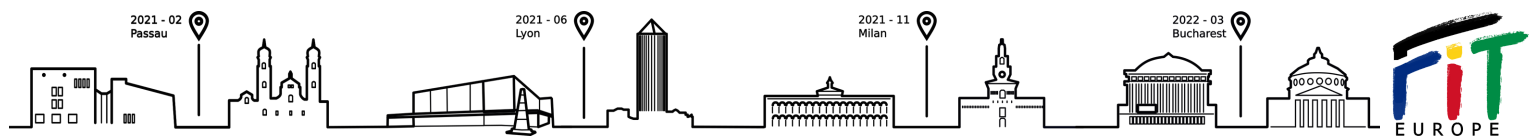
As previously, we aimed at the same set of global objectives and followed the same pedagogic methodology.

Students, researchers and industrial experts discussed about the challenges faced by the integration of robots in a human environment (navigation, interaction, person/object recognition and detections, integration), the different perspectives on what the role of robots should be, how robots should behave, the different levels of acceptance towards robots and the different levels of understanding of how a robot works.

In addition, discussions took place about what it can be expected from a robot, about security, privacy and ethical issues, intelligent automation as well as about recycling and recovering of materials used in robotics and electronics in general.

An examination of the role of assistive robots in a society where generations and cultures meet and mix occurred.

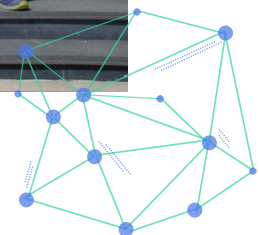
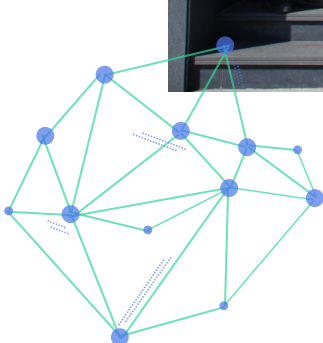
All the students were physically present in the UPB campus during the seminar. The participation of the researchers and industrial experts was hybrid: some of them were physically present in the UPB campus, some of them participated digitally. The researchers and industrial experts from France, Germany, Italy and Romania conducted high-level presentations that enriched the knowledge of the participating students in the field of assistive robotics. In addition, the students enriched their skills by participating to the development of a navigation module for a custom ant robot, built by a researcher at UPB and by visiting the AIMAS laboratory at UPB where they met Pepper, Nao and Baxter robots and took a close look on the projects in which the laboratory is implicated.



As earlier mentioned, FIT Europe is meant to facilitate and support interactions and collaboration between international students from different universities. At the beginning of the seminar, several controversial topics were proposed as challenges for the students. Students organised themselves in 5 teams and each team picked a controversial topic they worked on during the seminar. In the last day of the seminar, each team presented its work and conclusions. This opportunity allowed the students to work in international teams, to develop intercultural skills, and to develop their own points of view regarding current controversial subjects. The selected topics were:

- Are robots better fit for the future than humans?
- Can one be a fan of a robot football team?
- Can we let robots autonomously make important decisions, which concern humans?
- Reasoning about ethical issues in designing assisted living robots.
- Robotic Revolution.

Throughout the seminar, students from each team worked on the controversial topic that they selected and on the last day, each team presented their project to the FIT-Europe participants. The work of the five teams was high-level quality and exceeded the expectation of the jury. However, two teams showed a deeper address and better structure of their topics, and as such they were chosen as the best teams in this FIT Europe Seminar.



