PILOTING FASHION-TECH EDUCATIONAL STRATEGIES

PROOF OF CONCEPT FOR INNOVATIVE FASHION-TECH PRODUCTS AND SERVICES

edited by
Daria Casciani, Chiara Colombi

FTalliance

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FT*alliance*

FTALLIANCE
Weaving Universities and Companies
to Co-create Fashion-Tech Future Talents

THE CONSORTIUM FTalliance

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This publication is the result of a didactic research process involving students, teaching staff and industry experts from across Europe in three (3) learning experiences implemented over a period of almost one year (2021-2022). It aims to identify and describe the major lessons learned from the testing and piloting of three innovative Fashion-Tech learning experiences in order to discuss opportunities for Fashion-Tech (i) Strategic Innovation, (ii) applied Research for the future Education Agenda and (ii) cooperation, networking and partnership opportunities.

The work has been organised and synthesized by Politecnico di Milano as leader of the activities related to designing and piloting Fashion-Tech learning experiences (WP2), and project coordinator of the Fashion-Tech Alliance, a 3-years European academia-industries partnership project aimed to facilitate the exchange, flow of knowledge, and co-creation within the Fashion-Tech sector to boost students' employability and fashion-tech innovation potential. This project specifically involves five renowned Higher Educational Institutions Academic partners (Politecnico di Milano, Dipartimento di Design, ESTIA École Supérieure Des Technologies Industrielles Avancées, Högskolan i Borås, University of the Arts London - London College of Fashion, Technische Universiteit Delft), one Fashion-Tech research Centres (Centexbel) and seven industrial partners (Decathlon International, Pangaia Grado Zero, Pauline van Dongen, Pespow, Stentle / M-Cube Group, We Love You Communication, and PVH Europe). The aim of this project is to provide an evidence-based perspective on the Fashion-Tech education reporting on the relationship between advanced teaching/learning approaches about design, business management, and engineering that can be applied to the future generation of fashion-tech professionals.

This publication consists of five chapters presenting the learning experiences' workflow starting from the research premises, the implementation, and evaluation, followed by a reflection on the results with concluding remarks and future perspectives on Fashion-Tech education. Chapter 1 sets the premises of the Fashion-Tech educational research, meanwhile, the following chapters (2,3,4) present the case studies of the three piloted learning experiences describing the contents, objectives, and outcomes, reporting the methodology and lesson learned in terms of Fashion-Tech emerging topics, and reflections on the phases of the didactic experiences. Each of these chapters is followed by visual charts that present the results showcasing the portfolio of innovative Fashion-Tech concepts of products/services developed during the learning experiences. Finally, chapter 5 sets out the findings and future trajectories for Fashion-Tech education and collaboration. It discusses how the research findings led to setting the premises for prospective scenarios of the Fashion-Tech education, which serve as an invitation to open a collaborative discussion on the future of Fashion-Tech educational models, collaborative engagement between different stakeholders of the sector, and all concerned about the skills of future Fashion-Tech professionals.

This publication contains the deliverable D2.2 Proofs of Concept for innovative FT products/services, in fulfillment of the European Project FTalliance Weaving Universities and Companies to Co-create Fashion-Tech Future Talents (612662-EPP-1-2019-1-IT-EPPKA2-KA - FTall).

5. FASHION-TECH FAST FORWARD FUTURES

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This publication gives an overview on the importance of evolving the educational models in the Fashion-Tech field. These are proposed in order to nurture and prepare future fashion-tech professionals with the necessary strategic and systemic open-minded attitudes, along with soft and subject-specific skills which can be influenced by external input and which enable them to govern the changes that the sector is undoubtedly driving. Stemming from the literature review and also benefiting from the evidence provided by the applied case studies about Fashion-Tech learning experiences, this publication describes the essential features and opportunities of Fashion-Tech educational model focusing on:

- **Multi-Inter-Transdisciplinary collaborations and connections facilitation** between Higher Educational Institutions, Companies and Research Centres in the Fashion-Tech field. Facilitating the interchange between industry professionals, technicians, scientists, researchers, students as well as educational staff from various disciplines (applied sciences such as design and engineering, social sciences and natural sciences) in research and education projects;
- **Experimentation with digital transformation and sustainability.** Knowing how to apply these two transformations with a critical, transparent, and ethical perspective to the work, giving the students the ability to position themselves in a critical and reflexive way.
- **Sharing knowledge and skills on theoretical, methodological and empirical research** as a base for providing both a clear understanding and tools to explore the Fashion-Tech context and its implications for the fashion industry at large

