

Project acronym: AEQUALIS4TCLF
Project number: 101139988
Project title: Addressing Skills Gaps in the European Textile, Clothing leather and Footwear Industries, emphasising Equality, Innovation and Resilience.

D3.3: TCLF Skills Needs Analysis Report

Erasmus+

Deliverable due date 30 November 2024

AUTHORS

REVIEWERS

ATOK

EURATEX, MODINT

Dissemination level: PU Public

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EXECUTIVE SUMMARY

This report presents the consolidated results of the AEQUALIS4TCLF project's Work Package 3, which aimed to identify and analyse the current and emerging skills needs in the textile, clothing, leather and footwear (TCLF) sectors across seven participating countries: Croatia, Czechia, Finland, Lithuania, the Netherlands, Serbia and Slovenia. The findings are based on two complementary research phases. Deliverable 3.1 assessed policy frameworks and structural changes driving demand for new skills, while Deliverable 3.2 captured qualitative evidence through stakeholder interviews, focus groups and an online survey conducted across the participating countries.

The research confirms that the TCLF sectors are undergoing significant structural transformation, driven by technological innovation, environmental regulation, changing consumer expectations and demographic pressures. These developments are reshaping occupational profiles and creating new requirements for technical, transversal and regulatory competences.

The most urgent skills needs, according to the research, are concentrated in two areas:

- **Digital skills**, including the use of CAD/CAM tools, digital pattern-making, 3D product development, and the ability to work across digitalised production and distribution systems.
- **Green skills**, such as understanding circular production principles, life-cycle assessment, waste reduction strategies, and the use of sustainable materials and production methods.

In addition to these core domains, the research highlights important gaps in transversal skills. These include weak capacity in problem-solving, quality assurance, communication, leadership and interdepartmental collaboration, which are essential to adapting to innovation and cross-functional work processes.

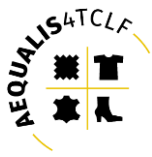
Persistent barriers continue to limit the inclusion of underrepresented groups. While women are well represented in low- and mid-skilled production roles, they remain underrepresented in technical and decision-making functions. Migrant workers are often employed in low-paid manual jobs with little access to training or advancement opportunities. Discrimination—while not always overt—was identified as a structural challenge in several national contexts.

The field research identified systemic obstacles to effective skills provision. These include a misalignment between formal education and workplace needs, outdated curricula and training equipment, and weak coordination between training institutions and employers. In some cases, learners lack access to even basic digital or green modules, especially in institutions located outside major cities or industrial centres.

The report concludes with targeted recommendations to guide curriculum development and training reform under Work Packages 4 and 5. These focus on embedding digital and green competences in technical curricula, improving transversal skills instruction, strengthening inclusion measures, and enhancing the collaboration between education providers and industry stakeholders. Without coordinated action to address these gaps, the sector risks falling short of its transformation goals and losing competitiveness in both domestic and international markets.

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1 INTRODUCTION

According to the project documentation, Work Package 3 of the AEQUALIS4TCLF project undertakes a comprehensive skills needs assessment across the Textile, Clothing, Leather and Footwear (TCLF) sectors in seven European countries. This report (Deliverable 3.3) consolidates the findings of that assessment, drawing on both desk research and field research evidence. The desk research phase established a framework of key drivers of change and initial hypotheses about skill demands. These preliminary findings were then validated and enriched through field research – including stakeholder surveys and focus groups – involving industry representatives, educational providers and other experts in all partner countries. The combined approach ensures that the analysis is grounded in documented trends as well as real-world insights from the sector.

The context for this study is the twin transition the TCLF industries are undergoing, with rapid advances in digitalisation and growing imperatives for sustainability. At the same time, the project places a strong emphasis on equality and inclusion, reflecting persistent issues of discrimination against certain groups of workers (notably women and migrants) in these industries. The overarching goal is not only to identify current and emerging skills needs – especially in the green and digital domains – but also to inform the design of updated curricula and training programmes that will address those needs in a way that promotes diversity and resilience in the TCLF workforce. In line with this goal, the findings of this skills needs analysis will serve as a key reference for subsequent project activities (Work Packages 4 and 5) focused on developing and piloting new training curricula aligned with industry requirements.

2 DRIVERS OF CHANGE AND EMERGING PRESSURES ON THE TCLF SECTORS

2.1 Technological Transformation and Digitalisation

The desk research identified technological change – including the acceleration of digitalisation and innovation – as a primary driver reshaping skill demands in TCLF. Rapid advancements in automation, artificial intelligence (AI), and 3D printing are already **reshaping production processes and the nature of jobs** in these sectors. According to the desk research, companies will require a workforce increasingly *skilled in operating new technologies and digital processes* to maintain a competitive edge. This includes not only specialist technical roles (such as CAD/CAM design, digital machine operation, data analysis and IT systems management) but also a general upskilling of existing workers in digital literacy. Field research participants affirmed that many companies are currently struggling with shortages of digital competencies, as older workers often lack training in contemporary software and equipment, and younger workers with such skills are in high demand.

