CRAFT IT 4 SD

Craft Revitalization Action
for Future-proofing the Transition
to Innovative Technologies
for Sustainable Development

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D2.1

Method Playbook (Initial)

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List of Acronyms

Abbreviation / acronym	Description
GA	Grant Agreement
CCSI	Cultural and Creative Industry and Sectors
CDP	Customer Data Platform
CEAP	Circular Economy Action Plan
CLC	Colocation Centre (EIT Culture & Creativity)
CRM	Customer Relation Management
DMP	Data Management Platform
EC	European Commission
ESPR	Ecodesign for Sustainable Products Regulation
EU	European Union
LCA	Life Cycle Assesment
SBM	Sustainable Business Model
SME	Small and Medium size Enterprise
SWOT	Strengths, Weakness, Opportunities, Threats
WP	Work Package
OER	Open Education Resources
NEIA	New European Innovation Agenda
EIE	European Innovation Ecosystems

Executive summary

The present Method Playbook of CRAFT-IT4SD, D2.1, serves as a comprehensive scientific and methodological guide for all consortium members and for the four pilot sites, in particular. The Playbook elaborates on and explains the overarching conceptual design of CRAFT-IT4SD and the scientific and methodological issues and roles underpinning the project. The CRAFT-IT4SD initiative focuses on how the CCSI can become a driver for the sustainable climate transition, in particular regarding the highly polluting fashion and textile industry. CRAFT-IT4SD relies on cross-sectoral experimentation in the intersection between craft and living heritage on the one side, and digital technologies on the other, to innovate and develop new sustainable business models. The approach is challenge-driven and involves inclusive partnerships and collaboration between diverse actors, specifically between microplayers, bigger industry and policy makers. The initiative establishes pilot sites in Europe for place-based innovation ecosystems, and creates learning communities across these national pilot sites, while replicating its findings in new ecosystems resulting in a growing movement for the green transition.

The Method Playbook provides a comprehensive review and scientific foundation for an ecosystem approach and outlines CRAFT-IT4SD's joint framework and methodology for conducting pilot demonstrations (WP4), which will be operationalized in the Method Handbook (D4.1.).

KEYWORDS: Sustainable Climate Transition; Craftsmanship, Living heritage, Fashion industry; digitalization and new technologies; CCSI

1.0 Introduction

1.1 The Creative and Cultural Sectors and Industries (CCSI) as drivers for Europe's sustainable climate transition

In 2019, the European Commission put forward the European Green Deal, an ambitious roadmap aiming at making Europe the first climate-neutral continent by 2050. Increasingly, the role of the Cultural and Creative Sector and Industries (CCSI) is recognised to support this sustainable transformation. In the recent report Culture and Creative Sectors and Industries driving green transition and facing the energy crisis (Voices of Culture, 2023), the authors present three main areas for action where culture can play an important role in supporting the Green Deal:

- The power of culture and creativity to inspire change by creating new narratives.
- Their potential for embedding sustainability in other industries.
- Their capacity to lead strong narratives and role-model progress towards a greener society.

The European Bauhaus introduced in 2021, brought aesthetics and inclusion as important elements in Europe's sustainable transformation. This means that where the focus of research and innovation on CCSI research and innovation primarily has been on finding evidence for the role of European CCSI driving economic growth and employment (Vuijlsteke et al., 2024; Pratt & Jeffcutt, 2009; European Commission, 2016; European Commission, 2018a), the significance of CCSI as instigators of new sustainable business models, models for degrowth and imaginaries for sustainable inclusive futures is increasingly recognised.

While the CCSI encompasses a diverse sectoral landscape, the fashion and clothing industries are particularly notable for their substantial negative environmental impact resulting from global industrial growth, non-transparent value chains, and traditional linear business models (European Environment Agency, 2019; Euratex, 2020; Köhler et al., 2021). To fulfil the commitments of the European Green Deal, the 2020 Circular Economy Action Plan, and the EU Industrial Strategy, the European Commission recently introduced the Strategy for Sustainable and Circular Textiles. This flagship initiative, through a series of actions, aims to disrupt the growth and mass consumption model that has driven the fashion industry into a fast-fashion paradigm, exerting extreme pressure on primary raw materials, water usage, land use, and greenhouse gas emissions (Niinimäki et al., 2020; European Commission, 2022). Consequently, the fashion and textile industries are urgently called to rethink practices and redirect its business operations towards a sustainable climate transition across all stages of the fashion value chain, from design and production to services and end-of-life solutions (Creative PEC, 2022; State of Fashion, 2024).

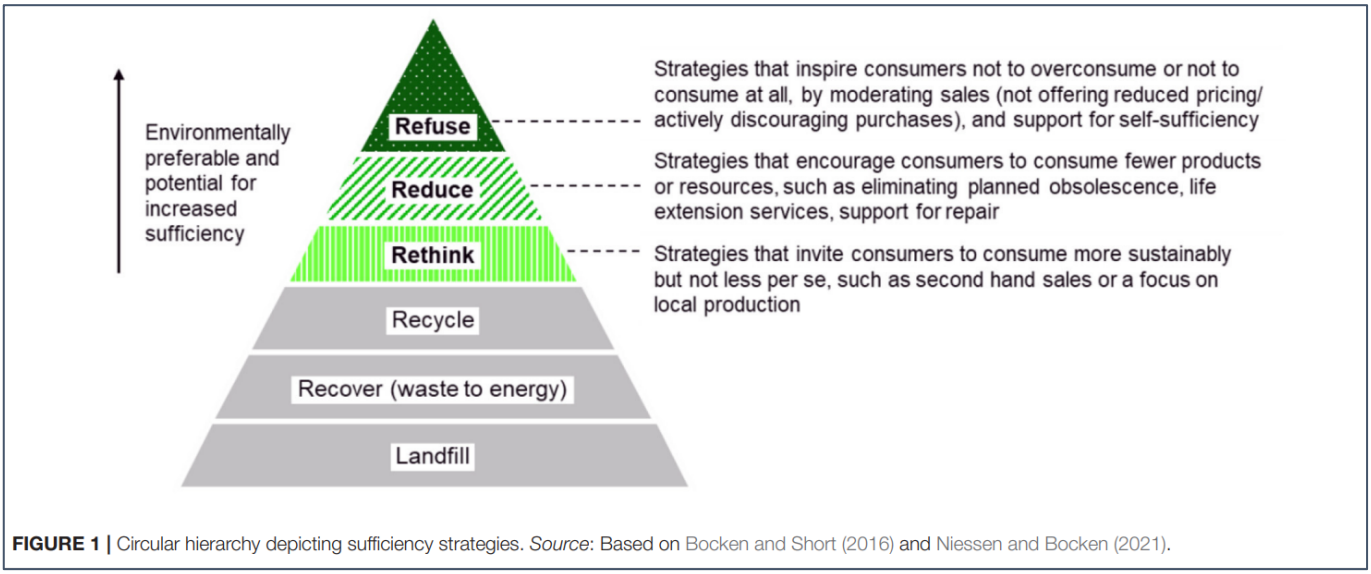

Figure 1. Circular hierarchy depicting sufficiency strategies. Source: Based on Bocken and Short (2016) and Niessen and Bocken (2021)

To ensure that new suggested practices result in reducing climate impacts, CCSI may draw on life cycle assessment (LCA) methodologies to provide the actors with more information on how climate impacts can be assessed and reduced. In so doing, more light is shed on what kind of actions, practices and stages are most relevant in terms of their climate impacts along product value chains and life cycles, and what kind of business models can support sustainable climate transition in the CCSI and the broader economy. This means that while still serving as an engine of economic growth and job creation, the CCSI may however also significantly contribute to the prevalence of the degrowth movement, which has been gaining traction in recent years. As a socio-economic and political movement, degrowth advocates for downscaling production and consumption by prioritising ecological sustainability, social equity, and well-being over economic growth. In response to the social and ecological crises intensified by the economic growth paradigm, the degrowth movement has, for instance, increasingly influenced policymaking and policy

proposals (Fitzpatrick et al., 2022). Thus, leveraging its unique societal position, the CCSI can drive the degrowth agenda by fostering a shift in values and behaviours towards more sustainable and equitable practices. This can be achieved by reshaping and revitalising cultural narratives, supporting local and sustainable economies, promoting equitable and inclusive practices, and fostering innovation in economic and social organisations. Continuing the degrowth dimension, the cultural values and local diversity inherent in the material and immaterial cultural living heritage further position the CCSI as a significant driver of the European green and social transition. This is attributed to the pivotal role of art, craft, and creativity in shaping and revitalising common values and contextualising ways of living, producing, and consuming (Luckman, 2015; OECD, 2020; EY, 2021), which is believed to pave the way for the triple transition addressing challenges posted by the social, green, and digital transition (OECD, 2023).

In this context, it is widely recognised that digitalisation and emerging technologies, even though not always green themselves, play a foundational role in driving the green and social transformation of the fashion industry. The collective adoption and adaptation of both basic and advanced technologies, such as Augmented Reality, Virtual Reality, Artificial Intelligence, cloud technologies, Internet of Thing, and blockchain, are already influencing and reshaping how the fashion industry creates, produces, organises, distributes, and consumes content, services, and products (Vuijlsteke et al., 2024; Business of Fashion, 2024). Recently, the rationalisation and industrialisation underpinning the increasing digitalisation of manufacturing, production, and consumption have been countered at the EU level by the ambitious New European Bauhaus initiative. This political vision, described as the 'soul of the European Green Deal,' is dedicated to shaping a sustainable and inclusive society by prioritising and connecting living spaces, experiences, and cultural heritage. Initiatives such as the New European Bauhaus result from the recent evolution of craft movements and craftsmanship, which have transitioned from being market niches to driving field-wide transformations that improve social, environmental, and economic conditions (Luckman, 2015; Pozner, Ravasi & Nyfeler, 2023; Kroezen et al., 2021; OECD, 2023). In these types of initiatives revitalization of not only existing but also threatened and disappearing craftsmanship knowledge and heritage-based expertise plays a decisive role.

From this perspective, CRAFT-IT4SD posits that leveraging technology, and digital tools must be integrated with revitalised knowledge and skills inherent in crafts and heritage to support sustainable climate transition in Europe. The interplay between immersive technologies, digital tools for textile and fashion design/production, crafts skills, and heritage knowledge supports this integration (Folisi et al., 2024). In other words, applying digital technologies and tools, informed by heritage craft and traditional techniques, will enable the CCSI to drive part of the green transition in the fashion industry. Considering this, CRAFT-IT4SD methodologically establishes collaborative pilot arenas for small and large players within the CCSI ecosystem, allowing them to engage and interact and collectively enact best and next practices. The Method Playbook presented in this document is an overall guide for designing, developing, executing, and evaluating the pilot demonstrations that form the backbone of these ecosystem collaborations.

1.2 Objectives of playbook

The Method Playbook serves as the scientific and methodological foundation for CRAFT-IT4SD in general, and for the pilot demonstrations, in particular. The Method Playbook is structured around two main objectives. First, it provides a detailed and robust scientific foundation for an ecosystem approach, facilitating connections among start-ups, artists, craftspeople, designers, policymakers, knowledge partners, and industry partners to create local and regional value pathways scalable as sustainable climate transition-supporting business models at the EU-wide level. Second, it develops and presents a joint framework and methodology for conducting pilot demonstrations (WP4) in a manner that allows for comparison and learning across pilot sites, supporting cross-border knowledge integration, capacity building through skills and cooperation.

This document represents the initial version of the CRAFT-IT4SD Method Playbook as defined in the GA with D.2.1 to be delivered in M8. To maintain high quality in the project's execution, this version will be reviewed and updated internally following the pilot demonstrations, culminating in the final version of the Method Playbook with D.2.2 in M28.

1.3 Method

The focus of this Method Playbook centres on the CCSI, fashion and clothing industries, particularly exploring how the revitalisation of craft work alongside emerging technologies could facilitate the transition towards sustainable climate transition. To achieve this objective, our methodology and research approach are structured into three sequential stages, which are in accordance with the three WP tasks outlined in the Project Handbook (D1.1) and GA. The initial stage involves establishing a robust scientific basis by conducting a comprehensive review of the current state-of-the-art, in accordance with Task 2.1. Subsequently, the second stage focuses on mapping and visually representing existing initiatives and projects integrated within the CRAFT-IT4SD framework, in accordance with Task 2.2. Integrating insights gained from stages 1 and 2, the third stage entails analysing the findings and mappings to establish the foundational elements of the overall conceptual methodology and pilot demonstration approach, in accordance with Task 2.3.

Stage 1: Reviewing state-of-the-art.

Initially, we conducted an open, preliminary, and exploratory review of the CCSI, identifying six main thematic areas of importance: 1. regulatory conditions; 2. LCA and data tools; 3. resilience in supply chains; 4. sustainable business models; 5. craft, cultural heritage and resilient communities; and 6. skills and learning communities. Although we primarily relied upon a snow-balling procedure starting from the most recent key European Commission reports and policies, we qualified our search strategy by including formal searches in Scopus, Web of Science, and Google Scholar databases. Keywords employed in our search contained terms such as "Creative and Cultural Industries," "Creative and cultural industries AND heritage," "Creative and cultural industries AND digitalisation," and "Craftsmanship AND technologies." Boolean operators (AND, OR) were employed to refine our searches. Additionally, we manually screened the reference lists of identified articles and reports to uncover additional relevant literature. Building upon the above-mentioned themes, we proceeded with an expanded review targeting the thematic areas. Our

review was flexible by design to ensure comprehensive coverage of the literature. To mobilise the expert knowledge of partner organisations, we developed a template for each thematic area, which was subsequently distributed to partner organisations based on their expertise in the corresponding themes. Each of the partner organisations then carried out a targeted review following the template. The template was designed based on the SWOT model, focusing on first defining the specific theme at hand, then proceeding to challenges/threats and opportunities/strengths. Using the same template as the framework allowed for duplicability. As lead author and work package lead, VIA collected and consolidated these templates into the primary document.

Stage 2: Mapping existing initiatives and projects.

For the identification exercise, Task 2.2., we were guided by a set of criteria developed through comprehensive discussions within Work Package 2 and consultations with ecosystem experts. The criteria encompassed both strategies and projects, classified across various administrative levels. See Table 1 below for details.

Table 1. Classification levels for identification exercise.

Level	Description
European	Initiatives and projects that have a broad impact across multiple European countries, supported or regulated by EU institutions.
Regional	Initiatives and projects that target specific regions (across countries), addressing regional cultural and creative sector needs
National	Nationwide initiatives and projects implemented and supported by national governments.
Local	Initiatives and projects focused on local communities, often driven by local governments, organizations, or community groups.

By design, the identification exercise was a collaborative effort involving project partners who contributed their local knowledge and networks. Each partner was responsible for populating a shared spreadsheet database with relevant initiatives and projects. For this task, partners were asked to follow a prepared guide that included the following categories as described in Table 2 below. This structured approach ensured a comprehensive and well-organized collection of initiatives and projects in an online database, facilitating further analysis and visualisation (see Chapter 3). In the first iteration, the online database will be maintained using an Excel file facilitated by CRAFT-IT4SD Teams site. This method allows for an organised and systematic approach to data collection and entry, ensuring that all relevant information is accurately captured. For the initial implementation, the Excel file was manually uploaded to the Kumu platform to facilitate visualisation and analysis (see Chapter 3 for further details on the Kumu platform and the visualisation process).

Table 2. Categories for identification exercise

Categories	Description
Name	The official name of the strategy, initiative, or project
Type	Indicates whether the entry is a strategy or project, and specifies the administrative level (EU, regional, national, local).

Years	The active years of the initiative or project.
Description	A concise summary that will be available in the interactive ecosystem map
Focus	Tags in keyword format that highlight the primary focus areas of the initiative
Website	A link to the official website for further information
Country	The country where the initiative is based or primarily operates.

As CRAFT-IT4SD progresses and according to the priorities set by the partners, several enhancements to the database infrastructure are foreseen. One of the primary improvements will be transitioning to a cloud-based database, which will enable real-time updates. This transition will ensure that the visualisations in Kumu always reflect the most current data, thereby enhancing the accuracy and timeliness of the information available to stakeholders. Additionally, another significant development will be the creation of a simple web application designed to allow ecosystem stakeholders to add and update data continuously. This participatory approach will keep the database comprehensive and up-to-date, effectively mirroring the dynamic nature of the CCSI ecosystem. These future progressions will be included in the final Playbook due in M28.

Stage 3: Synthesizing conceptual method and piloting approach.
In the final stage, we compiled the material of stage 1 and stage 2 into D2.1., Method Playbook. In this stage, we worked iteratively and collaboratively to analyse findings and mappings to determine and define core elements of the overall conceptual methodology. Against this backdrop, we carved out the pilot demonstration approach.