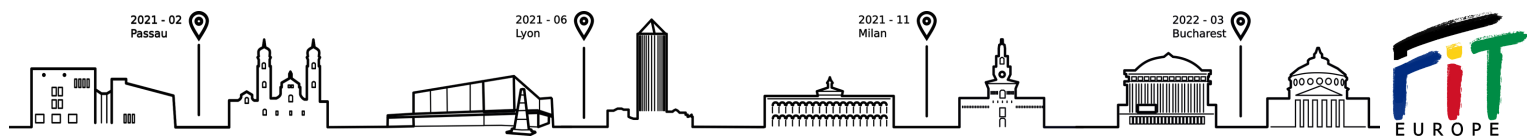
## I.4. Results

The key findings and the assessment the team can make of the project are related to the forward-looking methodology applied, the direct feedback obtained, and the created outputs. The success of the project is directly linked to the pedagogical approach of the four international seminars: the cooperation between academia and industry, the interdisciplinarity of the seminar programmes, and the international dimension of the seminars. Each Seminar was an immersive one-week training focusing on a hot IT topic, combining high-level scientific talks with advanced team projects assigned to the students, addressing cutting-edge technologies. Interdisciplinarity was at the core of the programme that dealt not only with technical issues but also with industrial, ethical and legal issues. This three-year cooperation points out the importance of integrating industry and entrepreneurship to academic curricula, within an international context.

A survey is in preparation to evaluate the impact the seminars had on the students over the medium and long-term. But focusing on the anonymous questionnaires created to gather and analyze the student's feedback immediately after the seminars, we can draw the following conclusions. The students all learnt quite a few or even a lot of things both in the technical field (up to 75% depending on the seminar) and in the ethical/societal field (up to 83% depending on the seminar). It is a success as one of the aims of the project is to remedy to the lack of training on these subjects in standard IT curricula. Our goals regarding intercultural interaction were also achieved in a great measure: 50% of students stated that they spent their leisure time, during the in-person seminars, mostly or entirely with students from other universities. In such seminars, the networking opportunity is of course one of the main interests for the participants. Most of the students answering our survey found the networking possibilities between students enriching and even very enriching (up to 83% depending on the seminar). They answered nearly as positively about the networking possibilities with experts (up to 75% depending on the seminar). Up to 66% of students thought the quality of the sessions was very good or excellent (depending on the seminar). To sum up the opinion of the students, they affirm that it is a good opportunity not only for research and academic purpose, but also for all people interested in international cooperation, leadership and ethic.

Furthermore, long-term positive impacts of this project are expected thanks to the FIT Europe multimedia library. It contains most of the material which was presented or discussed during the four seminars e.g., the slides of all the lectures and project presentations, as well as the video and/or audio recordings of the sessions. Each speaker is introduced by means of a short bio and a profile photo. This library is built using open-source technologies and is underpinned by the Moodle e-learning platform.

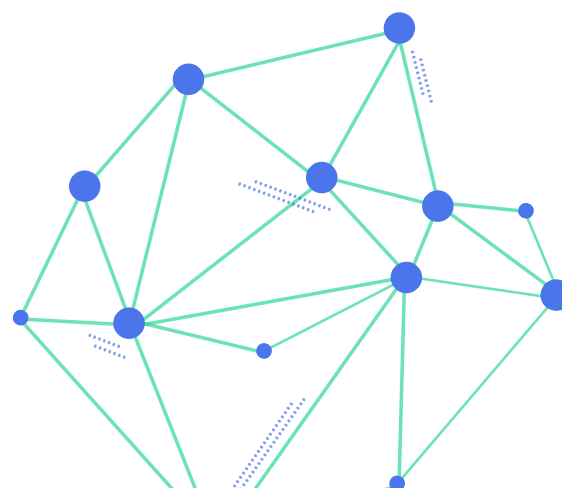
Finally, the methodology which was elaborated, the results obtained, and the lessons learnt can be generalised and transferred to various contexts, thus supporting technological innovation awareness to academic curricula and fostering industry/academy and international cooperation. They also allow elaborating recommendations for all higher education stakeholders i.e., higher education institutions and academic staff, socio-economic actors, policy makers and accreditation bodies.



# Section II - Recommendations

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**Designing and Implementing Academic  
Programs Supporting the Transition  
towards Multicultural, Innovative, and  
Humanist Digital Europe**



## Recommendations for Academia

Based on the experience the consortium gathered all along the FIT-Europe project, we make below 3 key recommendations for designing and implementing innovation-driven academic curricula for future IT experts addressing the opportunities and the challenges raised by the transition towards a digital European society.