This **digital skills gap** is seen as an urgent issue, as the adoption of Industry 4.0 practices (e.g. digital production management, robotics, IoT-based monitoring) spreads across the TCLF value chain. Urgently needed skills in this domain include proficiency in computer-aided design for fashion and footwear, data-driven decision making (for example, using data analytics to optimise supply chains), and the ability to work with automation and smart machines on the factory floor. The pressure to integrate e-commerce and digital marketing into business models also means that roles in marketing, sales and customer service now demand stronger digital skill sets than in the past. As reported in the field research, companies that have begun implementing advanced manufacturing technologies frequently find that their workforce needs additional training to fully utilise these tools – confirming the desk research’s anticipation that digitalisation is a dominant force in skills demand.

In short, **technological innovation is driving an immediate need for upskilling and reskilling**, so that TCLF workers can work effectively with new digital tools and processes.

2.2 Sustainability and Environmental Pressures

An equally prominent driver of change is the growing push towards sustainability in the TCLF sectors. Heightened consumer awareness about environmental and ethical issues – combined with new regulatory requirements – is forcing companies to adopt more sustainable and circular business practices. According to the desk research, this shift **demands new skills in areas such as circular design, waste management, and sustainable material sourcing**. Workers need to understand how to select and work with eco-friendly materials, how to optimise manufacturing processes to reduce waste and energy use, and how to comply with environmental standards across the supply chain.

Field research confirms that green skills have become a critical gap: many companies report difficulty finding employees with expertise in circular economy strategies (for example, designing products for recyclability or organising take-back and recycling schemes) and in emerging sustainable technologies (such as new textile recycling methods or bio-based materials processing). These skills are urgently needed as the TCLF industries respond to pressures like the EU’s sustainability agenda and consumers’ demand for low-impact, ethically produced fashion. There is also a need for knowledge of **environmental compliance and certification**, as companies must navigate standards for organic textiles, leather tanning regulations, pollution prevention, and so on. As reported in the field research, even traditional roles (e.g. product designers, production managers) now require awareness of sustainability principles – for instance, designers are expected to integrate lifecycle thinking into product development, and production managers must implement cleaner manufacturing techniques. This represents a significant cultural shift within the industry, and a challenge to the existing workforce’s skill set. The **environmental driver** is not only about technical know-how but also about mindset: companies are seeking to instil a sustainability-oriented approach at all levels, which in turn creates demand for training in topics like eco-design, resource efficiency, and corporate social responsibility practices.

2.3 Regulatory and Governance Changes

Changes in policy and governance structures are another major source of pressure on TCLF skills needs. The industry is facing a raft of new regulations at both EU and national levels – from chemicals and health & safety rules (e.g. REACH for chemical use) to forthcoming measures under the EU Strategy for Sustainable and Circular Textiles. According to the desk research, **emerging regulations**

– including stricter environmental laws, product traceability requirements (such as digital product passports), and corporate social responsibility (CSR) obligations – are significantly impacting the sector. Companies must now navigate complex compliance landscapes, which in turn creates demand for skills in regulatory compliance, quality assurance, and risk management. For example, knowledge of environmental law and standards is needed to ensure products meet new eco-design criteria and labelling requirements. Similarly, trade policy shifts and updated trade agreements affect export-oriented companies, requiring skills in international business law and trade compliance. The desk research found that references to regulation and governance have increased substantially compared to earlier years, reflecting how pressing this driver has become. Field evidence underscores that many TCLF companies, especially smaller ones, struggle with the expertise needed to adapt to these regulatory changes. In the focus groups, industry participants noted that keeping up with new rules (for example, on **product transparency and due diligence**) is challenging without staff trained in compliance and documentation. The **governance driver** also includes the need for better management practices internally – for instance, governance of supply chains to ensure ethical standards are upheld (no forced labour, etc.). Skills in supply chain due diligence and CSR auditing are increasingly valued as part of this domain. Overall, regulatory changes are **pushing the demand for legal, compliance, and standards-related skills** that were previously not as prominent in the TCLF skill profile. Companies are responding by seeking or training compliance officers and sustainability managers, illustrating how governance trends translate into new occupational needs.