1.4 Structure of the Method Playbook

This document is divided into five main chapters:

In **Chapter 1** we set the scene by describing the background for CRAFT-IT4SD as well as introducing the objectives of the Method Playbook. From there, the chapter provides an account of the methods applied to the Playbook. This includes descriptions of research design, review method, and sampling, as well as analytical procedures. Following that **Chapter 2** is a comprehensive chapter that covers three reviews, in accordance with Task 2.1. First, it provides a literature review of the current state-of-affairs in the CCSI in terms of craft, digitalisation and sustainability. Next, the chapter presents a systematic needs assessment involving mapping opportunities and challenges as well as barriers and drivers in the sustainable transition in the CCSI. Finally, the chapter maps new directions and opportunities in (e)merging sectors such as fabrics, fashion and Extended Reality, metaverse, and crafts. In accordance with Task 2.2., **Chapter 3** identifies and describes key initiatives and projects in the CCSI ecosystem of the consortium partners to map alignment opportunities with sister projects and other relevant initiatives and CRAFT-IT4SD. Based on the review, identification, and mapping exercises carried out in Task 2.1 and Task 2.2, **Chapter 4** describes the overall concept behind CRAFT-IT4SD as well as the foundational methodology that connects the/all work packages, while **Chapter 5** builds upon this foundation to define the overall approach to be used by partners in carrying out the piloting demonstrations.

2.0 Scientific foundation

2.1 CCSIs in the sustainable climate transition: Taking Stock and Moving Forward

The global landscape is undergoing profound changes due to geopolitical insecurities, an escalating climate crisis, and technological disruptions, resulting in mounting social and economic inequality (Islam & Winkel, 2017; OECD, 2023). The CCSI, encompassing a broad range of activities, including arts, heritage, media, and creative services, are at the forefront of these changes. At the same time, environmental and planetary awareness is gradually becoming a top priority among consumers, industry and policymakers. Here, craftsmanship and innovative solutions based on technological advancements to foster new more resilient business models for sustainability and social inclusion have been emphasised (EIF-KEA European Affairs, 2021; European Commission, 2022; Muench et al., 2022).

From this point of departure, this section of the Playbook is based on three reviews that collectively take stock to advance the CCSI within the context of the sustainable climate transition. Specifically, the review section aims to critically address and assess the role of the CCSI in navigating and shaping three significant matters of concern for the CCSI. Thus, each sub-section focuses on understanding, respectively, i) Craft and heritage as pathways to sustainability; ii) Digitalisation as pathway to sustainability; and iii) Data, data infrastructures and data sharing as pathways to sustainability. While each sub-section has its specific focus, they all combine to constitute sustainability paths for the CCSI.

2.1.1 Craft and heritage as pathways to sustainability

Drawing from our rich cultural heritage offers a plethora of knowledge, practices and traditional motifs that serve as symbols of our cultural diversity and authenticity and may inspire and catalyse creativity within the CCSI. The CCSI ecosystem contributes approximately 3.95% of the EU's value-added and employs around 8 million people, predominantly through micro-companies and SMEs (European Commission, 2019b). In this context, cultural heritage is not merely a relic of the past; it is recognised as a dynamic and formative influence that shapes our present and future by connecting us to our history (European Commission, 2021). The diverse professions and occupations within the CCSI play crucial roles as custodians of our cultural heritage, ensuring its preservation and passing it on to future generations. Therefore, the CCSI plays a pivotal role in safeguarding cultural diversity and intangible cultural heritage, as well as fostering intercultural dialogue (Pagán et al., 2020). Exploring and harnessing the potential of crafts and heritage within the CCSI, particularly traditional textiles, materials and fashion, as a pathway to digital and green transitions holds significant promise. Recent research and policies have emphasised the importance of human skills, technical mastery, embodied knowledge, and community engagement (Pozner et al., 2023; Gasparin, Hjorth & Raviola, 2024). There is growing interest in integrating traditional crafts and heritage with maker movements to forge sustainable pathways (Kohtala, 2017; Unterfrauner et al., 2019) and leveraging digital transformations (Bertola & Teunissen, 2018).

Through digital technologies, artisans and designers can explore innovative and more sustainable approaches to reinterpreting heritage and cultural motifs, integrating them into contemporary designs. Advanced technologies such as 3D laser scanning and holographic imaging facilitate the digital preservation of cultural heritage, ensuring broader accessibility and long-term conservation. Additionally,

augmented reality and virtual tours provide immersive experiences, enabling individuals to engage with and explore cultural heritage exhibitions and sites. This opportunity supports the fashion and manufacturing community by simplifying access to and gathering information on various traditional motifs (Csesznek et al., 2024). Furthermore, digital transformation enhances accessibility and global outreach through digital commerce via online platforms. For instance, artisans and craftspeople can showcase their products and locally inspired creations to a global audience, thereby expanding market opportunities and fostering growth rooted in local sustainable practices (Jacob, 2013).

Integrating traditional crafts and heritage into emerging technologies and digital transformation encounters significant impediments and challenges. Adopting new technologies, such as digital manufacturing, necessitates training and skill acquisition among artisans and craftspeople. However, smaller players in the craft industry, such as artisans and designers, often face limited access to resources and training opportunities. Moreover, they may resist change due to concerns about being absorbed into the commercial mass market (Luckman, 2018). This resistance can stem from fears of job displacement, particularly among older generations who may lack confidence in their technical skills and expertise (Müller, 2019). While digital technologies and advanced software can be instrumental in preserving cultural expressions, such as motifs found in textile heritage, digitalisation also poses a threat to the distinctive heritage-based identities of craftspeople. These barriers hinder the overall transition and are particularly acute in rural areas, where much of the craft-based cultural heritage is traditionally located (Fox Miller, 2017). In these contexts, resistance is further embedded in cultural norms, values, and generational perspectives.

2.1.2 Digitalisation as pathway to sustainability

The push towards digital transformation and integration of new technologies presents opportunities for innovating sustainable business models, production methods, market creation, and consumer culture (Parida et al., 2019). Recent research underscores how technologies such as 3D printing and virtual reality reshape the design, production, and consumption of cultural and creative products (European Commission, 2019; Jung & Tom Dieck, 2017). Moreover, the distinct value chains of the CCSI and the fashion and clothing industries demonstrate robust innovation potential, capable of driving advancements in other sectors through creativity, design, and novel organisational processes and business models (Colombi & D'Itria, 2023; Gustafsson & Lazzaro, 2021).

In addressing digital transformation within the CCSI, there is a pronounced emphasis on preserving traditional crafts and human-centric production methods in both policy and scholarly research (Pratt, 2005; European Parliament, 2023). Craftsmanship, characterised by manual skills and deep knowledge of materials, design, and techniques, is experiencing renewed interest in an era dominated by mass production. The human and community values represented in craftsmanship are considered essential for safeguarding the cultural and historical significance of creative endeavours and local identities. Crucially, this has heightened the focus on balancing technological advancements with the preservation of cultural heritage and locally rooted craft production (Gibson, 2016). Therefore, while new technologies have the potential to enhance efficiency and reduce environmental impact, their adoption must be managed carefully to mitigate risks such as job displacement and the marginalisation of traditional craftspeople (Folisi et al., 2024; OECD, 2023). In addition, digital technologies and the immense amount of data generated are not a

direct road to a greener world as they are heavily energy-dependent, and hardware components exploit rare materials and are difficult to recycle.

In the context of the digital transformation of the CCSI, and specifically the fashion industry, significant challenges arise from its fragmented nature. The fashion sector is mainly characterised by a multitude of small enterprises that face limitations in effectively utilising digital tools (European Commission, 2019; Gustafsson & Lazzaro, 2021). This fragmentation may hinder the sector's ability to exploit technological innovations fully and develop responsible growth strategies through digitalisation (European Commission, 2019). Most businesses in the fashion and clothing industries are SMEs and micro-enterprises, often employing fewer than 10 people, alongside self-employed and freelance workers (European Commission, 2019b). Because of their agility, SMEs play crucial roles as catalysts for change and experimentation with alternative business models, making them pivotal in the triple transition. However, these enterprises frequently lack the technical resources to adopt new technologies such as virtual and augmented reality, blockchain, 5G, and 3D printing. (European Commission, 2019c). Moreover, the scale of SMEs often limits their capacity to invest in new technologies or absorb the risks associated with technological experimentation. Consequently, the complexity and costs associated with these innovations frequently deter smaller players from engaging in cross-sector collaborations and maximising their societal impact (European Commission, 2019c)

Extant research has documented the importance of reskilling and upskilling within the CCSI, especially within the fashion industry, focusing on digital solutions and entrepreneurship (Luckman, 2018; Song, 2022). Recent policy documents and reports have reinforced this notion, stressing the need to equip today's and tomorrow's workforce with skills matching the evolving work landscape, as outlined in initiatives like the Recovery Plan for Europe 2020 (European Commission, 2020a) and the European Skills Agenda 2020 (European Commission, 2020b). To effectively navigate digital transformation, studies advocate for the CCSI to blend specialised technical skills with broader competencies. First, technical and digital skills are essential for designing, refining, and utilising digital solutions. Given the rapid evolution of technology, the ability to continuously learn and integrate new knowledge has become paramount within the CCSI (Folisi et al., 2024). Second, managerial skills are crucial for developing and implementing new digital processes. Many professionals within the CCSI have backgrounds in creative or arts disciplines with limited access to business-related educational materials (Folisi et al., 2024). Third, leadership and entrepreneurial skills are pivotal for devising new more sustainable business models and crafting strategies to harness emerging technologies. Lastly, creative and soft skills such as critical thinking and teamwork are indispensable for pushing boundaries and generating original content within the digital environment (European Commission, 2020; European Commission, 2024).

2.1.3 Data, data infrastructures and data sharing as pathways to sustainability

While data and data infrastructures play important societal roles (Kitchin, 2014a; Gray et al., 2018), they are also crucial for business operations within the CCSI, including fashion and craftsmanship (Acharya et al., 2018; Silva et al., 2020) and managing sustainability. Databases and infrastructures refer to solutions such as archives and repositories that facilitate data collection, storage, analysis, and sharing (Kitchin, 2014b). Key aspects of the modern business ecosystem, such as data collection, management, usage, and search, are reflected in the development of Data Management Platforms (DMP), Customer Data Platforms

(CDP), and Customer Relationship Management (CRM) systems. Consequently, data has become foundational for fostering innovation, gaining consumer insights, and enhancing competitive advantages by unlocking organisational capabilities (Wamba et al., 2015). Furthermore, while platforms facilitate digital content creation, they depend on data models and input. In fashion and craftsmanship, data-related platforms and infrastructures support using digital technologies, such as sensors for smart clothing, artificial intelligence for analysing 'big data,' and software for creating digital fashion and craftworks. The combination of these technologies with a data-driven approach can enhance product value, improve personalised customer impact, and contribute to the overall sustainability of the industry, as exemplified by 'smart wearables' (European Commission, 2016c).

Being data-driven presents a range of new opportunities for the CCSI to leverage data assets and cultivate more environmentally sustainable business models (Parkinson et al., 2020). For example, leveraging 'big data' on customers enables businesses to gather consumer and environmental insights from data associated with purchases (Grewal et al., 2017). Such insights are critical for enhancing the accuracy of consumer behaviour predictions and tailoring offerings to individual customer needs (Grewal et al., 2017). Silva et al. (2020) illustrates how the fashion retail sector utilises data for forecasting to minimise waste and enrich the overall consumer experience. In this context, data management and analytical techniques that rely on machine learning have demonstrated significant potential (Kitchin, 2014). Exploring data infrastructures for customisation and personalisation further enhances the value of fashion and craft products and services by fostering stronger emotional connections with customers, potentially extending product lifespans (Ma, Kim & Lee, 2022). Moreover, research indicates that data-driven workflows aid in automating tasks and processing real-time data from IoT devices embedded in clothing and accessories (Majeed & Rupasinghe, 2017).

While there are substantial opportunities and potentials, several significant challenges arise when integrating data platforms and infrastructures into fashion and craftsmanship. First, a critical challenge for businesses lies in selecting data and infrastructures that align with organisational and operational needs to enhance agility (Ghasemaghaei et al., 2017). Second, issues related to data security and privacy present considerable hurdles, particularly given the increasing volume of sensitive data being collected, utilised, and stored. It is essential for fashion and craft businesses to comply with current regulatory data requirements, such as the General Data Protection Regulation to ensure responsible data management practices. In this context, end consumers are becoming more informed about their privacy rights, potentially influencing how businesses design their services, especially within the increasingly complex fashion value chain. Third, there is the issue of copyright infringement, particularly concerning the definition and protection of intellectual property in the digital realm, where ownership and usage rights are increasingly open to interpretation (Biliakovych et al., 2024). Fourthly, adopting data-driven workflows represents a valuable effort for many companies, particularly smaller players predominant in the fashion industry. This also applies to sustainability data management systems. Apart from the time-intensive nature of implementing a data-driven approach (involving collecting, processing, and disseminating vast amounts of data), these companies often encounter significant financial and organisational constraints (Acharya et al., 2018; Clausen et al., 2022). Lastly, the environmental impact of data and data infrastructures within the CCSI warrants careful consideration. For example, concerning accuracy, comparability and reliability in collecting, managing and using sustainability data due to different assessments methods and no widely

shared standards. The lifecycle processes of digital files, encompassing their production, processing, consumption, and storage, in conjunction with the functioning of data infrastructures, demand energy resources. The sourcing of this energy may affect carbon footprints (Biliakovych et al., 2024). Consequently, since data servers and digital technology infrastructures typically are substantial energy consumers, the rising energy costs is likely to present a significant challenge that adds to sustainability concerns.

2.2 Building Bridges and Dismantling Barricades in the CCSI

CRAFT-IT4SD investigates how the revitalisation of traditional craft work with emerging technologies can facilitate sustainable climate transition in the CCSI and beyond. The convergence of craft and digitalisation presents opportunities for enhancing product quality and reducing the production and consumption of fast fashion products and by re-inventing new models of consuming fashion. However, to achieve these objectives, the fashion industry must both 'build bridges' and 'dismantle barricades.' In this context, we have identified six principal thematic areas of significance: 1) Regulatory conditions; 2) LCA and data tools; 3) supply chain resilience; 4) sustainable business models; 5) craft, heritage, and social well-being; and 6) skills and learning communities. These six themes are examined and expanded upon in the following sections.

2.2.1 Regulatory conditions (existing and in-the-making)

The EU has recognized the importance of sustainability in the textile industry and has introduced new requirements to promote more sustainable practices. These requirements will have significant implications for the textile industry, compelling companies to adapt their operations to comply with the new standards (European Commission, 2024; European Parliament, 2024). These include, among others:

- The European Circular Economy Action Plan (CEAP) that includes a model for the collection and separate management of waste, as well as the objectives for the reuse and recycling of textile waste at the European level.
- The Strategy for Sustainable and Circular Textiles, which sets 2030 for all garments made at its borders to be durable, repairable, reusable, recyclable and free of toxins and contaminants (i.e. circular).
- The Ecodesign for Sustainable Products Regulation (ESPR) that requires brands to use a % of recycled fibers in any new garment design.
- Corporate Sustainability Due Diligence Directive that introduces rules to ensure companies identify and address human and labour rights, among others. Likewise, the introduction of standards for reporting in the Corporate Sustainability Reporting Directive (CSRD) and the European Sustainability Reporting Standards (ESRS).
- The Waste Framework Directive, through which municipalities from 2025 will have to collect textile waste separately.

These regulatory conditions shaping the CCSI and the fashion industry have numerous implications that companies need to consider and not least be prepared to handle moving forward. For one, *transparency and traceability* are key elements shaping the new legislative landscape. The EU requirements include increased

transparency in supply chains. Companies must now provide detailed information about their product's environmental impact and production methods. It is projected that such requirements enable consumers to make more informed choices and thus, it is intended to pressure companies to improve their sustainability efforts. Transparency is likely to be operationalised through a digital product passport (DPP) that follows each product. Second, the introduction of much *stricter environmental standards* is likely to shape new practices to comply. For instance, it is expected that companies invest in cleaner technologies and processes to comply with these standards, which may involve significant initial costs, long-term savings, and environmental benefits. The consequence for companies may be increased transparency with a focus on waste in production processes and in relation to unsold finished goods. Third, the *promotion of circular economy* brings about key requirements. A key element of the EU Strategy for Sustainable Textiles is to reduce textile waste and promote reuse and recycling. Here, companies are required to design products that are easy to recycle, increase longevity, and support initiatives that promote a circular economy. This entails innovation in design and materials and the development of new business models, such as take-back programs and collaboration with recycling facilities. Finally, - in addition to environmental requirements, the EU will also focus on *social aspects of sustainability*, including working conditions and fair wages in the supply chain. This is intended to ensure that the production of textiles is not only environmentally responsible but also socially just.