Being a fluid and fast evolving field, Fashion-Tech has an intrinsic need to continue the dialogue between different actors on the implementation of the future of the sector. This is indeed to allow the exchange of information that contributes to current and future Fashion-Tech education. Accordingly, Fashion-Tech education should be nurtured by research in the realm of sustainability fashion and technology/digitization, by developing research programmes that share the same essential feature of transdisciplinary collaboration through theoretical, methodological and empirical approaches.

5.1 LESSONS LEARNED FROM THE FIELD: FASHION-TECH STRATEGIC INNOVATION AND APPLIED RESEARCH FOR EDUCATION AGENDA

The Fashion-Tech Strategic Innovation and Applied Research for Education Agenda focuses on two elements inform each other: (i) future perspectives of Fashion-Tech research and Innovation topics; and (ii) future perspectives in Fashion-Tech educational models. In the paragraphs below, the skills empowering future Fashion-Tech professionals are also highlighted.

Future perspectives of Fashion-Tech research and Innovation topics
Elaborating a comprehensive Fashion-Tech ontological definition
As emerged from the literature review about the sector and from the , implementation results of the learning experiences, Fashion-Tech is a multi-perspective sector that grows rapidly pace as technologies do with a fragmented and transdisciplinary domain of knowledge. Because of the complexity of the field, a comprehensive overview of the possibilities and opportunities both in terms of research and education is missing. Therefore, it is evident that a crucial part of future research could explore a more detailed ontology of the Fashion-Tech field, deeply understanding the different terminologies that have been used and examining deeper implications and the relations among the different topics and disciplines. This critical reflection on the widest perspectives of the field in research terms is deeply important to reflect it inside the curricula, understanding where to drive the educational models and pedagogical approaches both in instructional and organisational terms.

Next innovation trajectories and unexplored pathways of research and education
The three learning experiences have generated insights that would inspire specific research topic in the main investigation areas of the Fashion-Tech. These have been developed into case studies.
In digital and virtual fashion transformation, there is a need to explore (i) the relations, between the physical and digital realm and their implications in terms of meaningfulness, logistics and technological and manufacturing challenges emerging from the development and delivery of phygital solutions; (ii) Business Models and innovation strategies related to new product/service/systems elaborated in the digital and phygital fashion dimension; (iii) the holistic perspective of the sustainability of virtual fashion products/services; (iv) the communication and servitization phenomena with its implication in technological, business and customer-

related perspectives; (v) elaboration of streamlined processes of virtual fashion defining tools and methodologies, and negotiating simplification and complexity according to the desired outcome.

As garments become more intelligent, such as communication agents and data platform and collectors, more research is required for the ethical concerns they raise in data management, transparency and legislation along with other social issues related to culture, identity and education, to ensure positive sustainable values and behaviours. Further research and experimentation is needed to discover a truly essential day to day application for wearable technologies, or to define a sustainable interaction including strategies related to circular economy (shared ownership, rental and repair, modularity). In this regard, two research and education elements are crucial: (i) a reality check and anticipation of use and meanings *(Krippendorff, 1989)*, and (ii) user involvement during the project implementation, particularly at the early stages of idea generation and concept design. In a smart wearable it is very important to drive research with a user-centered design *(Norman and Draper, 1986)*, human-centered design *(IDEO, 2015; Hanington, 2010)* and user interaction design *(NNG, 2022)* approaches to challenge established sociotechnical imaginaries, and to gather insights to exploring users' ns and unintended uses and behaviours. This allows us to evaluate solutions, even at the early stages, and to measure each solution's impacts. This is important to consider the utility, relevance and sustainability of design and research outcomes. Hence, anticipatory competency are required as the ability to understand and evaluate possible, probable and desirable futures while creating one's own visions which take into account the consequences of actions, and to deal with risks and changes.