2.4 Evolving Consumer Demand and Market Trends

The tastes and expectations of consumers have shifted dramatically in recent years, which exerts another set of pressures on TCLF industries. On one hand, consumers are more eco-conscious (as noted above under values and sustainability), and on the other hand, they have rapidly embraced e-commerce, personalisation, and fast delivery as the new norm in retail. The desk research identified *“Values and identities”* as a driver, referring to increasing consumer awareness of sustainability and ethics, as well as the need for the industry to attract young talent by aligning with contemporary values. In practice, this means that TCLF companies must adapt their products and branding to meet expectations for sustainability, authenticity and inclusivity – requiring skills in marketing, storytelling, and community engagement that resonate with modern consumers. Additionally, the

rise of e-commerce and digital consumer interactions is a critical trend: **changing consumer demand (especially the shift to online retail and demand for customised products delivered quickly) requires the TCLF sectors to adapt quickly.** As a result, skills in areas such as logistics and e-commerce platform management have become crucial. Field research participants highlighted that companies are increasingly seeking expertise in digital marketing, social media, and online customer service to strengthen their brands and sales in the digital marketplace. Furthermore, the growth of demand for personalised or on-demand fashion is pressuring manufacturers to adopt more agile production methods – which links back to digital skills like 3D design and virtual prototyping, as well as supply chain coordination. In summary, **consumer-driven change** is broad in scope: it encompasses the need for creative skills (to design innovative, value-driven products), technical skills (to implement e-commerce and mass-customisation technologies), and service skills (to interact with and understand customers directly). The ability to analyse consumer data and trends is also emerging as valuable, so that companies can respond proactively to market changes.

Together, these market trends force TCLF businesses to become more responsive and innovative, which cascades into new skill requirements across roles from design and production to sales and distribution.

2.5 Globalisation vs. Regionalisation (Global Market Dynamics)

The TCLF sectors have long been exposed to global competition and global supply chains. The desk research pointed to the ongoing tension between globalisation and protectionism as a driver of change for the industry. On one side, open global markets mean TCLF companies must compete with producers from around the world, often requiring them to specialise, innovate, or move up the value chain. On the other side, there are pressures for re-shoring or securing supply chains (intensified by recent disruptions) that push companies to adapt their sourcing and production strategies. This dynamic environment means that **skills in international trade, export marketing, and global supply chain management are increasingly important.** The desk analysis noted that firms need people who can navigate tariffs, trade agreements, and logistical complexities across multiple countries.

Moreover, working in global markets brings a need for cultural competence and foreign language skills so that businesses can effectively collaborate with international partners and clients. As the

research noted, *“cultural competence”* and the ability to work in international environments are increasingly valued skills in the TCLF sectors. Field research confirmed that companies dealing with overseas suppliers or customers often find a gap in such transversal skills – for instance, middle managers might lack experience in international negotiation or understanding of foreign market norms. Additionally, as some focus group participants mentioned, global market volatility (including shifts toward protectionist policies or changes in trade regulations) requires **strategic and analytical skills** in scenario planning and risk management. In essence, the **globalisation driver** translates into a need for a more globally savvy workforce, capable of handling cross-border business and adapting to international market trends. This is especially true for European TCLF SMEs trying to export or integrate into global value chains, who may need support building these competencies.

2.6 Demographic Changes and Workforce Evolution

Demographic trends represent another underlying driver of change, although the desk research observed that they have been somewhat less emphasised in recent documents relative to other drivers. The TCLF sectors in Europe face an *ageing workforce* in many regions, as younger workers have not been entering these industries in sufficient numbers. This raises concerns about **skills transmission and potential labour shortages** as experienced workers retire. At the same time, the push for diversity and inclusion means companies are recognising the importance of creating workplaces that are attractive and welcoming to a new generation of workers, including those from different backgrounds (e.g. women in technical roles, migrants, and ethnic minorities). As noted in the desk research, *“diversity and inclusion also become increasingly important as companies seek to create inclusive workplaces that reflect their customer bases and societal values.”* The aging of the current workforce implies a risk of loss of traditional skills (for example, craftsman skills in leatherworking or high-end tailoring) unless there are effective knowledge-transfer and mentoring mechanisms. Field research discussions frequently touched on the **difficulty of attracting young talent** to TCLF careers – participants cited the perception of the industry as traditional or declining as a barrier. This is a structural issue (covered in more detail in Section 5), but it is worth noting here as a demographic pressure: without new entrants, the sectors may not have the human capital needed to adopt digital and green innovations at scale. Another aspect of demographic change is the increasingly multicultural composition of the workforce in some countries, partly due to migration (discussed further in Section 6). This requires management and teams to have strong interpersonal

and communication skills to integrate diverse workers effectively. In summary, demographic shifts (ageing and changing workforce composition) pressure the TCLF industry to not only replenish its workforce but also to adapt its skill development approaches – for instance, placing more focus on lifelong learning so that older workers can update their skills (e.g. in digital technologies) and remain productive longer, as well as tailoring training to new generations’ learning styles and expectations.