The upcoming EU requirements will push the textile industry to improve its sustainability practices, creating both challenges and opportunities. While the transition to more sustainable methods can be costly and demanding, the long-term benefits are envisioned to outweigh the short-term costs for the companies. Companies that adapt early and invest in sustainability will not only comply with the legislation but also strengthen their market position, enhance their reputation, and achieve economic benefits. Thus, Sustainability is a necessity and a strategic opportunity for innovation and revitalising the textile industry. CRAFT-IT4SD will generate important knowledge on how fashion and textile companies and customers prepare for the current and new legislation and provide important feedback on a policy level.

2.2.2 Using Life Cycle Assessment to quantify and reduce the adverse climate impacts

The textile industry is one of the largest consumer product industries and has large negative impacts on the environment (Moazzem et al., 2022). The industry has many challenges in its value chain, from reducing waste to promoting sustainable production and raw material use. Currently, the vast majority of textiles are disposed with incineration or landfilled, and out of the 26 kg textiles that are used by average European in a year, 11 kg are discarded (Fonseca et al., 2023), resulting in various negative environmental impacts such as climate change.

Life Cycle Assessment (LCA) is a science-based method that can be used to quantify the environmental impacts caused by different stages of textile production and consumption (Chen et al., 2023). It can also help define strategies to minimize these problems (Fonseca et al., 2023), and better understand how the sector's climate impacts can be reduced. method is standardised LCA LCA method is standardized by the International Organization of Standardization (ISO) (ISO 14040:2006) with the overall purpose of improving environmental performance throughout a product or process life cycle (Moazzem et al., 2022). In addition to global warming potential (GWP) that measures climate change, also other environmental

impact categories can be assessed through LCA, such as eutrophication, toxicity, acidification, ozone depletion, human health and ecosystem (Moazzem et al., 2022). LCA can be applied at the level of a product or an organisation. It can also be utilised for assessing business models. The information gathered during LCA provides information, for example, on material choices and their impacts, and this information can be to make more environmentally sound decisions, for example, in the design stage (Gonçalves & Silva, 2021).

Challenges. However, despite being a widely applied method both in science and business practice, the application of LCA in the textile sector has many challenges. One of these is that quantitative data collection from textile manufacturing is rather complex (Chen et al., 2023; Fonseca et al., 2023). Textile manufacturing includes several stages and different actors along the supply chain located in various geographic locations. There is also a lack of transparency in assessing the global multi-tier supply chain (Gonçalves & Silva, 2021), especially in developing countries where the manufacturing industries are located today (Fonseca et al., 2023). Further, assessing the impacts of the consumption phase has its own challenges. Collecting information from consumers and other end-users may have to be done by relying on user estimates that may not be accurate. Sometimes, access to such data is also limited. In addition, there is no common widespread methodology for calculating the sustainability of a textile product (Gonçalves & Silva, 2021). As a result, the calculation cases must be assessed individually. Also, data is not often consistent between different countries and regions, and there are technical differences in data among different regions (Fonseca et al., 2023).

In addition, rapidly changing fashion products and accelerated fashion consumption rates make data-collecting challenges even more complex (Fonseca et al., 2023). Moreover, the selection of the system boundaries required to conduct LCA creates its own challenges. For example, in some textile sector LCAs, the life cycle phases of use phase and end of life (EOL) are excluded, which makes comparisons and conclusions more difficult to make (Watson & Wiedemann, 2019). Therefore, the production of comprehensive life cycle inventory (LCI) data, used in LCA calculations, for the clothing manufacturing stage is highly challenging (Munasinghe et al., 2021). Furthermore, most LCA studies in textiles and fashion focus only on a few stages of the product life cycle or only on a specific type of product (Munasinghe et al., 2021). A systematic literature review by Munasinghe et al. (2021) showed that the list of studied textile fibres is limited (the main focus being on cotton, wool, nylon and polyester) and many other fibres should be explored (such as recycled polyester, wool, and nylon), also including fibres that are biobased, inorganic, synthetic, animal, vegetable and organic, or used in smart textiles. Finally, there is a lack of studies applying LCA at the level of business models. In practical business life, measuring the environmental impacts of business models is yet common. Often behind this are reasons such as a lack of resources and knowledge and reliable or comparable data (Das et al., 2021; Das et al., 2023; Løkke & Madsen, 2023).

Opportunities. LCA provides standardised and science-based information on products', organisations' or business models' environmental impacts such as climate impact. Using the LCA method can be seen as an opportunity and enabler of holistic assessment for the entire life cycle of textiles, covering the extraction of raw materials, manufacturing, distribution, use and end-of-life (Fonseca et al., 2023). When environmental burdens are quantified in each stage, and an extensive number of environmental issues can be covered, LCA can be a useful tool for decision-makers in identifying critical areas for improvement and

applying better alternatives (Fonseca et al., 2023). Furthermore, LCA can be used to assess the environmental sustainability of a business model to support strategic decision-making.

A comprehensive LCA also helps to account for potential trade-offs and rebound effects that may come with new solutions. A trade-off refers to gains in one area at the expense of another (Morrison-Saunders & Pope, 2023). For example, while circular business models are often suggested as a more sustainable alternative to traditional linear business models, LCA studies have shown that not all circular solutions are more sustainable or reduce climate impacts (Sandin et al., 2023). For instance, a product-as-a-service (PaaS) model may have worse environmental impacts than traditional ownership. While PaaS can extend product life and reduce users' initial costs, it may also incur higher company costs and lock users into lengthy contracts, potentially deterring service use (Pigosso & McAloone, 2016). Additionally, the environmental advantages of new circular solutions could be offset by an increase in production or consumption, a phenomenon known as the circular economy rebound (CER). Understanding both potential trade-offs and rebound effects is needed also to properly comply with the sustainability risk, impact, and opportunity (IRO) assessment as required in the new EU sustainability reporting requirements (CSRD and ESRS).

Furthermore, LCA provides useful information, for example, for the DPP introduced in the ESPR. In addition to requiring the disclosure of sustainability data, the DPP also supports the traceability of a product, its raw material and its life cycle stages. The traceability of the multi-tier supply chain can be seen as one main factor supporting sustainability. This is because traceability is a prerequisite to identifying challenges along the supply chain, assessing risks, and understanding and managing opportunities for implementing more sustainable practices (Gonçalves & Silva, 2021). Overall, by providing science-based evidence on the environmental performance of a product, organisation or business model, the impact assessment results of businesses. Therefore, LCA can support business decision-making in various ways and help build more future-proof, sustainable, climate-transition-enabling businesses. Moreover, LCA helps identify what kind of rebound effects changes in

2.2.3 Resilience in production and supply chains

Europe is affected by climate change, globalisation, political shifts, and digitalisation, which are exacerbated by a post-COVID-19 scenario. Contemporary European society, values and identity are increasingly challenged internally and externally by complexity and uncertainty, economic and social crises, a difficult cohabitation with new cultures, the gradual erosion of traditional know-how/craftsmanship and extreme competition. All these factors hinder the capacity for an effective response regarding resilience, flexibility, and innovation (Gustafsson & Lazzaro, 2021). In this light, the fashion and textile industry face severe challenges and disruptions that significantly test its resilience. As a major industry significantly damaging the environment, it is on a burning platform. Hence, there is an urgent call for action to accelerate the fashion industry towards sustainable transformation of all stages of the fashion value chain, from design and production to services and end-of-life solutions. Also, the current health crisis and the war in Ukraine have severely complicated global supply chains, making it extremely difficult to monitor and manage them, let alone allow for the transparency sought by businesses and end consumers. At the same time, all businesses need data along their value chain to comply with the CSRD and ESRS requirements.

Resilience in the context of the textile industry and supply chains refers to a company's ability to prepare for, respond to, and recover from disruptions and unforeseen events while maintaining continuity in operations and control over structure and function. It involves adapting to changes, quickly restoring operational efficiency, and building robustness, making the company resistant to future disruptions. According to extant research (Christopher & Peck, 2004; Gligor et al., 2019; Coşkun & Erturgut, 2024), the notion of resilience in the fashion and clothing industry is shaped by several key components. First, resilience depends on adaptive capacities and robustness. Resilience requires the ability to adapt and pivot in response to changes and disruptions. This involves a flexible and robust organisation that can withstand and absorb shocks and disruptions without significantly damaging its structure or function and then quickly alter its processes and strategies to meet new conditions. Meanwhile, adaptive capacity includes developing new skills and technologies that enable the company to transform quickly and efficiently, and robustness concerns having systems, risk mitigation processes, and safety measures in place that can handle stress and pressure without collapsing or minimising downtime and reducing losses. Second, resilience depends on collaboration, communication and continuity planning. Resilience requires effective collaboration and communication across the entire supply chain. This includes sharing real-time information and coordinating actions with suppliers, partners, and customers. Good communication ensures that all parties are informed about potential risks and disruptions and can work together to address them. Collaboration and communication also strengthen trust among supply chain members, improving overall robustness and responsiveness. Continuity planning involves having detailed plans and procedures in place to ensure that the company can continue operating during and after a disruption. This includes contingency plans, backup systems, and alternative suppliers and logistics solutions. Finally, there is a learning capacity perspective to resilience. A central component of resilience is the ability to learn from past disruptions and apply this knowledge to improve future strategies and operations. Learning capacity involves systematically evaluating events, identifying causes, and implementing improvements based on these insights. Therefore, an organisation that continuously learns and adapts becomes increasingly robust and better equipped to handle future challenges. These key components of resilience help textile companies build a strong, flexible, and resilient supply chain that can withstand and recover from disruptions, ensuring continuous operations and long-term success.

Opportunities. The integration of resilience and agility can help the textile industry meet the new EU sustainability requirements. These requirements include increased transparency, stricter environmental standards, and the promotion of a circular economy. For one, by applying the principles of resilience and agility, companies can achieve efficient resource use by quickly adapting to new sustainability initiatives and adjusting the supply chain to minimise waste and maximise resource efficiency. Second, companies can achieve continuous monitoring and prediction**.** Implementing systems to monitor and predict environmental impacts, as well as ensuring transparency throughout the supply chain, thereby ensuring compliance with regulations and adaptation to future requirements. Third, companies can achieve flexible adaptation capacity. Rapidly adjusting operations and tactics to meet changing sustainability requirements and consumer expectations

Challenges. A significant challenge is the need to balance long-term investments in sustainability with short-term requirements for agility and resilience. For example, investments in more sustainable materials and processes may require significant capital outlays and time, which can conflict with the need for rapid

adaptation to market demands. Another challenge is the new EU sustainability requirements, which mandate increased transparency and stricter environmental standards. These requirements will force companies to alter their production methods and supply chains, which can be a complex and costly process. At the same time, companies must maintain a high degree of resilience to withstand disruptions and a high degree of agility to respond quickly to market changes. Additionally, maintaining resilience often requires companies to have multiple suppliers and larger inventories, leading to increased costs and complexity. This can conflict with sustainability goals aimed at reducing waste and optimising resource use. Agility can also be challenged when companies need to ensure that their sustainable practices do not hinder their ability to adapt to market needs quickly.

2.2.4 Sustainable business models in times of planetary stewardship

The current modes of production, marketing and consumption of fashion products have resulted in numerous adverse sustainability impacts such as climate change (Thorisdottir et al., 2024). New ways of creating value are therefore needed in the sector to reduce these adverse impacts (Thorisdottir & Johannsdottir, 2019). The concept of a Sustainable Business Model (SBM) offers a framework for rethinking business strategies and value creation. It conceptually links the different activities of a firm, such as design, production, supply chains, partnerships, and distribution channels, and it also considers sustainability aspects (Bocken et al., 2015). In general, all SBMs draw on economic, environmental, and social aspects of sustainability in defining an organisation's purpose. They also use a triple bottom line (people, profit, planet) approach to measuring performance, consider the needs of a broader number of stakeholders than traditional business models, and incorporate a broader system-level perspective (Bocken & Short, 2021; Evans et al., 2017). Today, a broad body of academic literature exists on sustainable business models (Bocken & Short, 2021; Evans et al., 2017). An increasing amount of literature has also evolved around different types of sustainable business models in fashion (Bocken & Short, 2021; Coscieme et al., 2022; Mukendi et al., 2020; Thorisdottir et al., 2024).

Challenges. Despite a growing body of academic literature and practical business experience in experimenting with sustainable business models, designing and implementing successful, more sustainable business models has proven to be complex. First, it is often unclear how much new models quantitatively reduce the environmental and social adverse impacts compared to the traditional business models. For example, whereas circular business models are generally taken as more sustainable than linear business models, not all of them are sustainable (Geissdoerfer et al., 2018) or result in climate benefits – their climate impacts can even be worse or unknown (Dahlbo et al., 2017; Fonseca et al., 2023; Peters et al., 2021; Sandin & Peters, 2018). One reason behind this is that measuring the environmental impacts of business models is not a common business practice. This is due to a variety of reasons, such as a lack of resources and knowledge and reliable or comparable data (Das et al., 2021; Das et al., 2023; Løkke & Madsen, 2023). In short, understanding, modelling and calculating the various sustainability impacts of business models can be a highly challenging task for many companies. Furthermore, many current business solutions generally thought to be more sustainable can create rebound effects that reduce or even reverse the intended positive sustainability impacts. In many cases, the actual impacts have not been measured, resulting in unintended adverse impacts (Das et al., 2023; Milward-Hopkins et al., 2023; Sandin et al., 2023). In addition, new more sustainable business models should also be economically viable (Gutiérrez-Torrenova, 2021) and even

contribute towards more regenerative business practices - business practices and models that recognise the company's embeddedness in the biosphere, consider nature and society at large in their value proposition, and strive for net positive impact (Konietzko et al., 2023).

Moreover, new business models also face more traditional business management challenges. For example, in the clothing rental business model, such challenges can revolve around managing the logistics of rental processes, ensuring the quality and durability of products, and maintaining customer trust and loyalty (Fani et al., 2022). Finally, the new business models should provide added value to their end-users to enable them to accept and adopt more sustainable ways of consuming fashion (Arslan et al., 2021) and to support consumer acceptance and ease of access (Charnley et al., 2022). Currently, more sustainable alternatives compete against the dominant social paradigm (DSP) of fast fashion that shapes customer expectations for accessibility and affordability (Ritch & Siddiqui, 2023).

Opportunities. The new alternative business models offer opportunities for rethinking business value creation in a world that is facing severe sustainability challenges and limited natural resources (Todeschini et al., 2017). New alternative business models can offer fashion sector companies insights for transforming their current business strategies and practices to better align with the sector's climate emission reduction targets (Bocken & Short, 2021). This is particularly important as recent research suggests that while energy efficiency and renewable energy reduce the climate impacts of current business models, they are not enough to reduce the fashion sector's total climate impacts (Peters et al., 2021). In another recent study on the material flows of the UK clothing economy, it was concluded that meeting climate targets in the sector requires recycling, cleaner production and halving new consumption and that current fashion business models are likely incompatible with this required transformation (Millward-Hopkins et al., 2023). Therefore, re-thinking business models and strategies is becoming ever more vital for the companies in the sector across Europe. Consequently, business strategy building in the sector needs to consider various environmental and social aspects of the business to ensure business success and longevity in this changing environment and find innovative approaches to redesign its processes.

The long-established European cultural heritage, current Europe-based textile industries, and new technologies can support the emergence of new alternative, more sustainable business models in the European fashion sector. Both social and technical innovations have their role in the green and digital transition (Coscieme et al., 2022). For example, digital tools such as platforms for fashion rental (Arrigo, 2022) and local design and production practices (Henninger et al., 2016) enhanced with new technologies (Abbate et al., 2024; Ahmad et al., 2020; Coscieme et al., 2022) can support sustainable climate transition-enabling business models in the sector.

To support the new alternative business models, lessons can also be drawn from mindful consumption practices that include considering personal well-being, product information and marketing communication, and the consequences of consumption on self, society, and environment (Garg et al., 2024). However, attention should also be placed on the mundane obstacles and practical trade-offs that mainstream consumers face when making consumption decisions (Markkula & Moisander, 2012). Also, as sustainable alternatives often compete with fast fashion, the consumption experiences of fast fashion consumers should be understood (Ritch & Siddiqui, 2023). Finally, traditional marketing tools similar to those used for selling "ordinary" and fast fashion could be utilised to support more sustainable fashion consumption practices and

related business models (Fuxman et al., 2022) to avoid creating value propositions that do not speak to the intended target groups. Moreover, using the insights from the theory of disruptive innovation to disrupt the social norms of fast fashion consumption could support the transition to more sustainable consumption and business models in the sector (Ritch & Siddiqui, 2023).