Boosting Sustainability critical reflection
Education on sustainability should be positioned at the forefront of research and educational projects, guiding the development of all Fashion-Tech solutions. This should be done with a holistic perspective encompassing cultural, social, economic and environmental consideration. It is suggested that students, teaching staff and researchers become more aware and also more critical about the case studies they are inspired by but also from the implications of their ideated Fashion-Tech solutions. A real sustainability check should be included in research and educational activities, by providing assessment tools and dedicated exercises to boost critical thinking competencies as the ability to question norms, practices and opinions inform decisions and evaluations and take a position in the sustainability discourse. A possible platform is FashionSEEDs *(2022)*, aiming to provide a series of learning materials and toolkits about what

to teach, and how to teach through the discipline of Fashion Design for Sustainability.

The goal is to boost integrated problem-solving competency, an overarching analytical and critical ability to understand and solve complex sustainability problems and implications, boosting research skills in risks, barriers, criticalities, limitations' identifications, in order to develop a viable, inclusive and equitable solution.

Future perspectives of Fashion-Tech Educational models
Critical reflection and problem definition
Fashion-Tech pedagogical approaches need to boost students' attitudes inside the Fashion-Tech context, by detailing the problems and issues they are facing and also specifying all aspects of the delivered Fashion-Tech solutions (i.e. product, services and systems). Therefore, specific tools should be delivered during their project path to guide and increase the granularity of research and idea generation processes from general to specific aspects, thus grounding solutions. At the same time, students should be guided to abstraction and scaling activities, from the particular solution they have conceived to creating links and connections with a systemic thinking approach. In both the processes, students need to achieve the ability to recognize and understand relationships, to analyse complex systems, to perceive the ways in which systems are embedded within different domains and different scales, and to deal with uncertainty.

Collaborative Digital education
The concept of online education is a key component of 21st-century education. Digitalization of learning experiences is important for the expansion of students' knowledge in a more accessible and inclusive way, facilitating virtual distance learning, mixed learning, and distribution learning *(Suhartini et al., 2020)*. However, some limitations occur in terms of technology associated with socioeconomic privileges *(Barbour & Revees, 2009)* and reliability, internet access and digital divide of certain areas of the world. On the other side, digital education can help students learning-by doing the implications of digital technologies that they will use in their future profession in a more and more digitised fashion sector, both learning specific digital and virtual tools (e.g. CAD systems, on-line platforms, VR/AR/MR environments) but also aiming to elaborate critical reflections about opportunities and limitations. Collaborative digital education should boost collaborative competences by enhancing the ability to learn from others, understanding and respecting the needs, perspectives and actions of others from different backgrounds, dealing with conflicts in teamwork and facilitating collaborative and participatory problem-solving activities.

Therefore, the educational system needs to transform its courses with the use of Collaborative Virtual Prototyping (CVP) activities through the implementation and testing of e-learning platforms that can articulate digitally a collaborative project between all actors involved in the design/prototyping phase of a new collection (product managers, designers, pattern makers, marketing personnel). CVPs processes could enable the integration of remotely located 3D CAD systems, virtual fabric libraries, 2D CAD/CAM systems for the exchange of multimedia content (2D patterns, fabric data, etc) to encompass the design, prototyping, marketing phases. A preliminary version of this structure was tested and piloted during the three learning experiences. However, a key pedagogic challenge will be to explore how these spaces will enable and enhance real collaboration in such heterogeneous groups. It is suggested to boost collaboration among students, teachers and companies toward interdisciplinary and transdisciplinary activities through the design and implementation of collaborative platforms and interfaces that frame and make more evident exchange between different stakeholders. This means unpacking activities and designing learning processes through visual boards that allow reflection on disciplinary-specific contribution, facilitate the plural discussion among design, engineering and business, and guide the process of interdisciplinary decision-making along the whole project development.

In addition to this, it is also suggested to test the possibilities of remote collaborative education in Fashion-Tech by using virtual or augmented reality (VR or AR) that is an interesting pedagogic application of Fashion-Tech. However, two current limitations are envisaged: (i) missing fashion or interaction design specific VR collaboration environments *(Yang & Lee, 2021)*, and (ii) the costs of VR/AR equipment leading to concerns over digital exclusion of students not able to afford the technology.