2.7 Crisis Impacts and Resilience

A very recent set of drivers falls under the category of crises and unexpected disruptions – notably the COVID-19 pandemic, the war in Ukraine, and global supply chain shocks. These events were identified in the desk research as *new drivers of change* that were not prominent in earlier analyses but have had a significant impact since 2020. The COVID-19 pandemic, for example, forced many TCLF companies to adapt rapidly (some textile and clothing firms famously switched to producing face masks/PPE almost overnight), and it exposed vulnerabilities in global supply chains. The ongoing war in Ukraine has had implications for energy prices and supply chain routes, while other geopolitical tensions and energy crises pose similar challenges. These crises have underscored the need for **strong crisis management skills, supply chain agility, and contingency planning** in the TCLF sectors. According to the desk research, developing robust crisis response capabilities is now seen as crucial for maintaining operations and safeguarding the business during major disruptions. Field research interviews reinforced this view: companies that navigated the pandemic successfully often did so by retraining or redeploying staff rapidly (highlighting the value of multi-skilled workers) and by leveraging digital tools (like virtual showrooms or remote collaboration software) to keep business running. Participants noted that going forward, there is a need for training in risk management, scenario planning, and flexible production techniques so that companies can pivot quickly in response to sudden changes in demand or supply. Another lesson from recent crises is the importance of local sourcing and production capabilities; some companies are reconsidering their heavy reliance on distant suppliers. This shift could drive demand for skills in **supplier development, local production management, and inventory management** to build resilience. While these crisis-related skills were not traditionally part of the TCLF skill set, they are emerging as important for the sector’s future stability. In summary, the experience of COVID-19 and other disruptions has introduced a new emphasis on resilience skills – from high-level strategic crisis leadership down to

on-the-floor problem-solving and adaptability – marking this as an emerging pressure on skills provision in the industry.

Across all these drivers of change, it is evident that the TCLF sectors are facing a transformative period. The **desk research highlighted nine key drivers** (summarised above) that together shape the evolving skill needs landscape: from technology and sustainability, to market and consumer shifts, policy changes, global dynamics, demographic patterns, and crisis impacts. Each driver creates specific pressures on what skills are required. The subsequent sections of this report will delve into how these pressures translate into concrete skills needs (Section 3), where gaps exist (Section 4), and what barriers need to be overcome to address them (Section 5), as well as considering inclusion-related challenges (Section 6). It is worth noting that many of these drivers are interrelated – for example, digital technology (Industry 4.0) is both a driver itself and an enabler for responding to other drivers like sustainability or supply chain resilience. The holistic approach of this skills needs analysis is therefore crucial: it recognises that the TCLF workforce must adapt on multiple fronts simultaneously, requiring a strategic and coordinated skills development response.

3 IDENTIFIED SKILLS NEEDS IN GREEN AND DIGITAL DOMAINS (URGENT AND EMERGING)

3.1 Digital Skills Needs – Urgent Requirements

The research findings indicate that digital skills are among the most urgent needs in the TCLF sectors. As described in Section 2, the acceleration of digitalisation means that nearly all roles in these industries are evolving to require some level of digital competency. According to the desk study, the introduction of advanced manufacturing technologies (such as automation, AI-driven equipment, and 3D printing) **requires workers skilled in using and managing these new technologies**. Field research confirmed a widespread gap in this area: many companies report that their current employees lack sufficient training in the latest digital tools and software. For example, pattern-makers and designers increasingly need to be proficient in computer-aided design (CAD) software specific to textiles and fashion, yet employers find that not enough workers have mastered these tools. Likewise, in production, technicians and machine operators are now expected to interface with computerised machinery (knitting machines, cutting lasers, etc.), which demands a higher level of digital literacy and troubleshooting ability than traditional manual equipment. One urgent skills need highlighted is **data analysis and IT skills** for production planning and supply chain management. With the rise of enterprise resource planning (ERP) systems and supply chain tracking, TCLF industries are seeking personnel who can analyse production data, forecast demand, and optimise inventory using digital systems. Stakeholders in the focus groups noted that even medium-sized manufacturers are starting to implement data-driven decision-making, but often they must upskill existing staff or hire new talent because the necessary skills (like working with databases, spreadsheets, or bespoke software) are not present in the current workforce. Another critical area is **e-commerce and digital marketing**: as companies pivot to online sales channels, there is an urgent need for skills in managing online storefronts, digital content creation, and social media marketing strategies. Field evidence pointed out that many traditional footwear and apparel companies had little in-house expertise in these domains until the pandemic forced a rapid shift to online sales; now, digital marketing specialists and e-commerce managers are in high demand to help TCLF brands compete in the digital marketplace.

Crucially, these digital skill needs are not limited to new specialist roles but also extend to upskilling the **existing workforce at all levels**. For instance, a salesperson in a showroom now may need to use

digital catalogues or customer relationship management (CRM) systems; a quality control technician may need to use digital measurement tools or input data into QC software; and a production manager might rely on real-time production dashboards. The desk research emphasised that maintaining competitiveness hinges on workers' ability to adopt and work with such technologies. Thus, a large portion of the current skills gap is in **basic and intermediate digital skills** among workers who have not previously needed them. This is an urgent training priority: companies are calling for short-term upskilling programs (in digital literacy, basic IT, and specific software usage) to bring their workforce up to speed. In fact, the project's application foresees setting up rapid response training programmes to address urgent digital skill needs, aiming to train a significant number of workers in the short term. The urgency is underscored by the competition for digitally skilled talent – if TCLF sectors cannot quickly build these skills internally, they risk falling behind other industries that are also vying for workers such as data analysts, IT technicians, and digital marketers.