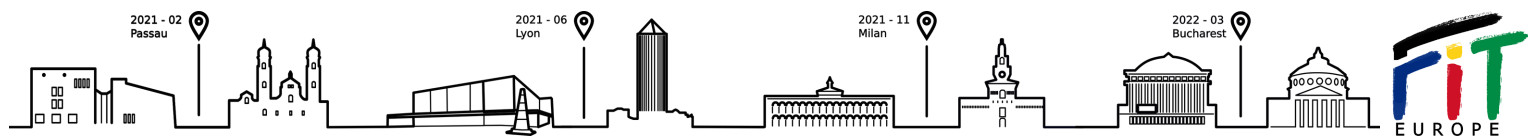
**1. Think global and multicultural, learn with each other and from one another.** Higher Education Institutions ought to meet the needs and requirements of a connected, digital and multicultural society. Thus, they should adapt their intern strategies to fit in this global context:

- Open more programs to international students and strengthen the hard and soft skills of the students by creating integrated double or joint degrees.
- Integrate intercultural dimension into curricula. The goal is not to erase any cultural specificity but to offer the students the possibility to understand the rich and multicultural European environment in which they evolve.
- Create a strong and sustainable international network: exchange students, exchange parts of curricula, exchange scientific and administrative staff.
- Leverage distance and hybrid learning, develop and share open learning resource.
- Challenge and stimulate students by promoting team-work and collective learning.

**2. Foster innovation and broaden the spectrum of activities by including non-academic partners.**

Get a stronger impact for your project:

- Bring third party partners such as industries, civil society bodies, NGOs, authorities. Partners from different branches can indeed bring new insights, real use cases, application targets into curricula.
- Target third party partners which address cutting-edge technology and research, and their application
- Involve these experts into pedagogic activities like seminars, keynotes, labs, internships, academic competitions/challenges.
- Develop cross-disciplinary curricula: Integrate humanities, entrepreneurial skills and set a focus on societal issues (environment, economy, welfare, etc.)
- Connect to the start-up regional ecosystem: as the number of students who consider creating a start-up after they get graduated is increasing, raise the student's awareness about innovation, entrepreneurship, start-up creation, and offer the students the best opportunities to transfer their innovation and ideas into marketable products and services.



**3. Raise sustainable development and societal responsibility (SDSR) awareness.** To address SDSR, implement new set of skills and methods:

- Integrate complex long time-running team projects into curricula in collaboration with socio-economic partners. This white paper proposes a methodology (see Section I.2.) for designing and implementing such projects, which has proven, along the 4 FIT Europe seminars, to be very effective. If needed, it can be adapted to local operational specificities.
- Balance the learning of hard and soft skills and consider the students' feedback. A regular and systematic curricula/program evaluation allows measuring the impact of the curricula/programme and give the chance to improve its quality and relevance.
- Propose long-term projects in order to address complex challenges and complex systems and put the focus not only on technical issues but also on legal, ethical, environmental, and societal issues.
- Involve into the loop political decision makers as well as end-users of the technologies studied and developed. Their feedback and support are crucial to make any innovation truly sustainable and well-suited to the current and anticipated needs.

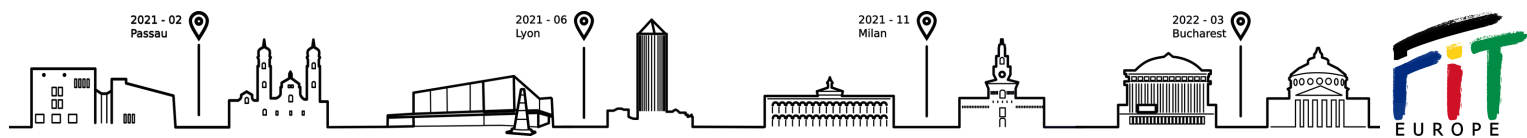
## Recommendations for the Industry

As outlined in our paper [2], today's interconnected world is requiring future IT leaders to demonstrate their ability to deal with the complexity of modern IT systems. The future of IT will be hybrid and governed by complex system requirements and complex multi-technological architecture. There will indeed be "no single tool" able to address all requirements and application objectives.