Crafting materials and experimentation through blended modalities of education

Apart from collaboration, digital education shows its major limitation in the loss of practical activities that require tangible tinkering, material knowledge, manipulation of crafts, hacking of technologies through hands prototyping by groups of students. To avoid the visual-only based kind of learning that is provided by digital education (based on presentation, screen sharing, video recordings), some hands-on induction lectures followed by brief practice-based assignments and exercises to be launched to students. This requires an organisation of a list of necessary materials (e.g. physical computing hardware, or biomaterials) to be shared in advance to students along with the possibility to access a network of workshops to establish their dislocated on-distance laboratory. At the same time, interdisciplinary collaboration should be enhanced assigning responsibility among students with different backgrounds through peer review activities or enabling blended learning modalities boosting the physical encounters of students being located in the same university to exploit in-presence collaborative activities.

Upskilling teaching staff from HEIs

Educational staff need to be provided with tools and teaching materials, models and previously tested learning experiences in order to upskill their teaching modalities to stay up to date and to confront the continuously mutating field of Fashion-Tech. Toolkits aimed to organise, implement, and design the digital interdisciplinary and international learning experiences were implemented and shared to support and enforce the co-designing process and exchange information among all stakeholders involved in teaching activities, from interdisciplinary educational staff from different HEIs to professionals of the Fashion-Tech industries. The toolkits are openly shared and usable from all interested parties in further implementation activities of Fashion-Tech Learning Experiences *(D2.1 Project-based Learning Modules, 2021)*.
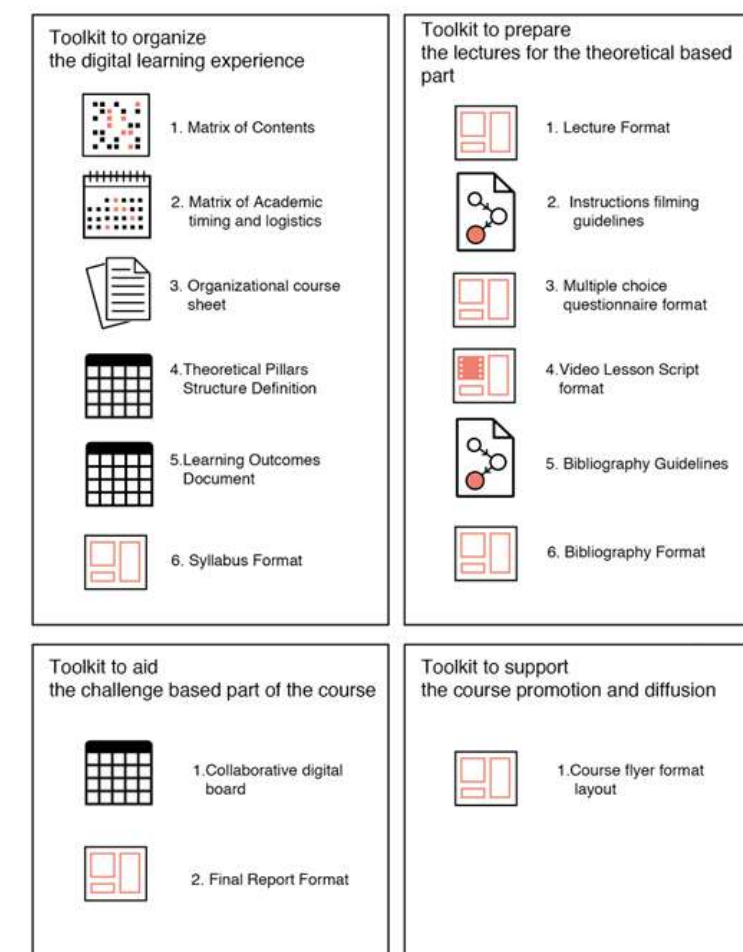