3.2 Emerging and Advanced Digital Skills

Beyond the immediate gaps, the research also identified emerging digital skill areas that are likely to become increasingly important in the near future. One such area is **advanced data analytics and AI applications** in TCLF. As more data is collected through connected devices (e.g. sensors on textile machines, RFID tags in inventory, consumer behaviour tracking online), the ability to interpret big data and deploy AI for insights (such as predictive maintenance of machines, trend forecasting in fashion, or personalised product recommendations in e-commerce) will be a valuable skill set. Field experts noted that currently only a few large, innovative companies in the textile/apparel sector are experimenting with AI or machine learning tools, but the expectation is that these practices will expand. Therefore, there is a nascent need for skills combining domain knowledge with digital expertise – for example, data scientists who understand fashion trends, or engineers who can develop and maintain digital twins of production lines. Another emerging digital competence is in the realm of **cybersecurity and digital asset management**. As companies digitise their operations and share more data (e.g. design files, client data) across networks, they become vulnerable to cyber threats. Skills in protecting digital infrastructure and intellectual property (through cybersecurity protocols, secure IT administration, etc.) are likely to become important, though the desk research did not explicitly highlight this, it was mentioned by some companies during field interviews concerned about safeguarding their design innovations and customer data.

Additionally, **additive manufacturing (3D printing) and other industry 4.0 technologies** represent emerging domains where skills will be needed. The desk research cited 3D printing as a technological advancement reshaping production. While still not mainstream for mass production, 3D printing (for prototyping or for specialised footwear components, for instance) is expected to grow. Skills related to 3D modelling, printer operation, and materials science for additive manufacturing may become more in demand. Similarly, knowledge of **virtual and augmented reality (VR/AR)** tools might soon be valuable for tasks such as virtual prototyping, virtual showrooms, or training simulations – areas which a few forward-looking TCLF firms are piloting. In summary, aside from the urgent need to raise general digital proficiency, the sector must also prepare for these more advanced digital skill requirements. The **emerging digital skill needs** are presently niche but are on a trajectory to become significant, meaning the education and training ecosystem should start laying the groundwork (for example, by updating curricula to include data analytics, or creating specialised courses on digital fashion technologies) so that the next generation of TCLF professionals is equipped for the future landscape.

3.3 Green Skills Needs – Urgent Requirements

In parallel with digitalisation, the shift towards greener and more sustainable practices has created a pressing need for new skills in the TCLF workforce. The desk research clearly indicated that sustainability-driven changes in production call for competencies in areas like circular economy and environmental management. One of the most urgent green skill needs is **knowledge of sustainable materials and processes**. This includes understanding the properties and sourcing of organic or recycled materials, new sustainable textile fibres, eco-friendly dyeing and finishing techniques, and alternatives to harmful chemicals in leather tanning (to comply with regulations like REACH). Companies are seeking textile technologists and product developers who are trained in these innovative materials and methods. Field research revealed that many companies currently rely on external consultants or trial-and-error when trying to adopt sustainable materials, due to a lack of in-house expertise. Thus, there is demand for upskilling designers and production staff in material science with a sustainability focus – for example, knowing how to work with biodegradable fabrics or how to incorporate recycled polyester without compromising quality.

Another critical skill area is **waste management and resource efficiency**. With growing pressure to reduce waste, TCLF companies need skills in process optimisation (to cut waste in cutting and sewing, for instance) and in implementing recycling or reuse schemes. The concept of *zero-waste fashion* has gained traction, meaning pattern cutters and designers who can minimise off-cuts through smart pattern designs are highly valued. Additionally, skills in organising the collection and recycling of textile offcuts or post-consumer garments are needed (this might involve logistics and some engineering knowledge about recycling processes). Field evidence indicates that only a small number of companies have staff dedicated to circular initiatives, highlighting a skills gap in practical circular economy implementation. The urgent need extends to **environmental compliance and auditing skills** as well. Environmental regulations are tightening (e.g. limits on pollutants in wastewater, requirements for traceability of materials), so factories need personnel who can monitor environmental performance, maintain proper documentation, and ensure compliance. This might be a role for an environmental manager or a quality manager with environmental training. Right now, such responsibilities are often appended to roles that historically didn't cover them (for instance, a quality control manager now also handling environmental reporting), which can lead to skills insufficiency. Training programs focused on environmental management systems (like ISO 14001) and compliance are therefore in urgent demand.