In this context, we cannot rely on academics alone for educating students. The industry has to step in and become involved in the students' education throughout their studies. The foreseen benefits are mutual and comprise complementing competences and knowledge, obtaining access to resources, broadening the scope of the innovation process, attaining critical mass to address complex projects, etc.

A number of recommendations are presented below which can support long-term partnership between academia and industry:

- Provide career talks directly to students and guest lectures to complement the academic curriculum and to raise both awareness and interest for the industrial environment. Also, organise field trips to companies and open-door events.
- Propose projects, labs, challenges, hackathons based on the use cases and topics actually addressed by the companies. Interact as mentors with the student teams.
- Propose internships in companies aligning their recruitment periods with the students' availability and dedicating staff for active supervision. Concomitantly, provide ideas for student projects and sponsor student project exhibitions.
- Provide access to specialist equipment and support acquisition of such equipment for the university departments.
- Become involved in academic advisory boards and in the curriculum design and quality assurance.
- Engage in joint nationally and internationally funded research projects in order to allow involved students to both improve their professional competences and knowledge as well as their communication and management skills.



## Recommendations for Policy Makers and Accreditation Bodies

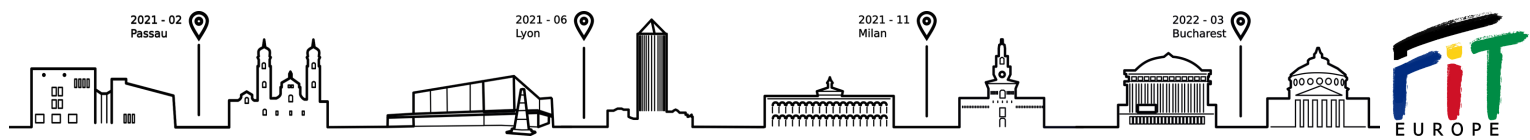
As a result of the activities carried on for the FIT Europe project, a number of key recommendations for policy makers involved in higher education and European cooperation can be made. Most of these recommendations are also valid for accreditation bodies.

The successful experience reported during the FIT Europe project, testified by the active and fruitful participation of the students and the involved speakers, suggests that similar projects need to be strongly supported. « FIT Europe like » projects contribute to the creation of an ecosystem where academics and researchers working in private companies can interact and combine their experience acquired in advanced research projects with the challenges faced when solutions need to be deployed to solve practical problems in a commercial perspective. All these considerations are enriched by the possibility to experience team working in an international context, bearing in mind that social and environmental challenges are to be faced from both local and global perspectives.

In this regard, accreditation bodies and policy makers have an important role to play by promoting key success factors which FIT Europe has allowed identifying, and by facilitating actions and supporting curricula that aim at leveraging and exploiting these success factors. We discussed below the most important of these key factors and describe how they actively contributed to FIT Europe success

- Creation of strong partnership among academic institutions and their socio-economic ecosystem, focused on appealing research and development topics. In FIT Europe, the way in which the consortium has been formed and the selection of seminar topics has created an interesting combination where academic and corporate worlds could collaborate on very stimulating R&D questions and issues on the edge of technology advancements.
- Possibility to work and study in an international context through the mobility of students and teachers. One of the goals of FIT Europe was to stimulate the interaction of young students in an international scenario. The participating students came not only from the four organizing countries, but also from other 15 nationalities that were involved in exchange programs with the hosting universities. The final results were of a rich and multi-cultural environment and inspiring interactions with very competent speakers. Creating such an international context is crucial for developing multi-cultural thinking, addressing challenges and complex questions under different perspectives, and enriching the students' intercultural, soft, and technical skills. It also showed its capability to create a strong and very positive dynamic among all participants (students, academic researchers, industry experts, administration staff)