2.2.5 Revitalising cultural heritage and building resilient communities

The cultural values and the local diversity in material and immaterial cultural heritage make the CCSI strong drivers towards the European triple transition, as argued by the European Partnership on Cultural and Creative Spillover, the UN campaign #culture2030goals, as well as the UN New Economics for Sustainable Development (UN Economist Network, 2023). Positioning the CCSI as sustainability drivers is foundational to the New European Bauhaus-initiatives and to the KIC for CCSI, EIT Culture & Creativity. These initiatives take cultural heritage, such as heritage crafts, beyond a former preservation agenda by integrating aesthetic and material values of our livable environments and the sensuousness of our everyday life as drivers for a green and social transition, positioning artists, artisans and designers as 'agents of change' with the ability to raise awareness and to influence ways of living, producing and consuming towards resilient and sustainable futures. Thus, the CCSI and cultural heritage are crucial not only in defining Europe's economic structure but also in its diverse cultural identities in ways that hold the power to inspire green and social innovation from the wealth of intergenerational knowledge and community resilience.

Craftsmanship has long been considered detached from industrial production, universalist design paradigms and an understanding of technology as driving standardisation and optimisation on a global scale. The digital transformation has further strengthened this discourse of disruption and distance, even oppositions, between previous times and sustainable futures. However, revisiting the past through craft and craftsmanship is not merely a form of collective nostalgia and heritage preservation through making, but a means of intergenerational connection, rediscovering a place in the social and historical continuum, which offers ways of innovating, avoiding disrupting communities. With the crafts revitalisation of knowledge, practices and techniques which has been growing for the latest decade comes a renewed focus on skills for sustainability and on locally sourced nature-based materials, crafts and crafts communities are revalued as both keystones of continuity and renewal in local cultures and as ways of engaging in and experimenting towards better future states. Thinking about creativity as a 'process of environmentally situated and perceptually engaged activity that is of use, through which real forms emerge and are held in place' (Ingold 2001: 22) provides a framework beyond a conceptual dichotomy of original art, innovative design and crafts as repetitious processes. CRAFT-IT4SD proposes that intergenerational knowledge of local crafts and aesthetics strengthen sense-making and belonging and ingest craft practices and skills grown with locally sourced materials, living as tacit knowledge and identities in crafts communities.

In the EU strategy for Sustainable Textiles, it is emphasised that: "digital tools are changing how clothing is designed, manufactured and serviced around the world". We argue that digital tools and skills also harbour craftsmanship (e.g. digital weaving, Bang 2022) which goes hand in hand with the knowledge and skills inherent in analogue crafts, opening opportunities to expand the field of both green, digital, and social innovation when shared across crafts communities. With the Circular economy action plan (CEAP) to

reduce, reuse, repair and recycle - adding cycles to the use of garments and textiles before disposal, the textile and garment industry faces challenges but also opportunities for rethinking the ways in which we inform and apply the crafts techniques and digital technology to design, production and use. Crafts as lived cultural practices and techniques, embedded in local environments, may become a strong catalyst for sustainable regeneration through an interplay of traditional techniques and new technologies and provide an essential stimulus to collaborate and co-learn across sectors. Crafts and material knowledge contribute tools and techniques to inform and redesign with new technologies, such as localised data-histories, digital participatory design, 3D simulations and immersive storytelling. Co-designing experimental fashion and textile design by observing ways of local craftsmanship and enriching digital technologies will contribute to a baseline analysis of capacities for craft-led innovation and subsequent prototyping across technologies towards a circular economy with reuse, repair and regenerative design.

Challenges. Local craft and living heritage are embedded in intergenerational practices, communities and histories and are often strongly connected to local, sometimes politicised, identities. The challenge is that these local identities might not align with economic business models that require scale and compliance with European-born legislation and market demands. The European and global approaches to fashion design and production do not necessarily resonate with the values and practices of local communities. An example is the Sápmi community, which produces garments and clothing for an individual within the close family system of the Sámi craftsperson only when a practical need for such an item arises, and an existing item cannot be mended. Sápmi garments and clothes are expensive and time-consuming; they are sustainable and hold emotional value but are not manufactured with an eye on scale and profit. Fast fashion, including outsourcing textile production, is so ingrained in contemporary European society that most citizens have neither knowledge about the materials applied in the textile they are buying nor where and how textiles were produced and how to repair the items they have obtained. Recently, initiatives have started to look into opportunities for bio-design that include local materials and the possibility of decentralised production by applying new technologies and establishing micro-factories. Innovative solutions have already seen the light, such as using bark and wood in Finland and sheep wool for insulation and designer cloths, trying to make the first steps towards novel applications for the tons of sheep wool destroyed in Europe every year. However, this move to more localised contexts often does not sufficiently consider community and intergenerational perspectives. This might mean that local resources are not brought sufficiently into play, and initiatives might be misaligned with communities' values and needs. Innovative actors that can operate locally in ethically responsible ways, community-born initiatives, and new sustainable business models that innovate in the cross-section between living crafts and digital technologies should be supported.

Opportunities. Moving beyond preservative approaches to cultural heritage opens perspectives where heritage and craft are not historical remnants of the past that need to be protected but where living heritage and craft are change agents, a creative source for imagining new sustainable futures and a base for a practice-oriented and sensuousness sense-making of the world. Where digital transformation is often known for its disruptive nature, by seeing both digitalisation and craft as technologies that can enrich and innovate each other for sustainable futures, already available resources will be able to be put into play, combining novelty with community resilience, intergenerational perspectives and robust relations between past, present and future. The need to explore paradigms other than the current market-driven mass consumption at the core of the global climate crises emphasises the role that heritage and crafts embedded in community

contexts can play for social imaginaries. The CCSI can inspire and help people imagine other ways of living and explore models of degrowth, for example, already available in many European communities and beyond.

2.2.6 Skills gap, education, and learning communities

Skill sets encompass a blend of competencies and experiences applicable across diverse tasks and activities. In addition to soft skills like creativity, collaboration, teamwork, and adaptability, technical skills such as proficiency with digital tools and utilising sustainable green technologies are indispensable within the CCSI, including fashion and craftsmanship (European Commission, 2020). Likewise, craft skills related to product manufacturing and materials are, broadly speaking, lacking, and there is a risk of their being forgotten.

Renewing and enhancing skills through collaboration among social, research, academic, and business stakeholders within complex networks of learning communities has been advocated as an effective strategy to achieve sustainable competitiveness, social equity, and resilience (Vuijlsteke et al., 2024). Among the European initiatives highlighted in the Skills Agenda, three initiatives specifically address the increasing demand for a Pact for Skills, aimed at fostering collaboration among various stakeholders in training and education to support the green and digital transitions. These initiatives emphasise a harmonised approach to delivering new learning content formats, such as high-quality training through short courses (micro-credentials) that meet the immediate needs of individuals, companies, communities, and society at large (European Commission, 2024).

The renewal of skills associated with traditional crafts and the emerging potential for integrating new digital technologies and services are pivotal in adopting a new ecosystem approach. This approach facilitates co-creation among traditional craft stakeholders, the fashion industry, and SMEs, including designers, artisans, and artists through immersive media technologies. The shortage of entrepreneurial and cross-cutting skills in cultural and creative sectors affects both emerging sub-sectors and mature sectors undergoing a profound digital transformation driven by sustainability policies and regulations. These skills are crucial for fostering innovation amidst the labour market changes confronting the sector (European Commission, 2021). The Pact for Skills (European Commission, 2024) underscores the necessity for digital skills, green skills, design and product development expertise, artisanal skills, and entrepreneurial skills. Learning communities hold significant potential for cross-sectoral integration of learning and training to produce sustainable products that amalgamate high creativity with digital and green transformations. However, establishing such learning communities poses challenges and complexities.

Challenges. Education and societal pressures are signalling a shift towards sustainable lifestyles (Böhme, 2022). Concurrently, there is a growing recognition of the need to integrate digital tools with the traditional knowledge and skills inherent in crafts and heritage (CHARTER, 2020). Consequently, there is a clear demand for skills and talent that promote innovation driven by creativity, design, emerging technologies, and innovative business models (CHARTER, 2020). Addressing this significant challenge requires a collaborative effort involving multiple stakeholders from research, industry, policy-making, and civil society. These stakeholders must come together to address skills and capacity gaps through cross-sectoral

learning ecosystems (González Fernández et al., 2019). However, several obstacles hinder the adoption of new skill sets within learning communities. These include a lack of motivation and community engagement, resistance to transitioning from traditional methods to digital tools and new business models, and various social factors that may inhibit collaboration within these communities. Moreover, the overwhelming size of virtual communities can discourage individual participation, while community members' time constraints often impact their engagement level.

Opportunities. Learning communities serve as forums where designers, artists, students, researchers, academics, and craft manufacturing companies/local businesses engage collaboratively. These communities offer unique opportunities for sharing findings, exchanging ideas, and establishing collaborative pathways. These pathways aim to harness the transformative potential of integrating valuable cultural and craft heritage with advanced technological resources. Additionally, by sharing best practices and experiences, members of learning communities actively contribute to the appreciation of creative potential and bridging regional innovation disparities (European Commission, 2020). This approach leverages European creative expertise and traditions to cultivate cross-industry skills and partnerships. Moreover, learning communities play a crucial role in facilitating transnational training, mobility, and networking among stakeholders involved in various projects and initiatives. This enhances creativity and supports the preservation of craft heritage (European Commission, 2019). In this regard, these communities may help identify skills gaps, co-create learning pathways, and develop knowledge and skills essential for green upskilling and reskilling formats. However, such collaborative effort involves teams from diverse organisations representing the CCSI.

2.3 New Directions and Future Horizons for the CCSIs

The CCSI plays a crucial role in advancing the triple transition (green, social and digital) across Europe. As these industries undergo evolution, new pathways and future perspectives are emerging, characterized by technological progress, interdisciplinary collaboration, and a renewed emphasis on skill development, funding opportunities, and social and environmental sustainability. The following section outlines these critical issues that will define the future landscape for the CCSI, emphasizing the opportunities and challenges that await.

First, the CCSI are placed in a triple transition, in which digitalisation and technological advancements transform the sectorial landscape. For instance, advanced digital technologies are reshaping CCSI ecosystems (Peukert, 2019; Li, 2020). As recent studies highlight, generative artificial intelligence has the potential to revolutionise content creation (Lee, 2022), while augmented and virtual reality are transforming content presentation and production (Jung et al., 2020). The rise of the metaverse, non-fungible tokens (NFTs), and blockchain technology is likewise introducing new business and revenue models that re-configure the ways of doing business (Li, 2020). These shifts are exemplified by the increasing number of CCSI-related tech startups, particularly in sectors like video games and media technology, but with cross-fertilisation into fashion (Priyono et al. 2021). While the digital transformation has gained significant momentum, so has the green transition. CCSI sectors are increasingly adopting a range of more sustainable technologies, such as renewable energy sources in architecture and cultural infrastructure, eco-friendly materials in design, and sustainable production methods in fashion and clothing. The use of 3D technology

to digitise cultural heritage assets and the adoption of virtual events to reduce physical travel are also edging closer to the mainstream (Skublewska-Paszkowska et al. 2022).

Second, the CCSI and the fashion industry face the need to enter strong interdisciplinary collaborative partnerships and alliances to drive innovation and mobilise skills needed for the future (Günzel-Jensen & Rask, 2021). In this regard, the fashion industry is in fact a catalyst for broader field-wide transitions and transformations of society at large. European policymakers recognise that artists and creative professionals bring unique perspectives that can inspire new technological applications and spur innovation across various sectors, which is why the notion of co-creation is considered a key mechanism for fostering collaboration between the CCSI and other domains, driving participatory and holistic societal change (Matti et al., 2015; Ruess, Müller, & Pfotenhaur, 2023). As fully described in chapters 4 and 5, CRAFT-IT4SD adapts cocreation in the four pilot ecosystems.

Third, the skills and educational agenda constitute a fundamental component of the triple transition. To facilitate these transitions, both specialised and general digital skills are essential within the CCSI and fashion industry. It is imperative to equip professionals with technical skills to effectively utilise digital tools, entrepreneurial, legislator and sustainability skills and knowledge to innovate new sustainable business models, and creative skills to explore the artistic potential of emerging technologies (Rayna & Striukova, 2021). This is clearly reflected in the EU's Digital Education Plan (2021-2027) and the Creative Pact for Skills (C-P4S), which aim to address these needs by fostering skills development and interdisciplinary training (European Commission, 2020d; European Commission, 2024b).

Fourth, while investments and funding opportunities have experienced an increase, access to financial resources poses a considerable challenge. Despite the challenges posed by the COVID-19 pandemic and the subsequent economic crises, investment in digital technologies within the CCSI has substantially increased (Khlystova et al., 2022). Public authorities are crucial in financing the CCSI through grants, tax incentives, and guarantee schemes. Post-pandemic recovery plans have significantly boosted investments in digital and green technologies, enabling the CCSI to continue its transformation. However, a key challenge is access to finance, especially for micro-sized companies producing intangible intellectual property assets. For that reason, public initiatives like the Cultural and Creative Sectors Guarantee Facility are designed to mitigate these challenges by providing financial support and reducing investment risks for CCSI projects.

Moving forward, the fashion industries must continue to integrate sustainability into their core operations to stay competitive while being resilient to the escalating number of disruptions that continue to challenge the foundation of the industry. This includes adopting green technologies, reducing resource consumption, and minimising environmental impact. Innovative practices, such as the way we use (local) materials in a smarter way and applying energy-efficient technologies, introduce transparent value chains and new formats for collaboration will be essential in achieving these goals. The CCSI must address structural challenges such as precarious employment conditions and dependency on a few dominant global platforms to enhance such resilience. Strengthening creative professionals' social and economic conditions, ensuring fair remuneration, and safeguarding cultural diversity and craft are critical steps in this direction. Enhancing the competitiveness of the CCSI on a global scale will require continuous upskilling, awareness for already existing resources and the development of innovative sustainable business model. Hence, the future of the

CCSI is marked by a triple focus on digital, green, and social transformations. Technological advancements and interdisciplinary cooperation will drive innovation, while targeted investments and skill development will support sustainable growth. By addressing current challenges and leveraging new opportunities, the CCSI can play a pivotal role in shaping a resilient and dynamic European cultural and creative ecosystem. As these industries continue to evolve, policymakers, industry stakeholders, and creative professionals must collaborate closely, ensuring that the CCSI adapts to and leads the way in the digital and green transitions.

3.0 Identification and alignment with key initiatives and players in the CCSI ecosystem

On a European level, the consortium includes EIT Culture & Creativity (EIT C&C) as an Associated Partner. EIT C&C addresses the triple (green, digital and social) transition and works from an ecosystem perspective, focusing on connecting smaller CCSI players with policymakers, higher education institutions and the industry. In the last phase of CRAFT-IT4SD, a number of ecosystems linked to EIT C&C Colocation centres will be mobilised for replicability of the results. This activity is anchored in Task 4.6 and led by ECBN. Aarhus University (AU) and OAMK are Associated Partner in EIT C&C.

AU is also involved in Europeana Research Advisory Board. Europeana leads the European data space for cultural heritage, a new EC flagship initiative to accelerate the digital transformation of Europe's cultural sector and foster the creation and reuse of content in the cultural and creative sectors. In CRAFT-IT4SD's Advisory Board the link to European data Spaces is further strengthened by Atos representation who leads the European Data Space for Energy. Other key initiatives and organisations represented in the Advisory Board are Climate-KIC, Consumer organisation Tænk, and Euratex, facilitating dialogues with industry partners and seeking strategic alignment with other key projects, such as Regiogreentex, bringing 43 partners from 11 European regions, together, including 24 SMEs, to pioneer innovative solutions to recycle textile waste and turn waste into value. CRAFT-IT4SD has become a member of Ecosystex, a joint initiative of the European Commission's Research Executive Agency (REA), the European Health and Digital Executive Agency (HaDEA) and the Circular- Biobased Europe Joint Undertaking, facilitated by the Textile ETP, and works closely together with its sister projects PACESETTERS and STRATEGIES. Other relevant project where we seek synergies are "tExtended project" on new business models and symbiotic interactions in textile value chains, focused on circular economy aspects; Telavalue, building value chains for sustainable production, use and recycling of textiles in a national context; ASTRICO NE, EU-TEXTILE2030, TEX4IM, HereWear and Skills4Smart TCLF Industries 2030; Trace - Transition towards Circular Economy - 'Culture Testbeds for Interactivity, Performance and Technology' (aCuTe) and several partners in our consortium are actively engaged in Pact for Skills.

Besides the above, the four pilot sites are embedded in regional ecosystems, making up a diverse and multifaceted landscape of projects and initiatives that offer opportunities for collaboration and creating synergies. In the following sections, we will present the first results of our ongoing ecosystem mapping, which will be further developed and presented in more detail in D7.3 Playbook for Ecosystems, which is due May 2025.

3.1 Charting and Visualisation of CCSI ecosystems

CRAFT-IT4SD uses the online platform Kumu (www.kumu.io) to visualise and cluster projects and initiatives within the CCSI ecosystem. Kumu is chosen because it is a highly recognised and powerful tool for mapping complex systems and relationships, providing an intuitive way to visualise and analyse the connections between various initiatives and projects. For example, Kumu's suite of mapping tools is used in projects and initiatives such as the Oxford Map the System, Standford Change Labs, and the Hewlett Foundation.