3.4 Emerging Green Skills and Knowledge Areas

Looking beyond the immediate needs, the TCLF sectors will require increasingly sophisticated sustainability-related skills as the industry moves further towards circular and carbon-neutral models. One emerging area is **life-cycle assessment (LCA) and eco-design**. Being able to conduct LCAs – to quantify a product's environmental impact from raw material to end-of-life – is a specialised skill that is growing in importance for larger brands and for compliance with future regulations (such as likely requirements to substantiate green claims or to label products with environmental impact information). The field research suggests that very few TCLF companies have this expertise in-house; instead, they rely on external experts. In the coming years, training more professionals in LCA and eco-design principles will be necessary so that sustainability can be embedded at the design stage of products. Eco-design skills mean designers and product managers who can creatively balance functionality, aesthetics, and minimal environmental impact, for example

by designing garments that are easier to recycle or using modular design in footwear so components can be replaced or recycled.

Another emerging skill need is related to **innovative circular business models**. As companies explore models like product-service systems (rental, leasing of clothes), resale of used items, or take-back schemes, new competencies at the intersection of business development, logistics, and customer service are needed. Personnel will need to understand how to manage reverse logistics (collecting used products), how to evaluate the condition of returned goods, and how to interact with customers in these new models. These are *transversal green skills* that combine an environmental mindset with business and operational know-how. Furthermore, **carbon accounting and sustainable finance** are emerging knowledge areas – companies might need staff who can calculate the carbon footprint of operations or products, and who understand the financial mechanisms related to sustainability (like carbon credits or sustainability-linked financing). While such expertise might currently reside with consultants or specialised sustainability teams, mainstreaming these considerations will make them part of general management skill sets eventually.

Innovation in **bio-based and biodegradable materials** is another frontier requiring skills. For instance, the development of lab-grown leather alternatives, or new cellulose-based fibres, is typically done by material scientists and chemists; however, to commercialise and use these materials, TCLF companies will need technicians and designers familiar with their properties and processing requirements. This suggests a closer integration of scientific knowledge into the skill set of the industry, implying a need for collaboration between industry and research institutes to train people in applying material science innovations on the factory floor.

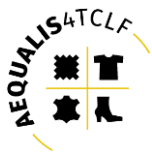
In summary, the **green skill needs** span a spectrum from immediate, concrete skills (like operating new machinery that uses less water or applying new dyeing techniques) to broader strategic competencies (like redesigning business models for circularity or performing environmental impact assessments). The field research highlighted that many of these sustainability skills are not yet widespread in the workforce – they often reside in isolated roles or are outsourced – making capacity-building in this domain a top priority. The urgency is underlined by both market forces (brands differentiating themselves on sustainability) and regulatory timelines (for example, the EU's upcoming requirement for Digital Product Passports for textiles will force companies to gather and

manage sustainability data for each product, a task requiring specific skills in data management and supply chain transparency). Hence, training curricula and upskilling initiatives must rapidly integrate **green skills development**, treating it with the same importance as digital skills. The desk research concluded that sustainability and digitalisation are twin pillars of the sector's future, and accordingly, the workforce must be equipped with the **twin skill sets of green and digital competence** to remain relevant.

3.5 Overlap and Integration of Green and Digital Skills

It is also important to note that digital and green domains of skill needs are increasingly interconnected. For example, digital tools are used to achieve sustainability goals (such as software for optimising material utilisation, or blockchain systems for supply chain traceability in support of ethical sourcing). This means the workforce will need combinations of skills – an awareness often echoed by field stakeholders. As reported in the focus groups, companies value employees who can “bridge” areas, such as a production engineer who understands both automation (digital) and energy efficiency (green), or a supply chain manager who can use data systems to monitor environmental KPIs in the supply chain. The implication for skill development is that siloed training (purely technical vs purely environmental) may be less effective than integrated approaches that reflect the way digital innovation can drive sustainability. One example of an integrated emerging skill is proficiency in using **digital sustainability tools** – for instance, software that calculates environmental impacts or tracks compliance in real time. Training on such tools would simultaneously enhance digital fluency and sustainability knowledge.

In conclusion, the analysis of skills needs in the green and digital domains shows a clear double imperative for the TCLF sectors: **address the immediate shortages in basic and applied digital and sustainability skills and anticipate the more advanced competencies that will soon be critical**. The urgent skills (digital literacy, CAD, e-commerce, sustainable materials, compliance, etc.) require immediate action in upskilling and curriculum updates, while the emerging skills (AI, circular design, LCA, etc.) call for forward-looking educational strategies and perhaps new specialisations. Both the desk research and field research support this view – the desk research by mapping the broad areas of change, and the field research by providing concrete examples of skills that companies currently lack or foresee needing soon. The next section will examine the gaps in **transversal skills**, which



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complement the technical green and digital skills discussed here, as well as the subsequent sections addressing systemic barriers and inclusion challenges that affect skills development in the TCLF sectors.



4 GAPS IN TRANSVERSAL SKILLS

In addition to the technical skills discussed above, the research identified significant gaps in **transversal skills** (often termed soft skills or cross-cutting skills) within the TCLF workforce. Transversal skills refer to those that are not specific to performing technical tasks of a job, but rather enable individuals to adapt, collaborate, and effectively perform in various contexts. These include communication, teamwork, problem-solving, leadership, language and cultural skills, and learning-to-learn abilities, among others. According to both desk and field evidence, such skills are increasingly important in the TCLF sectors – especially as job roles evolve with digital and green transformations – yet employers often find them lacking in the current pool of workers.