- Focus on SDSR themes, including legal and ethical aspects. A starting point of the project was the observation that technological progress should also be balanced with discussion on the societal impact, addressing themes that are often left out of discussion. In all the seminars, the questions raising from inappropriate usage of the technology have been discussed and their influence on current and future life of the people evaluated.
- Creation of the framework to promote and support academy-industry educational networks. It is unusual in academic curricula to include in educational actions partnerships with researchers coming from R&D teams of companies, where research has a strong connection with practical applications. FIT Europe seminar weeks oppositely represent a successful example of educational cooperation between academia and companies.
- Raising entrepreneurship awareness and entrepreneurial thinking. Other than corporate participants, during the seminars, external speakers coming from the worlds of start-ups and spinoffs have been invited, and in some case they have included students in hands-on activities. One of the goals of these activities was educating motivated students to entrepreneurial thinking, showing what are the steps needed to create and develop a startup, and what are the activities they need to run in a commercial competitive environment. Experience of FIT Europe demonstrates that this goal can be achieved through the implementation of such activities
- Recognition of ECTS credits. FIT Europe seminars relied on participants' volunteering and motivation. Thus, students did not obtain any ECTS credits. As an experimental project, this was not an issue for any participating student. However, in order to scale, address large number of students, and move from an experimental logic to academic routine, accreditation bodies should encourage the recognition of the soft, scientific and technical knowledge and skills acquired in activities as those implemented in FIT Europe seminars (lectures, round-tables, challenges and projects, team work, controversies, etc.).



## Conclusions

The FIT Europe project aimed at contributing to strengthen the European Higher Education Area. It built a community gathering students, industry experts, and technology and social sciences researchers, with the goal to train graduate students who will be tomorrow IT leaders but also to build a group of excellence in this field.

Based on four pillars i.e., cutting-edge technologies and innovation, interculturality, academic-industry partnership, societal challenges/SDRS, FIT Europe developed a set of four seminars which addressed four key IT technologies for the future (Big Data analytics/Machine Learning, Blockchain, Internet of Things, Robotics) and discussed the business and societal opportunities they offered as well as their environmental and societal impact, the issues they raise (ethics, privacy, social inclusion, discrimination, digital gap, democratic and societal changes, technology acceptability...), and the solutions to address them.

To support the four pillars which build the philosophy of FIT Europe, the project's team developed a common methodology and leveraged a mix of activities: scientific, technical, and business lectures and labs given by academic researchers and experts; projects and challenges proposed by industry partners which focused on the application of cutting-edge IT technologies in use-cases and scenarios actually addressed by the companies and which were carried out by international student teams ; student team mentorship by academics and experts; “embedding” of students into start-ups ; societal controversies discussed in international teams; round tables; and interpersonal exchanges.

Their success demonstrated that such seminars could go far beyond traditional pedagogic activities and student exchanges by creating a hub of collective intelligence where all participants could learn from their exchanges, foster their intercultural mindset and entrepreneurial thinking, develop accurate understanding of the opportunities but also of the societal and environmental issues raised by emerging IT technologies and solutions to address them.

This collective intelligence was made possible thanks to the diversity and expertise of the participants: academic researchers, industry experts, students; from more than 15 countries; from 4 European academic institutions; participating in various master programs; with different background, experience and expertise; from different domain (IT development, computer science research, social sciences, human resources, business management...) and different types of entities (academia, multinational and national companies, SMEs, start-ups, scale-ups...). This unique diversity brought to the seminars a very large spectrum of knowledge, experience and competence; but, even more important, it allowed students, and all participants, to benefit from a very large diversity of points of view, insights, and visions for the future.

This project can be seen as a living experimental lab which explored a new way of thinking European Higher Education Area as such a unique hub of collective intelligence. The success of FIT Europe demonstrates how academic programs, especially those which deal with advanced technology and innovation, should build on such a hub to train today's students who will be tomorrow's leaders who will conduct the digital transition. This is the condition to achieve a multicultural, innovative, inclusive, humanist digital Europe.

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