FIG. 25 - THE FASHION-TECH LEARNING EXPERIENCE TOOLKIT

Open Knowledge Production and Circulation

Knowledge accessibility is nowadays a paramount concern for education, being tools and information directly accessible out of the HEIs, and so skills could be acquired on the Internet and from open-access resources. Fashion-Tech education should also participate in making knowledge available openly to communities *(Bertola & Colombi, 2021)*. For this reason, a selection among the materials produced for the three-learning experience has been released in the shape of Open Educational Resources (OERs). The video-lectures include teaching, learning, and research materials in a digital video format focusing on presenting fashion-tech trends, methodological approaches to design next and far future scenarios, methodological approaches to assess and evaluate user experiences of fashion-tech garments/accessories, technical lectures related to digital transformation and sustainability impact, along with business oriented lectures related to new fashion-tech business and revenue streams models. OERs have been shared in the public domain under an open licence that permits no-cost access, use, adaptation, and redistribution by others with no or limited restrictions via the FTalliance OER platform *(2022)* and FTalliance Youtube channel *(2022)* to guarantee the widest reach toward interested stakeholders in the Fashion-tech sector.

The platform for FTalliance OERs has been implemented so that it allows the research of educational materials by playlists related to the implemented three learning experiences that were delivered during the FTalliance project:

(Fashion-Tech Interline, the secret life of clothing, Scalability of Multidisciplinary Fashion-Tech Solutions) but also browsing the contents via the following thematic topics:

• Fashion-Tech Business Management and Impacts
• Sustainability in the Fashion-Tech Industry
• Fashion-Tech UX, Research Methodology and Trends
• Fashion-Tech Prototyping
• Virtual & Digital Technologies in Fashion-Tech
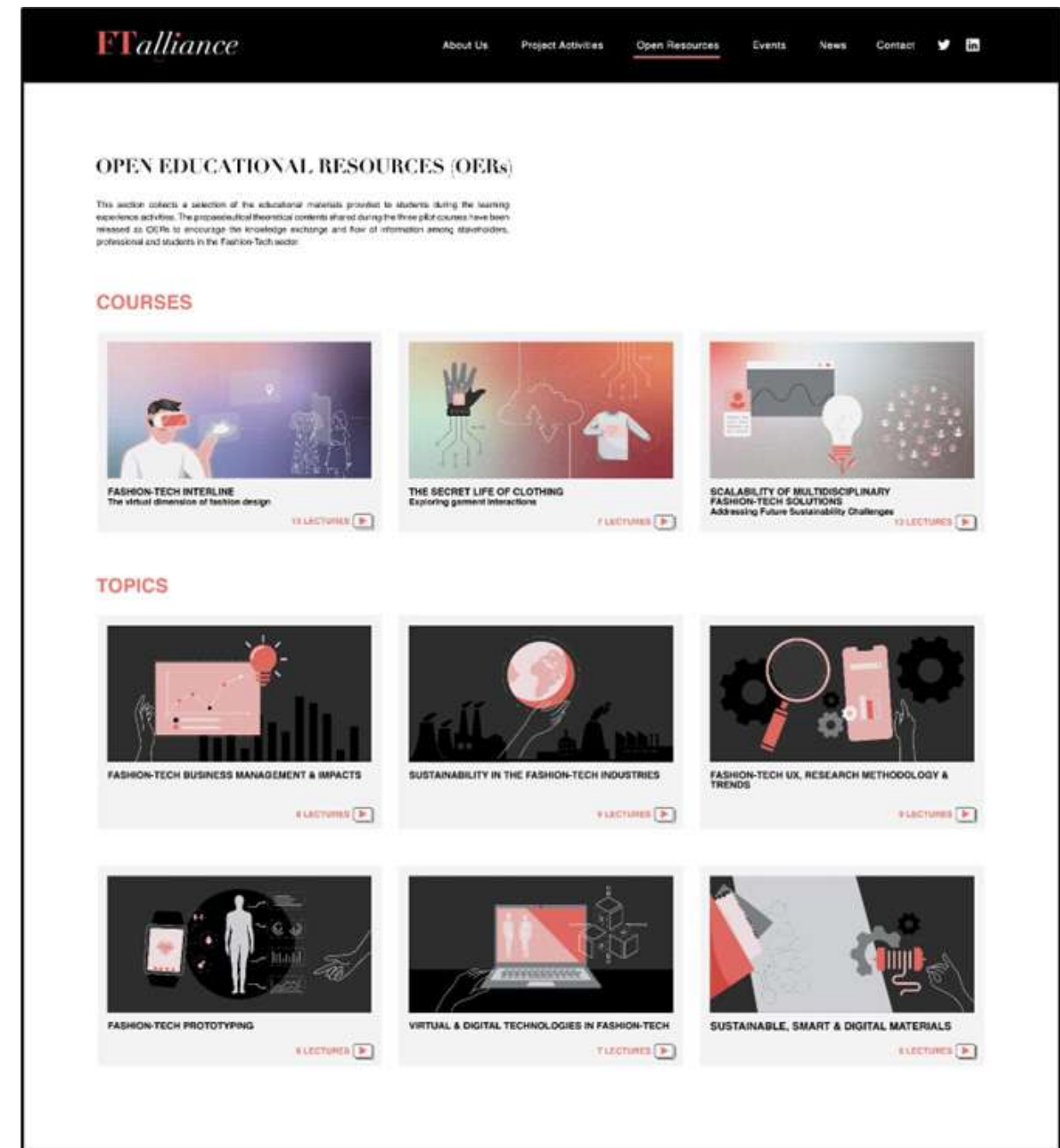• Sustainable, Smart & Digital Materials