4.1 Communication and Collaboration

As production processes become more integrated (for instance, design, production, and marketing teams needing to work together closely to respond quickly to trends), the ability of employees to communicate clearly and work in teams is critical. However, focus group discussions revealed that many TCLF companies experience internal communication challenges. For example, technical staff may not effectively communicate quality issues or production delays to the sales team, or designers may struggle to collaborate with engineers due to differing vocabularies and working styles. Strengthening teamwork skills and cross-departmental communication is seen as important for improving efficiency and innovation. This includes not just basic communication, but also skills like conflict resolution, negotiation, and the ability to give and receive constructive feedback – all of which contribute to a more agile and responsive organisation.

4.2 Problem-Solving and Critical Thinking Skills

With rapidly changing production scenarios (driven by new tech or sudden supply issues), companies need employees who can think on their feet and troubleshoot effectively. The field research suggested that some TCLF workers – particularly those who have performed routine tasks for years – may struggle to adapt when confronted with novel problems or when procedures change. For instance, implementing a new digital system might require workers to rethink their workflow, and not everyone finds it easy to adjust without step-by-step instructions. Employers are therefore looking for more self-directed problem-solvers who can identify issues in a process and propose improvements. This is a shift from the more hierarchical, instruction-driven work culture that

historically characterised many manufacturing environments. It implies that education and training programmes should place more emphasis on developing learners' ability to analyse situations, think critically, and exercise initiative. Indeed, the project's desk research highlights that aligning educational offerings with industry needs isn't only about technical content but also about fostering adaptable mindsets in students.

4.3 Foreign Language and Cultural Competence Skills

As noted in Section 2, TCLF businesses are often engaged in international trade – whether importing materials or exporting finished products – and the workforce is becoming more international as well (with migrant workers in production and diverse markets for products). However, not all employees possess adequate language skills (particularly English, which is key in international business) or cross-cultural communication skills. The desk analysis mentioned the increasing value placed on *cultural competence* in the context of globalised markets. In practice, this could mean a sales manager being able to understand and adapt to the norms of clients from different countries, or a factory supervisor effectively integrating workers from various cultural backgrounds on the shop floor. Field participants reported cases where misunderstandings due to language or cultural differences led to operational inefficiencies or even lost business opportunities. Thus, language training (English or other relevant languages) and intercultural communication training are areas that need attention. For example, a company in a focus group noted that while their designers are very talented, they struggled during negotiations with an overseas client simply due to language limitations and lack of exposure to the client's business etiquette. Bridging this gap would improve the company's competitiveness and working environment.

4.4 Leadership and Management Skills

Many TCLF businesses are SMEs or family-run businesses where managers often rise through technical roles without formal management training. With the growing complexity of operations (incorporating new technologies, stricter compliance, etc.), there is a need for more professional management and leadership capabilities. This includes basic managerial skills like planning, budgeting, and HR management, but also leadership competencies such as the ability to motivate teams, drive change, and foster innovation. The field research noted that in some cases, promising modernisation projects in factories faltered because middle managers did not have the change

management skills to get worker buy-in or to systematically implement new processes. Similarly, entrepreneurial skills – the ability to identify new business opportunities, develop business plans, and navigate market risks – are valuable, especially for those aiming to start their own ventures or lead company growth. According to earlier studies (e.g. the prior Skills4SmartTCLF project), entrepreneurial thinking is not widespread in these traditional sectors, and the current qualitative evidence in AEQUALIS4TCLF similarly points to a gap in forward-looking, entrepreneurial skill sets. To address this, some stakeholders suggested integrating modules on basic business and management skills even for technical workers (so they understand the bigger picture of how their work affects business outcomes) and offering leadership training to supervisors and young professionals showing potential.

4.5 Adaptability and Learning-to-Learn

Another transversal skill gap is the capacity for continuous learning and adaptability. Given the speed of technological and market changes described in previous sections, the workforce needs to be not only technically skilled but also ready to continuously update those skills. The concept of “learning to learn” – being able to acquire new competencies efficiently and with a proactive attitude – has been highlighted in EU skills policy and is highly relevant to TCLF. However, field research indicates that a culture of lifelong learning is not yet deeply entrenched in these industries. Many workers have followed the same methods for decades, and some may be resistant or anxious about training, especially in digital skills, if they have limited prior exposure. This suggests a soft skill need at both individual and organisational levels: individuals need resilience and openness to change, while companies need better change management practices and motivational strategies to encourage ongoing learning. Transversal training that covers growth mindset, adaptability exercises, or modern learning techniques (like how to use online learning platforms) could be beneficial. In one focus group, participants discussed that offering short, stackable courses and micro-credentials might help engage workers in learning gradually, but it also requires them to have basic self-directed learning skills to take advantage of such opportunities.