The visualisation process in Kumu comprises four key features: interactive maps, clustering, dynamic data, and user interaction. **First**, using Kumu, *interactive maps* will be created to display the geographical distribution and interconnectedness of strategies and projects across different levels (EU, regional, national, and local). **Second**, initiatives will be *clustered* based on their focus tags, allowing for the identification of common themes and focus areas within the ecosystem. **Third**, the platform will enable *dynamic data* updating and visualisation, ensuring the most current information is always available. **Finally**, users can *interact* with the visualisations, exploring detailed information about each initiative, including descriptions, active years, and links to official websites. For CRAFT-IT4SD, Kumu offers a thorough and visually compelling means to comprehend the landscape of initiatives and projects within the CRAFTIT-4SD ecosystem, thereby facilitating the identification of patterns, gaps, and opportunities for collaboration and growth. While the visualisations for the Method Playbook in section 3.2. are static screenshots, the online platform enables interactive navigation of the CRAFT-IT4SD ecosystems. As CRAFT-IT4SD progresses, partners will feed the platform continually with data, expanding the ecosystems, and illustrating the interconnected relationships within and between the pilot sites of CRAFT-IT4SD.

3.2 The four pilot ecosystems

In the following, we present first a preliminary overview of CRAFT-IT4SD pilot ecosystems (Figure 2). In this, we *zoom out* to get a view of the entire CRAFT-IT4SD ecosystem and show how the pilot sites are interconnected. In following visualisations, we *zoom in* on the respective pilot sites in Romania, Finland, Spain, and Denmark. Here, we distinguish between visualising key initiatives and projects, and focus areas and themes.

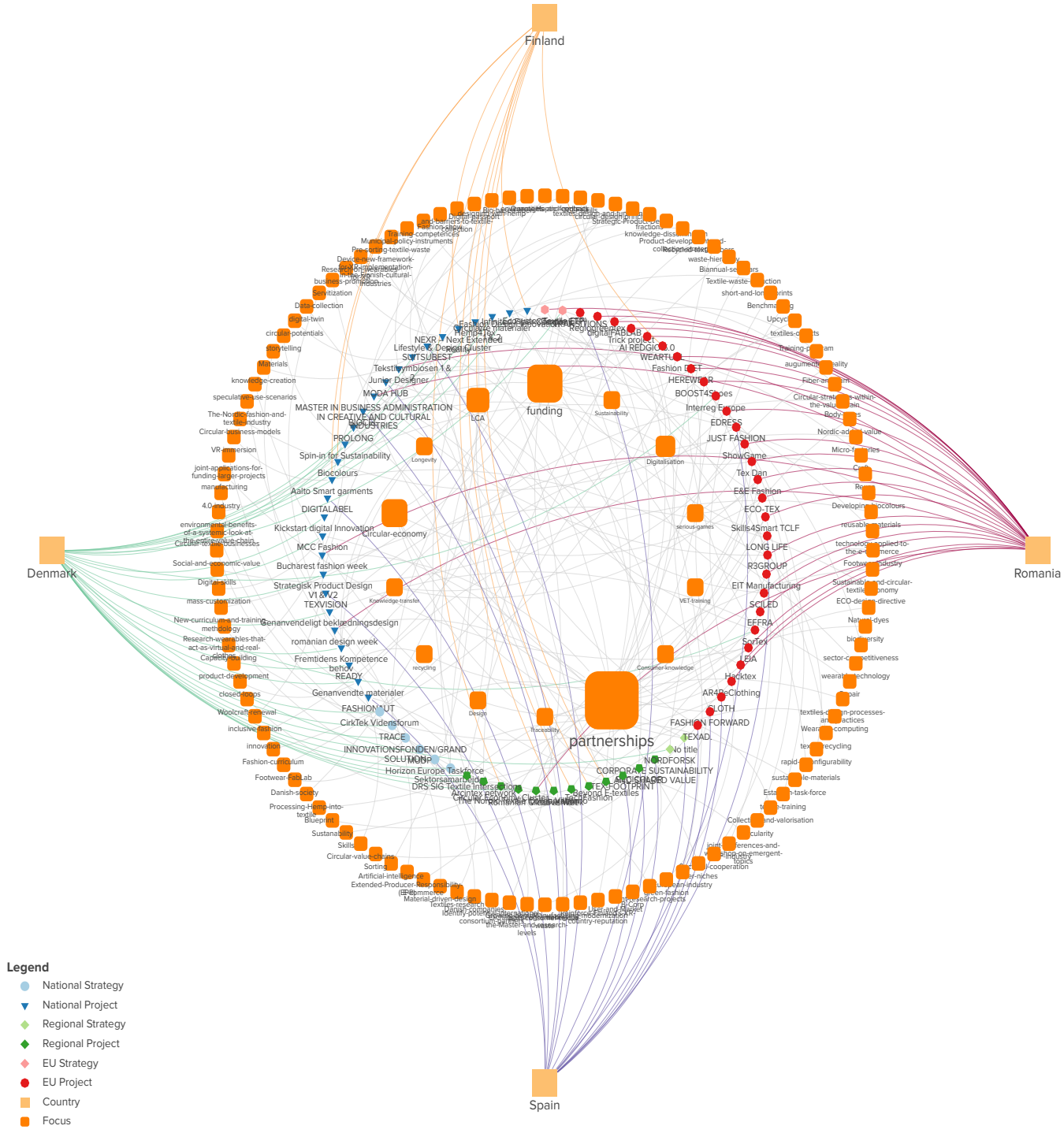

Figure 2. Overview of CRAFT-IT4SD pilot ecosystems

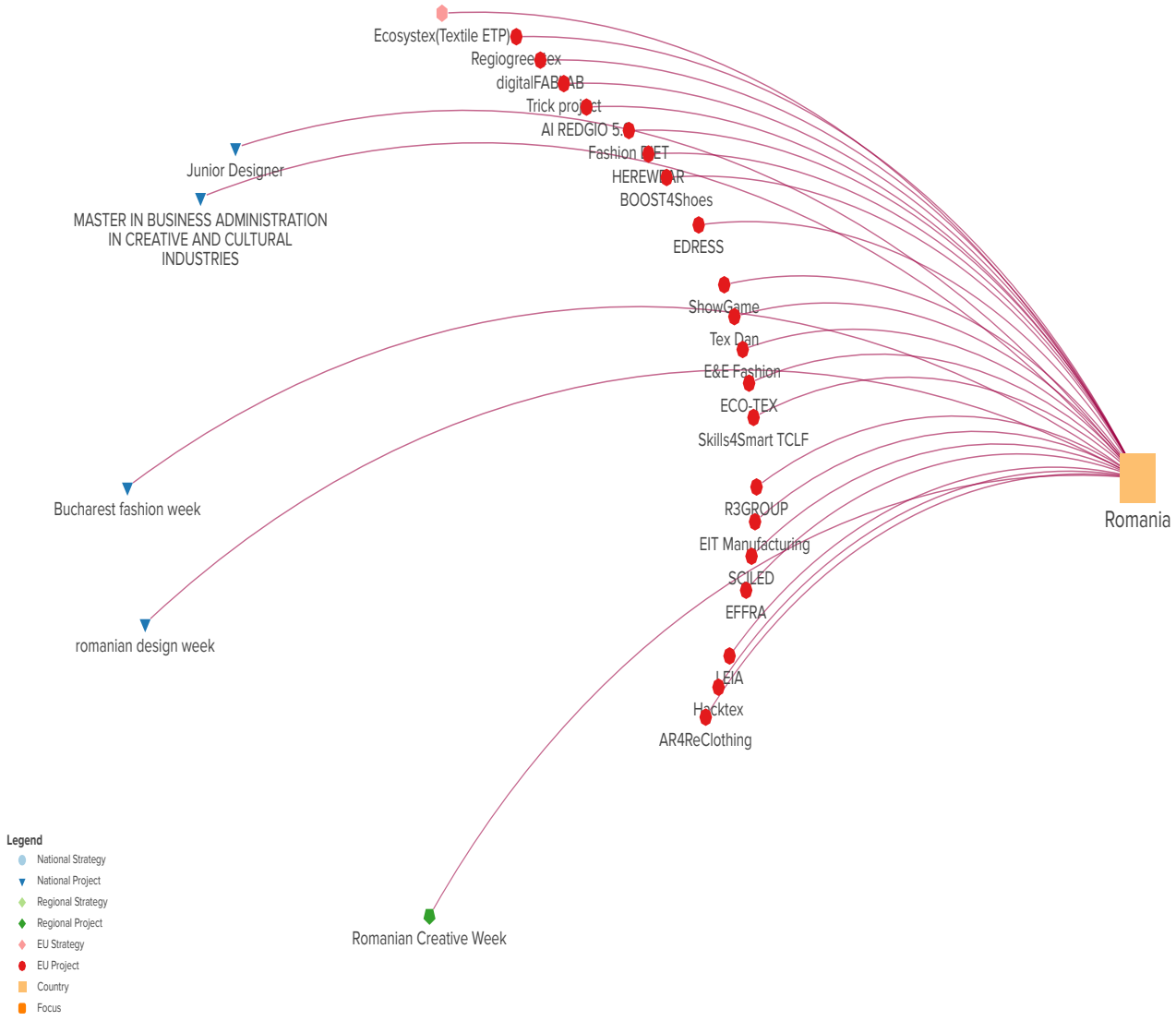

Figure 3. Zooming in on Romanian pilot ecosystem: Initiatives and projects (TUIASI)

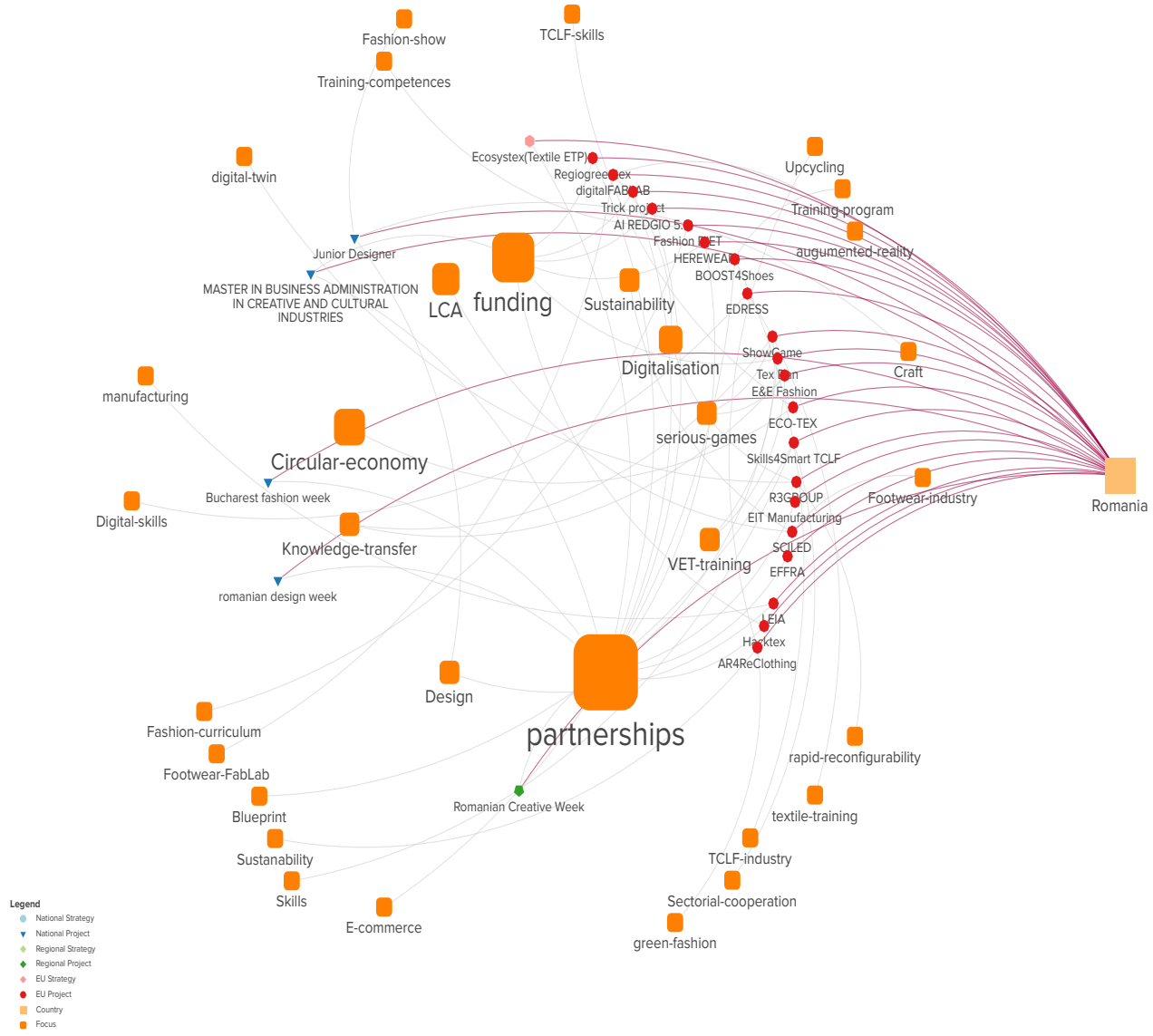

Figure 4. Zooming in on Romanian pilot ecosystem: Focus areas and themes (TUIASI)

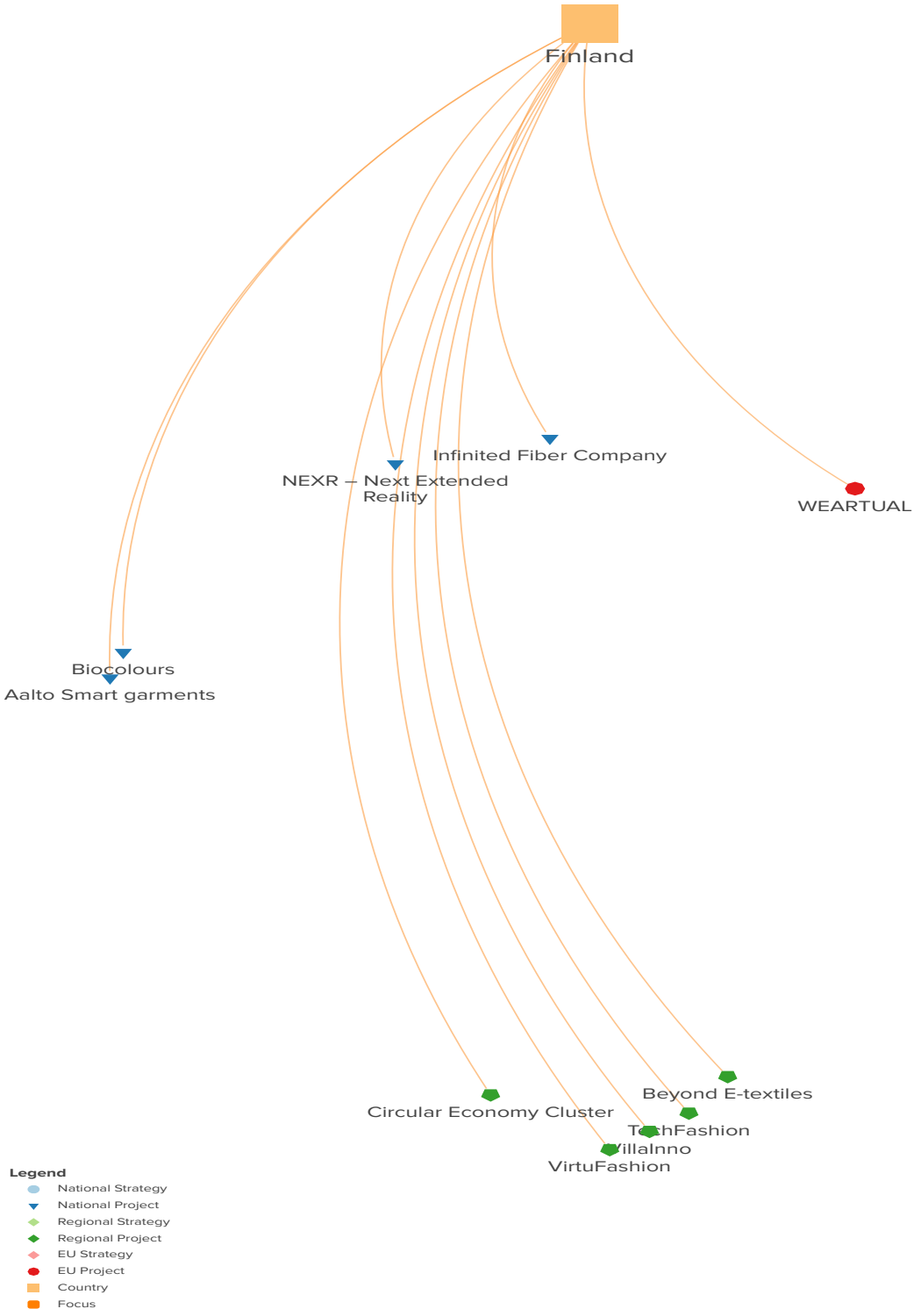

Figure 5. Zooming in on Finnish pilot ecosystem: Initiatives and projects (OAMK)