FIG. 26 - FASHION-TECH ALLIANCE OER PLATFORM

5.2 LESSONS LEARNED FROM THE FIELD: COLLABORATION AND NETWORKING

Education at the highest level in universities has a major impact on society, both developing the future executive classes and professionals and also building relationships with the external world, conceived as local eco-systems, industry and government *(Bertola & Colombi, 2021).* Thus, more than solely working on research and education, HEIs need to boost their third mission toward innovation, social, outreach and entrepreneurial scope, transferring their knowledge to the general public through societal outreach and also aiming to spread innovation through incubators and accelerators that bridge applied knowledge with the companies. In this context of HEIs expansion out of their current boundaries, sustainable collaboration among the European HEIs and companies of the Fashion-Tech field needs to be established and nurtured through a proper strategy that allows personalized educational models, and one that is willing to invest in research, continuous innovation, knowledge dissemination and establishing good practices toward entrepreneurship and societal change.

HEIs and Companies collaboration for innovation, entrepreneurship and social impact

The results of the learning experiences and the FTalliance project at its current status shows that to achieve research excellence as a key factor toward HEIs innovation impact, the importance of relational closeness, collaboration and knowledge transfer between HEIs and Industry researcher, experts and professionals are very important. In particular, strategic and long-term collaborations built around a shared research vision for a decade or beyond are the most productive for reducing non-productive tensions and conflicts that emerge from the initial cultural and communications divide happening in the Industry-Academia collaborations. In the longer term, strong collaborations increase mutual benefits between the partners, elaborating and delivering new knowledge, competence, prototypes, new methods, new technologies' application and innovative solutions. All of which are useful to improve researchers' and students' entrepreneurship which constitutes a small but crucial part of academics' innovation contribution to society and to general economic growth. In addition to this, the rise of a global knowledge economy has intensified the need for strategic partnership and alliances that go beyond the temporal and financial limitations of discrete research projects. If, on one side, policymakers need to ensure a stable environment of funding and regulation for long-term Industry-Academia strategic partnerships to thrive, HEIs need to have more agile processes to formulate and operate effectively to forms collaborations. For the first part of granting established funds at the European level, the future EU programmes on education, research and innovation through Horizon Europe will ensure that such partnerships are fostered and fully exploited.

Democratization and diffusion of knowledge

Distributed and accessible knowledge also that HEIs should become more open and offer learning activities in collaboration with a wider network of stakeholders and cooperative learning spaces *(Bertola & Colombi, 2021).* In particular, Fashion-Tech research and education should happen through the direct access to technologies in hybrid workshops (consisting of basic machinery and tools but also advanced high-tech instruments). These should be accessible both internally at the HEIs but also in the constellation of networked actors that are driving digital change (e.g. Competence Centres, Innovation and R&D Hubs, FabLabs and Maker Spaces, Research Laboratories). In this open and networked setting of spaces, comprehensive research with virtual prototyping, digital fabrication, sustainable materials and biomaterials can take place under the guidance of skilled technicians and tutors, existing within a distributed model of knowledge and educational experiences. To share knowledge and participate in thede distributed shared educational models, students should be nurtured with a basic understanding of other disciplines' languages in search of a common vocabulary.

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