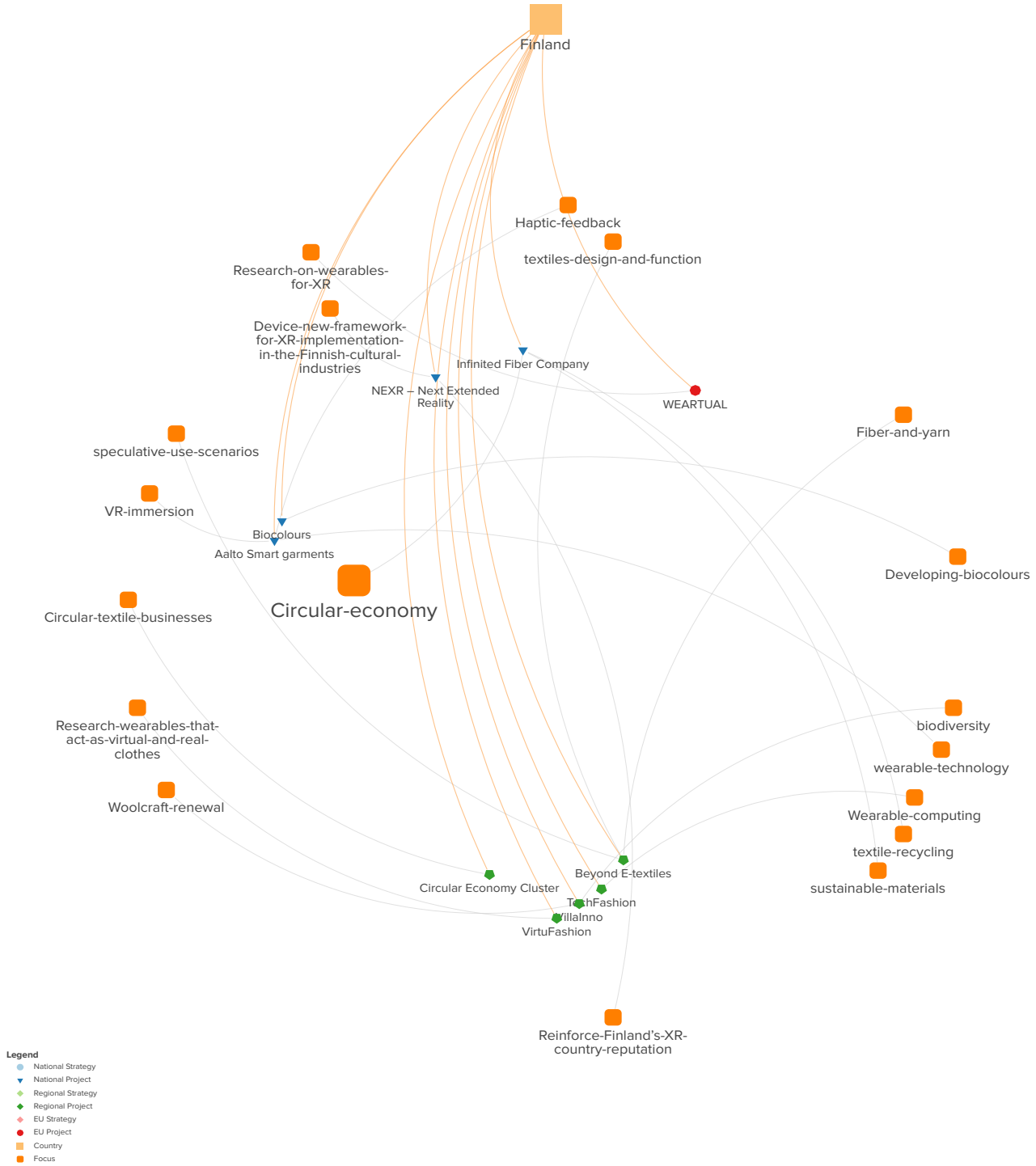

Figure 6. Zooming in on Finnish pilot ecosystem: Focus areas and themes (OAMK)

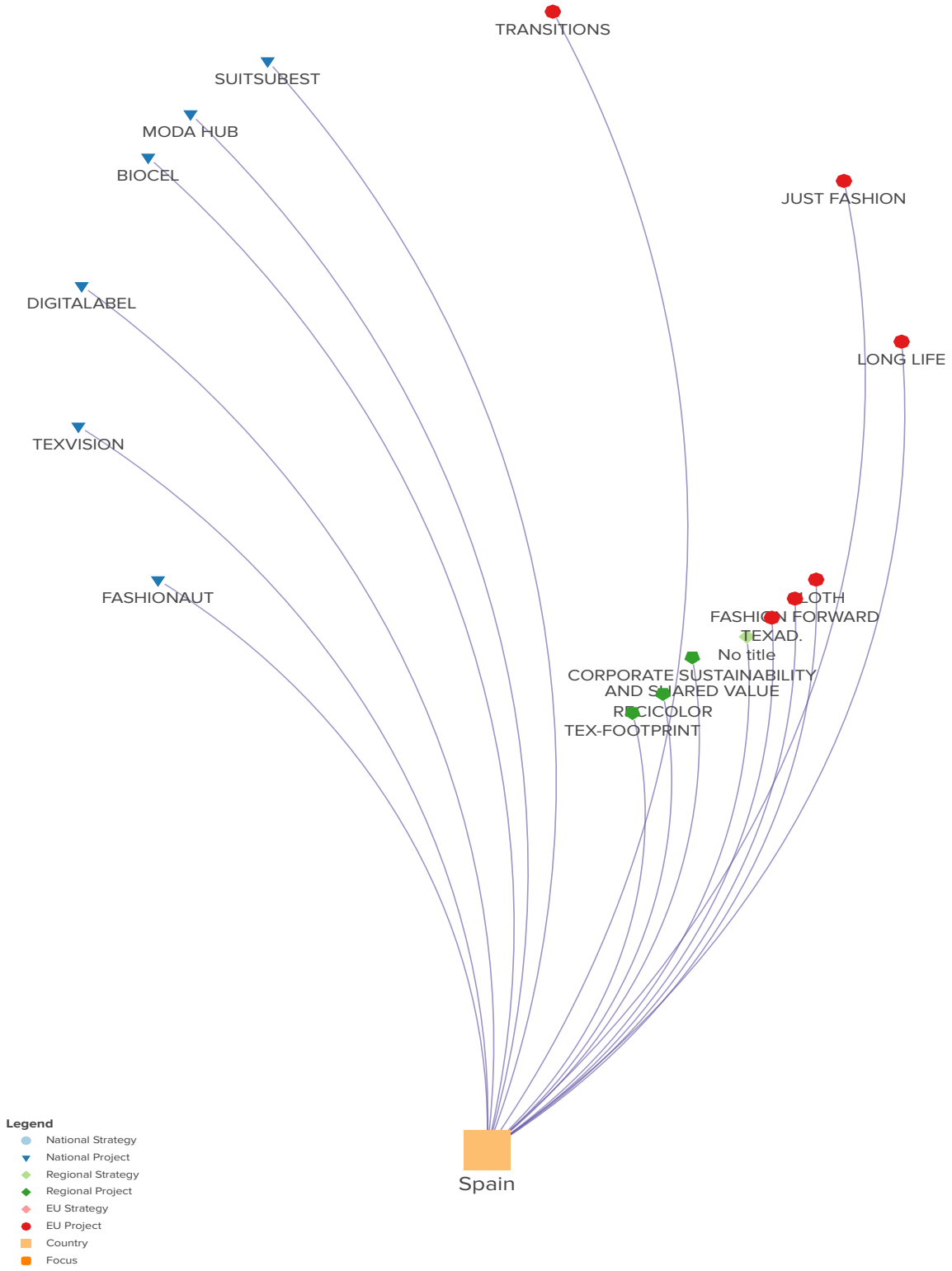

Figure 7. Zooming in on Spanish pilot ecosystem: Initiatives and projects (MODACC)

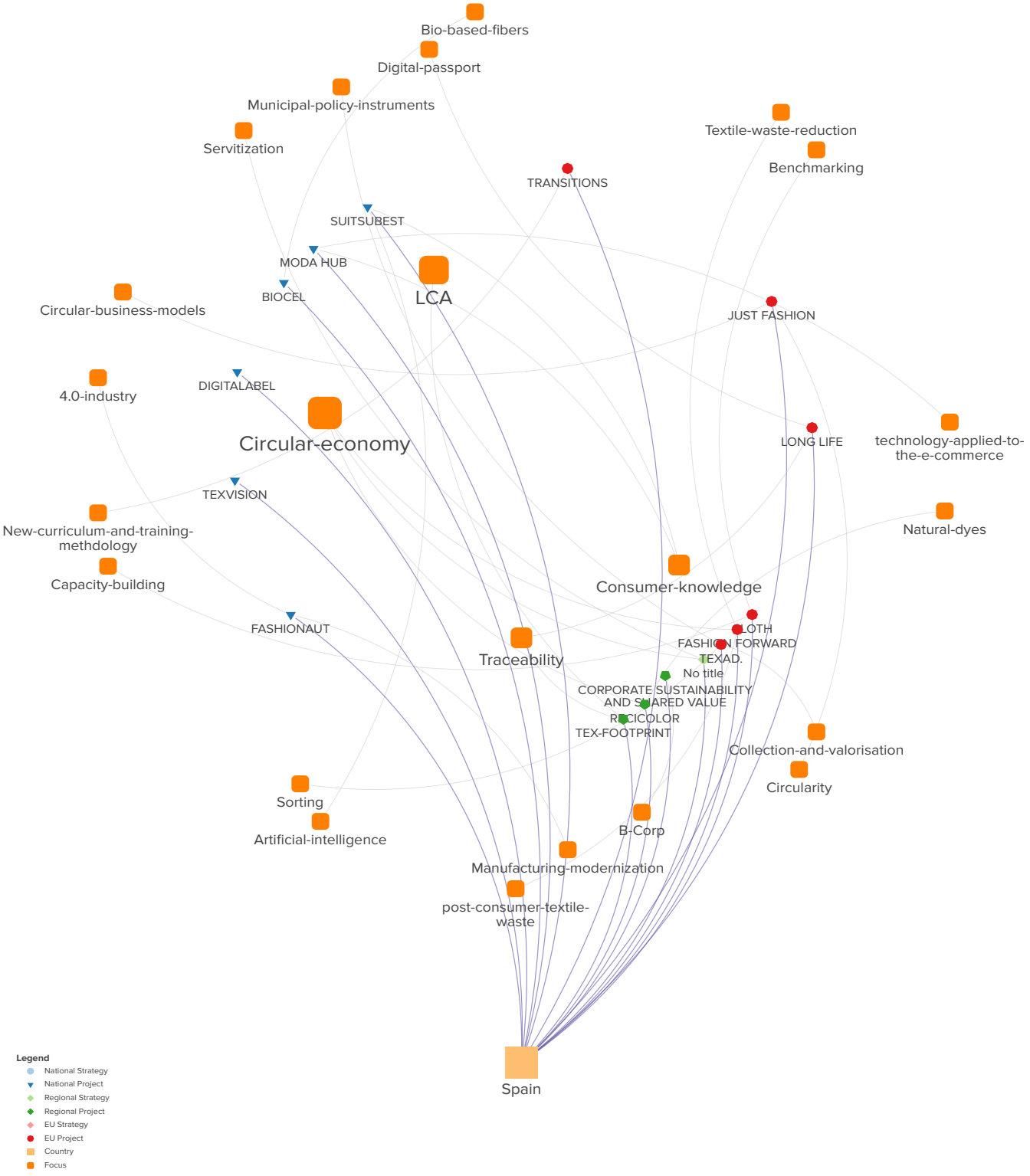

Figure 8. Zooming in on Spanish pilot ecosystem: Focus areas and themes (MODACC)

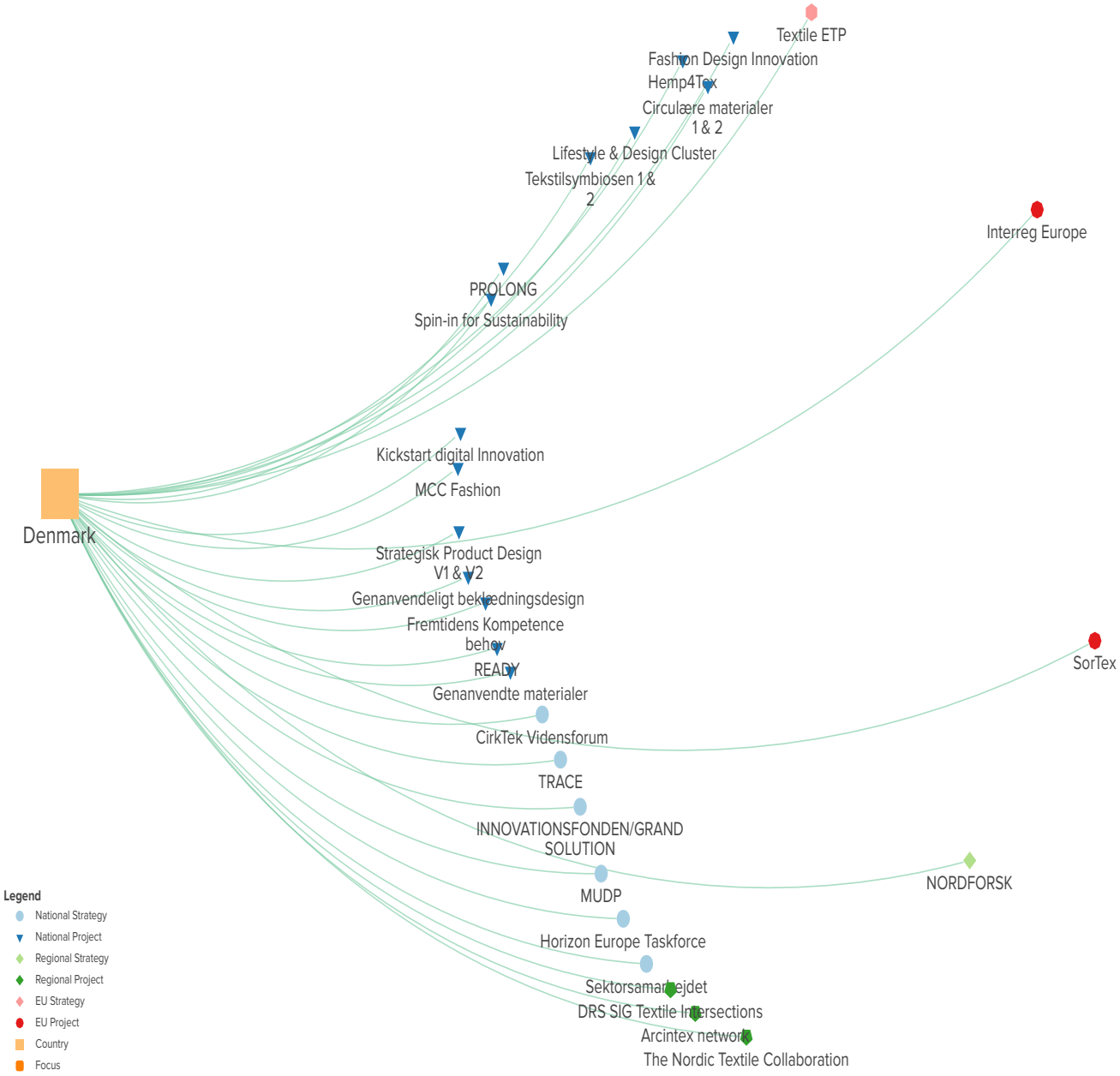

Figure 9. Zooming in on Danish pilot ecosystem: Initiatives and projects (VIA)

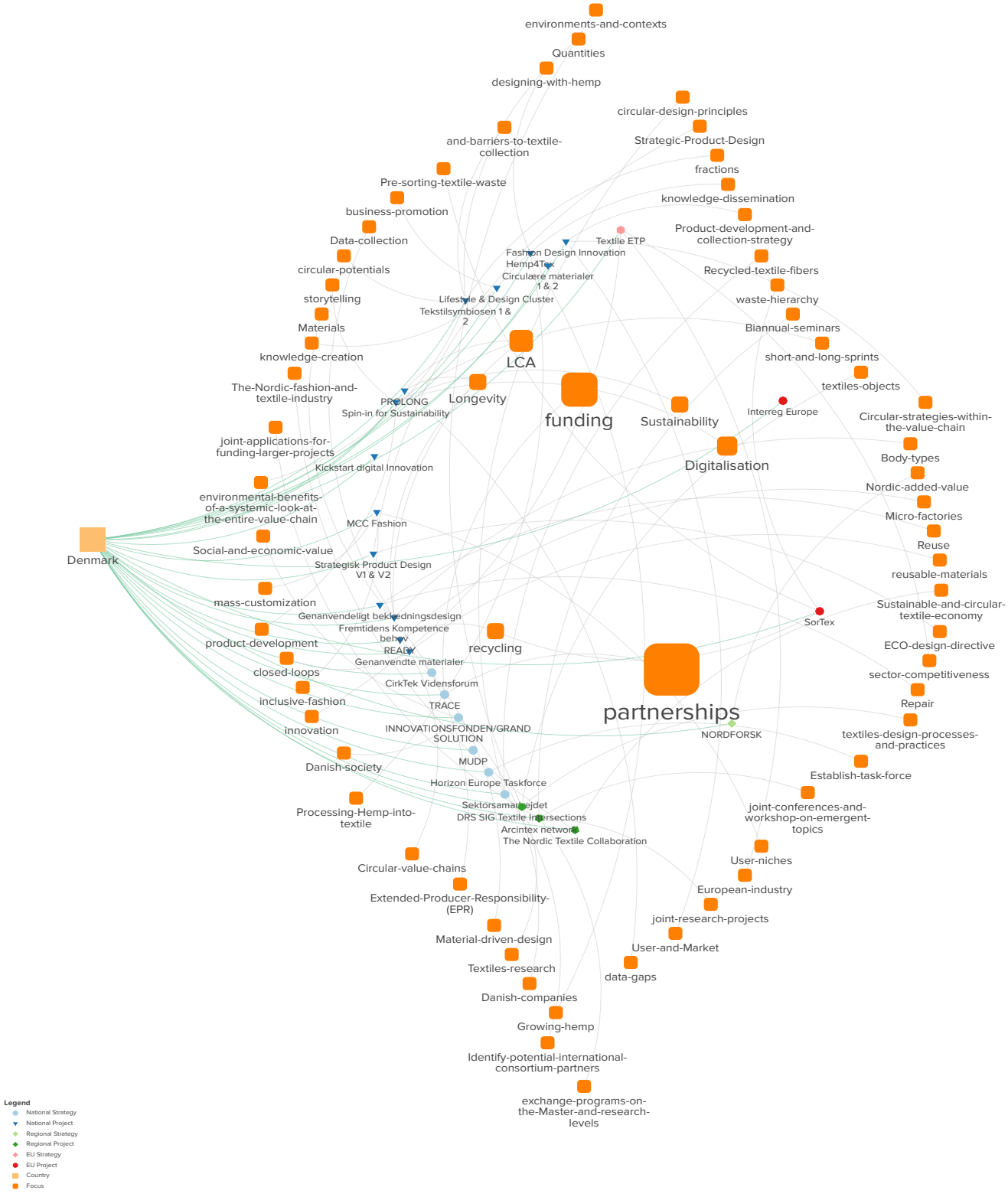

Figure 10. Zooming in on Danish pilot ecosystem: Focus areas and themes (VIA)

4.0 CRAFT-IT4SD objectives and methodology of CRAFT-IT4SD

The main objective of CRAFT-IT4SD is to identify pathways for cross-sectoral experimentation to become a driver for the sustainable climate transition for the fashion and textile industry. The cross-sectoral experimentation builds on an ecosystem approach across creative clusters of craft communities, the fashion industry, and living technology lab hubs for innovation. To reach this objective, CRAFT-IT4SD applies ecosystem analysis and experimentation to merge craft and traditional techniques with emerging digital technologies. Data readiness is applied through LCA and climate impact data, feeding into the development of new sustainable business models. The CRAFT-IT4SD methodological approach is challenge-driven and builds on 4 foundational pillars that constitute CRAFT-IT4SD, as illustrated in Table 3. Table 3 shows how Work Packages are connected to the foundational pillars, and Figure 11, further below, visualises how the Work Packages are interconnected and combined to make up CRAFT-IT4SD.

Table 3. The four foundational pillars of CRAFT-IT4SD

	Revolves around	Connected to following WPs
Pillar 1	Ecosystem analysis for systematic experimentation across craft techniques and digital technologies.	WP 2; WP3; WP 4; WP 7
Pillar 2	Design Thinking process in three iterative phases across connected ecosystems and cross-sectoral approaches	WP4; WP6; WP7
Pillar 3	LCA and collection of climate impact data for future scenarios and sustainable business models.	WP 3; WP 4; WP 5; WP 6
Pillar 4	Explorative data validation, data sharing and data-driven business modelling for climate and economic sustainability.	WP 3; WP4; WP 5; WP 7

To reach the objectives and ambitions described above, CRAFT-IT4SD builds upon inclusive partnerships involving diverse but complementary CCSI actors. In line with flagship three of the New European Innovation Agenda (NEIA) on creating 'regional innovation valleys', CRAFT-IT4SD adopts an ecosystem approach to initiate, develop and support transnational alliances and multi-helix collaborative partnerships between knowledge institutions, SMEs, policymakers and customer organisations. CRAFT-IT4SD seeks to broaden stakeholder engagement and bring actors together in joint action and collaborative partnerships by establishing pilot sites for place-based innovation ecosystems. To enable experimentation, testing and demonstration, it is key to ensure an infrastructure for transregional knowledge circulation and mobility between pilots in which CRAFT-IT4SD include links between resources and organisational actors. As many micro companies, artists, craftsmen and designers, startups, and SMEs within CCSI are born with a sustainable mindset, CRAFT-IT4SD will connect their great innovation potential to larger industrial players, knowledge institutions, policymakers and consumer organisations to unleash the innovation potential and counteract the fragmentation. In this process, larger players and policymakers will be aware of the potential. They can implement measures to open their legislation or innovation models to help push the smaller actors to drive the sustainable transition. By building strong interconnected research and innovation ecosystems in this way, the methodology of CRAFT-IT4SD complements other instruments such as European Innovation Ecosystems (EIE), EIC and the EIT.

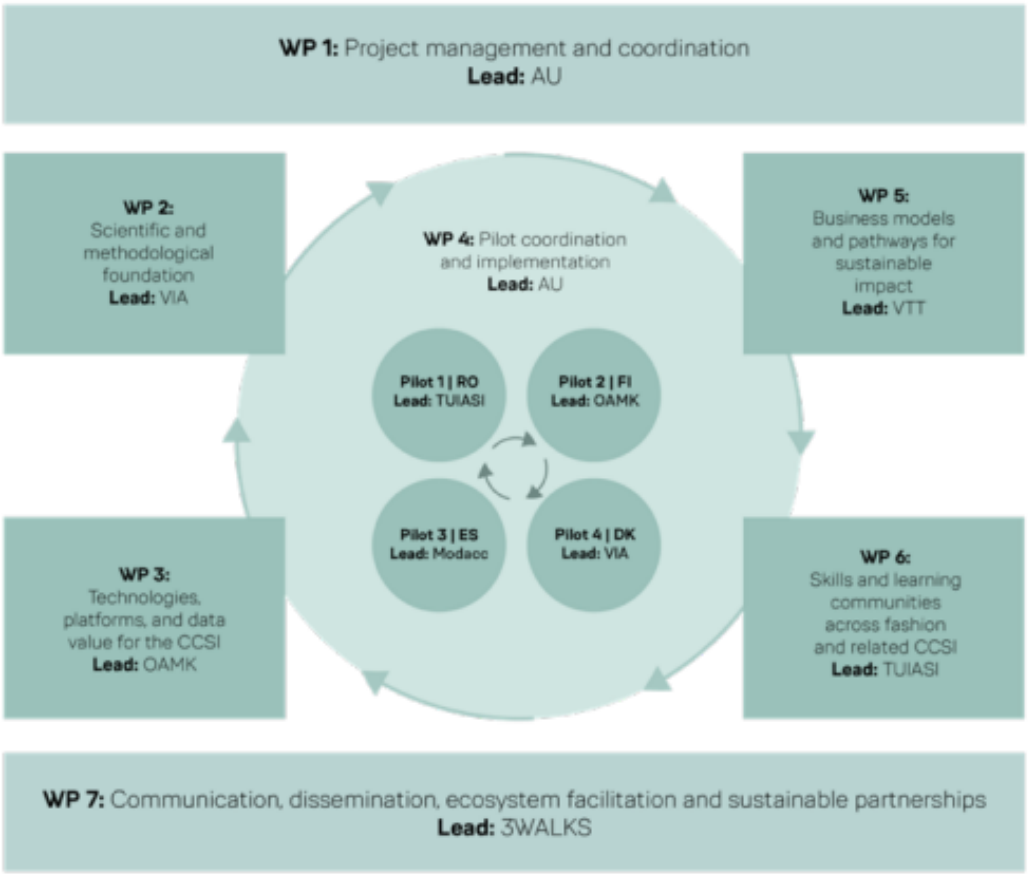

Figure 11. CRAFT-IT4SD Work Package structure

4.1 The foundational pillars

4.1.1 Pillar 1: Ecosystem analysis for systematic experimentation

The pilot regions will carry out a baseline analysis of the CCSI-ecosystem in the pilot regions to assess cross-sectoral innovation readiness between sustainable-production and consumption-based in the localised ecosystems, and their infrastructural capacity to enable innovation through digital infrastructures, lab facilities and innovation hubs for the sustainable climate transition. This analysis will assess the organisational readiness of the pilot regions SMEs for networked and open innovation. The pilot ecosystem analysis, part of WP7, will map the cross-sectoral CCSI ecosystems not only as economic actors but also as creativity-driven productive systems. The ecosystem analysis will qualify the profiles and resources put forward by the pilot ecosystems; the analysis will be methodologically conceptualised in WP2 as part of D.2.1 (see chapter 5), to be carried out locally in the pilot ecosystems in WP4, with an uptake and further qualification as a model analysis in WP7, for dissemination and replication. The ecosystem analysis will take off from the fact that cultural and crafts production is localised in regions rich in crafts and local industrial heritage and will target the technology and data readiness for these SMEs.

4.1.2 Pillar 2: Design Thinking process across connected ecosystems

To secure progression and circularity despite variation in topics and application contexts within the pilot ecosystems, Design Thinking is applied to structure the overall process while accommodating flexibility and independence in managing the pilots to secure a high-quality content development based on co-creation and a bottom-up ecosystem approach. Design Thinking is chosen as an overarching methodology for three reasons:

i) Design Thinking as implementation methodology enables CRAFT-IT4SD to ensure that content development will be in line with the target group: the small and micro-sized companies within fashion, textile, crafts, and immersive technologies. Design Thinking is a well-reputed approach driven by a human-centered philosophy, which goes hand in hand with the CRAFT-IT4SD focus on small/micro-sized companies and ecosystems. Hence, the first key objective of using the Design Thinking approach is to nurture an empathic alertness to the needs and challenges of those in focus.

ii) Design Thinking provides a framework through which CRAFT-IT4SD can learn rapidly by means of recurrent loops of iteration. Hence, the learning outcome is cumulative and ongoing throughout the entire process, as visualised in Figure 12 in Chapter 5. The benefit of this is that the project will not have to wait long for learning to occur. A second key objective for using Design Thinking is, therefore, the flexibility of the approach that enables rapid shifts (pivoting) when or if needed.

iii) A third key objective for using the Design Thinking approach in CRAFT-IT4SD is the holistic structuring of WPs in which many stakeholders collaborate towards a common goal. The involvement of multiple stakeholders is important due to the complexity of the industries' challenges. Design Thinking enables a way of thinking and developing that will holistically involve stakeholders in strong participatory partnerships.

4.1.3 Pillar 3: Life Cycle Assessment and collection of climate impact data

As described earlier, Life Cycle Assessment (LCA) is a widely applied science-based method for assessing environmental impacts, such as climate. LCA is a foundation for company decision-making for the provision of transparency in climate impact pathways, providing environmental impact documentation towards users and customers. The LCA carried out in CRAFT-IT4SD provides a key method for analysing the status of sustainable business models in the pilot sites and their climate impact. It also allows for the collection of climate impact data, for creating future-oriented climate scenarios, building pathways for a sustainable climate transition and supporting sustainable business models based on the results of the assessment. In WP5 and in collaboration with WP4, the status of business models in the pilot sites will be assessed with a particular focus on sustainable climate transition aspects. Before applying LCA, a baseline mapping of the different pilot sites is needed. This mapping is based on qualitative methods. It will use interviews and workshops to collect information on current business models, future development aspirations and alternatives, and business challenges and opportunities in relation to sustainable climate transition to identify critical topic areas for consideration in the creation of future-oriented scenarios and for building sustainable climate transition enabling new sustainable business models. The mapping supports

the LCA-based climate impact assessment of current business models. Selected business models will be assessed quantitatively and follow the LCA methodology. The climate impact assessment will help to understand the climate impact baseline at the four pilot sites and what kind of new business models can be developed to support sustainable climate transition. In addition, principles of LCA thinking will be introduced to the pilot site actors, integrated with the Learning Ecosystems (WP6), and offered as Open Educational Resources (OERs). CRAFT IT4SD will secure the transferability of the assessment model with a specific focus on the CCSI cross-sectoral potentials for driving the green transition to secure replicability beyond CRAFT-IT4SD.

4.1.4 Pillar 4: Explorative data validation, data sharing and data-driven business modelling

The LCA and the collection of climate impact data will, together with data from digital process innovations, support the CRAFT-IT4SD business modelling under the holistic approach by bringing together data and information in a triple transition, considering climate impact data from LCA (WP5), the human-centred approach from the pilots in the form of business stakeholder perspectives (WP4, WP5) as well as given enabling technologies and infrastructures (WP3, WP5). The digital approaches proposed by CRAFT-IT4SD will generate data for assessment across processes and local ecosystems. Responding to legislation developments requires reliable and comparable quantitative climate impact data CRAFT-IT4SD will provide such data through LCA. The climate impact OERs will then support the co-creation-based development of new sustainable business models while also considering aspects related to the economic sustainability of the models. CRAFT-IT4SD will use standardised and common naming conventions for files and datasets. This, combined with extensive use of metadata, will enable dataset findability. All outputs will be tagged either as confidential (restricted use for a single partner), restricted (open to project participants and the EC) or open data (third-party usage). CRAFT-IT4SD aims to provide as many open data sets as possible to maximise the reuse of the material generated in other research initiatives and for potential new algorithm training. This includes data sharing inside pilots (intra and inter-pilot) and with the projects funded under the same call and other relevant initiatives. The explorative data methodology for new sustainable business models combines awareness of the impacts of climate change, of the requirement for data standards and interoperability for CCSI and the Fashion and Textile Industry following the incoming European directives and legislation, and of regional engagement for sustainable climate transition, and the translation of ecosystem-engagements into cross-sectoral pathways for sustainability in order to develop operational data-sharing across CCSI, to disseminate knowledge, playbooks and platforms for data-sharing, and to empower cross-sectoral CCSI-ecosystems to exploit project results. At the end of each pilot cycle, the operational results will enrich methods, data readiness, sustainable business modelling and upskilling in understanding data requirements as a basis for decision-making. Operational results are promoted and disseminated beyond CRAFT-IT4SD, through the CRAFT-IT4SD communication strategy and replication with other CCSI-ecosystems (WP7).

5.0 Pilot Demonstration Approach

5.1 Design Thinking and co-creation as a methodological approach

CRAFT-IT4SD deploys Design Thinking as a methodological approach, strong on co-creation, to secure a cohesive force revolving around the pilots at the heart of the project. Connecting pilot sites for synergies and cross-fertilisation is key to CRAFT-IT4SD due to the ecosystem approach, and co-creation is a proven framework to accommodate and integrate a participatory architecture for the ecosystem. According to a recent Science for Policy report by the EIT Climate-KIC and the JRC, co-creation holds great promise as a "flexible and powerful approach to understand better economic, social, technological, cultural and environmental challenges and design innovative solutions collaboratively at many levels" (Matti et al., 2022, p.7). Co-creation is a widely used methodology, endorsed by European innovation policies as a concept that connects diverse individuals and entities through democratic principles, enabling inclusive and socially robust forms of innovation for the benefit of all (Ruess et al., 2023; Müller et al., 2021). Therefore, Design Thinking is well-suited as an overarching methodology as it captures the principles of co-creation through the dynamics of divergent and convergent thinking in a manageable way (Lawson, 2005; Liedtka & Oglivie, 2011).

5.2 Concept for executing pilot demonstrations and intra-pilot collaboration

In line with the Design Thinking approach, CRAFT-IT4SD prioritises the power of pivoting and iterative qualification, which is why we run three rounds of piloting at each national pilot site. Each pilot is embedded in a national and regional ecosystem of actors and stakeholders. However, all four pilots are closely connected through cross-pilot collaboration and the sharing of resources and capabilities to address challenges in joint action. Figure 12 below illustrates how the project envisions the conceptual design-thinking approach.

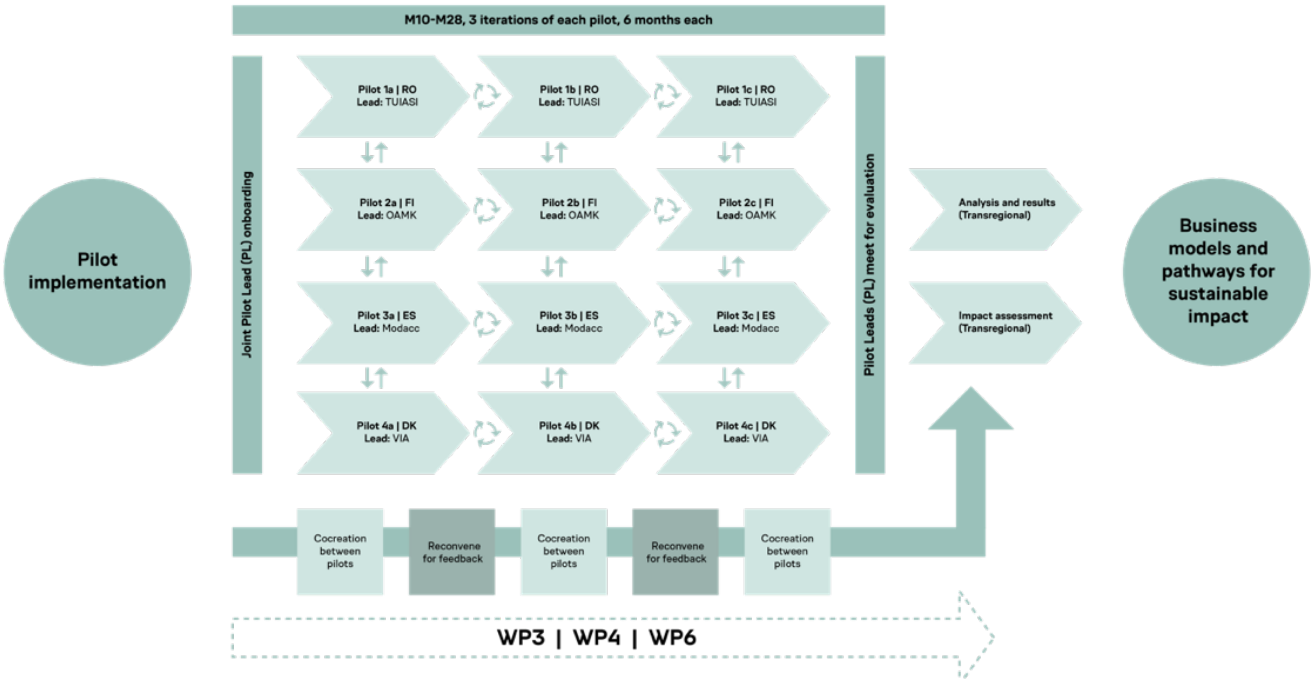

Figure 12. Design approach to piloting

In accordance with WP 4, the pilot period will be kicked off by a joint onboarding of the Pilot Leads. Key to the onboarding is the Method Handbook (WP4), which is an operationalisation of the present Method Playbook (WP2). The handbook is described in detail in WP4, Task 4.1, in collaboration with the Pilot Leads. Likewise, after three iterations of 6 months each, the pilot period will be finalised by the Pilot Leads joint evaluation of the three pilots. While the pilots run in parallel over 18 months, each pilot will undertake three iterations. Each iteration consists of a diverging period, which opens for lessons learnt, curiosity, experimentation, and ideation, and a converging period allows the pilots to make decisions, re-frame, and deliver results and status for the next iteration and the surrounding work packages. Task 3.3 will support this iterative process by providing the Open Connector Platform, as well as a platform for the pilot sites as learning communities, accommodating for experimentation with business modelling and the development of new services, sharing challenges and ideas for cross-pilot initiatives delivering towards sustainability at scale. The activity on the platforms and the data generated will be subjects of research and innovation activities in a transparent way, requesting full consent of the participants. To secure knowledge exchange and circulation between the pilot sites, the Pilot Leads will convene for feedback, knowledge sharing and joint knowledge generation after each pilot iteration is completed. In addition, during each iteration, co-creation sessions (variation of virtual and f2f) will be held between the pilots to foster and facilitate collaboration and sharing of results that might be useful in all the respective pilot settings. Additional funding to allow pilot participants to visit other pilots, share resources, and work together on common challenges is sought by the Consortium partners through other instruments.

The four pilot sites are marked with blue dots on the map below. As shown, they are widely spread across Europe. The yellow dots mark the EIT Culture & Creativity Co-location Centres for the replication exercise. The Co-location Centres stretch over a larger geographical area, and WP4, in collaboration with WP7, will identify the ecosystems where the replication can take place in the final phase of the project.

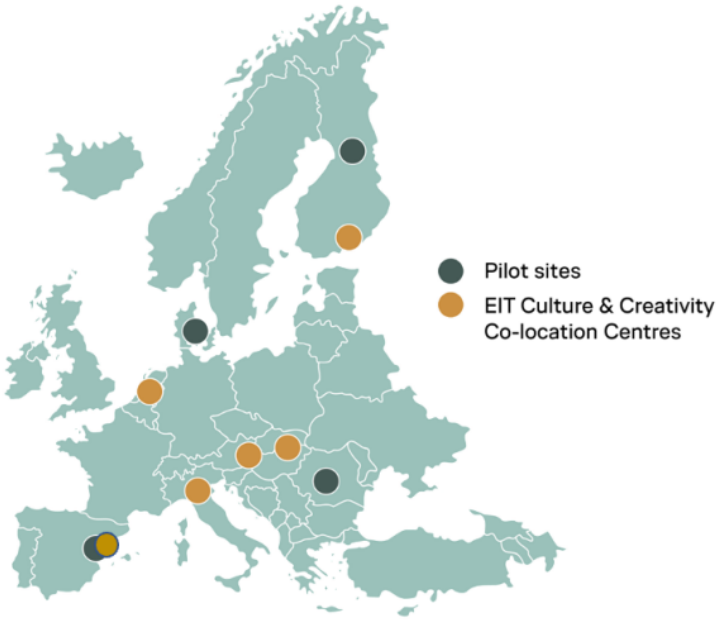

Figure 13. Map of pilot sites and ecosystems related to EIT C&C CLCs for replication

The sites for the four pilots are carefully selected, representing innovative hubs for post-industrial and contemporary arts and crafts development, leveraging skills and a rich cultural heritage. The pilots are situated in pioneering regional areas committed to advancing the green transition through the CCSIs. The initiatives already undertaken within the pilot ecosystems align with the objectives of CRAFT-IT4SD. This includes exploring new sustainable business models, reinventing (local) materials, recontextualising crafts, and discovering inspiration and new opportunities through collaboration with and across sectors and technologies. CRAFT-IT4SD provides a cross-sectoral, physical and digital infrastructure for experimentation, firmly embedded in strong ecosystems where previously closed gates can be opened, where value chains become value networks, and channels and connections to policymakers and more significant industrial partners are articulated and accessible.

CRAFT-IT4SD builds on existing activities and ecosystems in the regions and push these to the next level by creating awareness for resources and knowledge in other sectors and sites that can be accessed and experimented with, across national boundaries. Table 4 provides an overview of the four pilots and their thematic focus. In the following text, we further elaborate on the pilots regarding the dynamics between local and regional identities, resources, knowledge and practices within these pilots.

Table 4. Overview of pilots and priorities

Pilots	Sites/location	Lead partner	Thematic focus
Pilot 1	Country: Romania Region: Moldovia	TUIASI	3D printing and additive manufacturing for sustainability, based on living heritage
Pilot 2	Country: Finland Region: North Ostrobothnia & Sápmi	OAMK	Craft, new materials, and co-design
Pilot 3	Country: Spain Region: Catalonia	MODACC	Legal framework, SMEs capacity building, Ecodesign for Sustainable Products Regulation, environmental indicators
Pilot 4	Country: Denmark Region: Central Denmark	VIA	Prototyping, experimentation, and sprints co-created with users and consumers

Each pilot provides open access to specialised laboratories, resources, and expertise aligned with its thematic focus. While these resources are available locally, they can also be employed during co-creation events involving pilot participants. This establishes a local and international foundation for ecosystems, further supported by online platforms (T2.2 and T3.3). This infrastructure will serve as the basis for developing new business models and pathways for sustainable fashion (WP5) and fostering skills and learning communities across the fashion industry and related cultural and creative sectors (WP6). Monthly online meetings between the pilots will be held, and the pilots will plan and coordinate co-creation onsite events each half year by the design approach illustrated in Figure 11. This will ensure that the pilot participants enlarge their international network and support establishing the cross-regional ecosystems based on the experiences made in the local pilot ecosystems. The operational details of the piloting are described in the Method Handbook (D4.1) due 30 September 2024. Likewise, while the detailed data collection and capture protocol is described, explained and unfolded in the Method Handbook, the conceptual design presented by the present Method Playbook will shape the protocol.

5.3 Impact and measurement indicators

The long-term expected impact of CRAFT-IT4SD is a sustainable climate transition supported and driven by the CCSI sector, which aligns with the European Green Deal. There are three main expected impact pathways of CRAFT-IT4SD: 1) Enhanced and updated understanding of CCSIs in sustainable climate transition, 2) Research and knowledge-based approach(es) to CCSIs in driving a sustainable climate transition, and 3) Contributions to support CCSIs in climate transition in line with the 2030 goals. Table 5 below elaborates on the pathways, also describing how CRAFT-IT4SD links to specific United Nations (UN) Sustainable Development Goals (SDGs). KPIs, related targets and how they connect to expected outcomes will be further detailed in the Method Handbook (D4.1).

Table 5. Impact pathways in CRAFT-IT4SD

Pathway 1: Enhanced and updated understanding of CCSIs in sustainable climate transition			
Aim	**SDGs**	**Impact**	
To secure the knowledge-based sustainable climate transition supporting CCSI ecosystems created via the 4 pilot sites.	-Goal 9 -Goal 11 -Goal 12 -Goal 13	**Short-term impact**	Strengthening the regional sustainable climate transition through CCSI ecosystems. Expanding sustainable climate transition enabling ecosystems beyond the CCSI sector and regional level. Public recognition of the value of the fashion and creative ecosystems for the economy, society and European heritage in advancing sustainable climate transition.
		Medium-term impact	Enhanced role of CCSIs in supporting EU's sustainable climate transition.
		Long-term impact	Lead to a climate-neutral and digitalised CCSI sector with impact across other sectors in driving the green transition.
Pathway 2: Research and knowledge-based approach(es) to CCSIs in driving a sustainable climate transition			
Aim	**SDGs**	**Impact**	
To secure practical tools and skills to drive sustainable climate transition in the pilots.	-Goal 12, -Goal 13	**Short-term impact**	Understanding crafts, digital technologies and climate sustainability and combining this understanding with garment design approaches, leading to value-added design products building on sustainable climate transition enabling circular business models, digital tools and co-creation.
		Medium-term impact	Provide an enhanced understanding of CCSI potential in supporting EU's sustainable climate transition across eco-systems
		Long-term impact	Lead to a climate-neutral and digitalised CCSI sector with impact across other sectors in driving green transition.
Pathway 3: Contributions to support CCSIs in climate transition in line with the 2030 goals			
Aim	**SDGs**	**Impact**	
To identify climate hotspots to enable making concrete GHG	-Goal 11 -Goal13	**Short-term impact**	secures future-proof, economically viable climate-friendly business models for CCSI micro companies and SMEs in broader ecosystems. This will lead to an improved understanding and skills on green technologies and digital

emission reduction plans in pilot ecosystems			capabilities of business practitioners, designers and entrepreneurs operating in CCSI and related sectors as well as new green job opportunities in the CCSI sectors combining manual and creative skills with novel digital technologies.
		Medium-term impact	Securing a sustainable climate transition supporting business models in CCSI sectors.
		Long-term impact	Lead to a climate-neutral and digitalised CCSI sector with an impact across other sectors in driving the green transition.

The use of KPIs in CRAFT-ITSD is always in accordance with the three foundational objectives that structure and propel the project forward:

Objective 1. CRAFT-IT4SD aims to provide an enhanced and updated understanding of the challenges and opportunities for the cultural and creative industries (CCIs) in relation to a sustainable climate transition by building on the rich craft and creative art heritage and strong design traditions nested across four localised pilots the European fashion and clothing sector, and to renew these traditions through CCSI cross-sectoral innovation with immersive media and extended reality technologies, to explore new sustainable design and production processes through digital technologies, tools and lab-environments as well as new ways of driving more sustainable consumer behaviour through immersive storytelling and co-designing processes in immersive media-environments. The uptake of these approaches will be tested, shared and implemented through new sustainable and data-driven business models provided by a business-modelling platform. This ambition will be implemented across WP2; WP3; WP4; WP5

Objective 2. CRAFT-IT4SD will deliver research and knowledge-based approach(es) on innovative business models based on the use of new technologies to help the Fashion and Textile Industry become a driver of sustainable climate transition. By providing experimentation into data-driven business modelling for the green transition, it is the ambition of CRAFT-IT4SD to contribute good data standards, interoperability and data sharing for the Fashion and Textile Industries, where data standards and infrastructures are gravely lacking, not least for small and micro-sized players. As responding to the developments in legislation requires reliable and comparable quantitative climate impact data, CRAFT-IT4SD will provide such data using the principles of LCA thinking (cf. section 2.2.2.). An experimental platform will provide and share new business models, allowing sustainable small and micro-sized enterprises to share knowledge, practice and data and flourish in an ecosystem with larger industry in the sector. The CRAFT-IT4SD cross-sectoral approach will be supported by cross-sectoral Learning Ecosystems to bridge skills and capacity gaps. With reference to the newly formed PACT4Skills for CCSI (C–P4S) and the skills' blueprint approach; CRAFT-IT4SD will deliver interactive Open Education Resources (OER) for up and reskilling for Innovative business models; Life Cycle Assessment and Circular Economy; Empowering consumers and communities; Crafts and emerging technologies; these up- and reskilling activities will be tested across CRAFT-IT4SD pilot ecosystems to be subsequently offered online and finally structured into a micro-credential-based curriculum. This ambition will be implemented across WP3; WP5; WP6.

Objective 3. CRAFT-IT4SD will significantly contribute to helping the CCSI, not only to become better prepared and adapt to, but also become drivers of the sustainable climate transition in line with the key objectives of the European Green Deal. This is achieved by exploring, in a collaborative way, how pathways to sustainability can be facilitated by identifying existing living heritage resources and craft, and by testing and implementing such pathways through experimentation with digital technologies and the development of new data-driven business models. CRAFT-IT4SD holds the ambition that insights, processes and tangible results leading to a CCSI-driven sustainable transition for the Fashion and Textile Industry, will contribute to the forthcoming EIT Innovation Agenda on Circular Textiles and Fashion, as proposed by EIT Climate-KIC, EIT Culture & Creativity, and EIT Manufacturing, and be replicable in other CCSI ecosystems, specifically those connected to EIT Culture & Creativity Co-location Centres. This ambition will be implemented across WP4; WP5; WP6 and WP7.

6.0 Concluding Remarks

CRAFT-IT4SD aims to activate the CCSI towards the sustainable climate transition by building on the rich cultural heritage and strong creative craft traditions which underpin the European CCSI. This Method Playbook describes, in an initial format, the scientific foundation and methodological approach to achieve the project's ambition to revitalize knowledge, practices, and traditional techniques as shared cultural resources for sustainability, as well as spillovers into a new, customer driven and sustainable creative economy. The conceptual framework, design-thinking and collaborative approach is outlined in this document leading to the facilitating of learning communities across national pilot ecosystems that allow for circulation of resources, capacities, and ideas. By presenting preliminary results from the analyses of the work conducted in the project's first phase, the handbook shows directions and potentials of CRAFT-IT4SD's approach which will be further translated in D4.1 into concrete guidelines and actions for experimentation, collaboration, and impact generation, targeted at the four pilot ecosystems and the sites for replication (to be submitted in M9).

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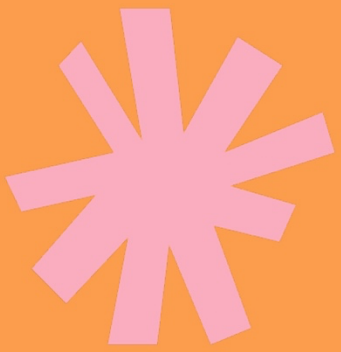

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