4.6 Creativity and Innovation Skills

These can also be considered transversal and are particularly important in design and product development roles. While creativity is a hallmark of the fashion segment of TCLF, in other areas like

technical textiles or footwear manufacturing, fostering an innovative mindset among engineers and technicians is equally important (for process improvements, product innovation, etc.). Some employers note that employees often stick to “tried and true” methods and are hesitant to experiment or suggest innovative ideas – possibly a remnant of a top-down management culture. Building a workplace culture that empowers employees at all levels to contribute ideas requires soft skills on both sides (employees feeling confident to communicate ideas, and managers having the listening and openness skills to receive them). The skills gap here is not as easily measured, but qualitatively, the need for more creative problem-solving and innovative thinking emerged as a theme.

In summary, **transversal skills gaps** in the TCLF sectors revolve around communication, teamwork, problem-solving, language/cultural skills, management/leadership, and adaptability. These gaps can hinder the effective deployment of technical skills – for instance, even if a company invests in advanced machinery (technical skill), without good teamwork and communication the potential productivity gains may not fully materialise. The desk research underscored that aligning education with industry needs means paying attention to these broader skill sets, not just the technical ones. Field research participants similarly reported that often the difference between a successful department and a struggling one came down to soft skills of the people involved rather than technical know-how alone.

Addressing transversal skill gaps will likely involve updated curricula in VET and higher education to incorporate soft skills training (for example, project-based learning to enhance teamwork and communication), as well as targeted upskilling of current workers (such as leadership workshops for supervisors, language courses for employees in internationally-active companies, etc.). It is worth noting that transversal skills development can also aid in other project goals like inclusion: improved communication and cultural competence, for example, directly facilitate better integration of diverse groups like migrants or new-entrant women in workplaces (topics which we examine in Section 6).

The next section will discuss structural and institutional barriers that currently hinder skills provision – many of which also affect the development of transversal skills – and how they might be overcome.

5 STRUCTURAL AND INSTITUTIONAL BARRIERS TO SKILLS PROVISION

Analysis of the TCLF skills ecosystem has brought to light several structural and institutional barriers that impede the effective provision of needed skills. These are systemic issues in education and training frameworks, industry practices, or labour market conditions that make it challenging to close the skills gaps identified. Understanding these barriers is crucial, because even the best-defined skills needs or curricula updates will have limited impact if these underlying obstacles are not addressed. The research (particularly the qualitative evidence from stakeholders in different countries) highlights the following key barriers:

5.1 Mismatch Between Training Offerings and Industry Needs

A fundamental barrier is the misalignment between what the formal education and training system provides and the actual skills needs of modern TCLF companies. Desk research emphasised the importance of aligning educational offerings with industry requirements, implicitly noting that current alignment is insufficient. Many vocational education and training (VET) programs in textiles, apparel, leather, and footwear have curricula that lag behind the latest industry developments. For instance, some textile schools may still focus heavily on conventional techniques but offer little content on digital textile printing or sustainable materials. From the field research perspective, employers often commented that graduates of existing TCLF courses lack proficiency in the latest technologies or methods by the time they enter the job – meaning companies must invest in additional on-the-job training. This curriculum lag is partly due to institutional inertia: updating official curricula or introducing new qualifications can be a slow process, often requiring government approvals or accreditation updates. By the time a new module on, say, 3D CAD for fashion or circular economy is introduced, the industry may have moved further ahead. As a result, there is a **skills mismatch** where job seekers and recent graduates do not meet the evolving needs of employers, and employers in turn grow hesitant to rely on the formal training pipeline.

5.2 Limited Industry-Education Collaboration

Closely related to the above is the often-limited collaboration between companies and training providers (schools, institutes, universities). In some regions, focus group participants noted that there is a historical separation – educational institutes design programs with minimal direct input from businesses, and businesses do not proactively engage with schools to communicate their skills

needs or offer practical training opportunities. This leads to theoretical or outdated training content. Where partnerships do exist (e.g. apprenticeship programs, industry advisory boards for schools), they tend to be on a small scale or dependent on specific individuals. A structural barrier here is the lack of formal mechanisms or incentives to foster collaboration. For example, not all countries have strong apprenticeship systems in TCLF like those seen in some other sectors, and funding for collaborative projects (such as curricula co-development or teacher externships in industry) might be scarce. The **absence of structured dialogue** between industry and education means that training provision is slow to react to changes – one of the reasons the desk research classified education itself as a driver of change, implying a need for education to become more responsive and innovative. Overcoming this barrier likely requires institutional innovation, such as establishing sectoral skills councils or public-private partnerships specifically for the TCLF sectors, where stakeholders can regularly update each other and jointly plan training reforms.

5.3 Outdated Image and Low Attractiveness of TCLF Careers

A significant barrier to skills provision is on the demand side of learning – i.e., attracting learners into TCLF-related training and careers. The **image of the TCLF industries** in many countries has been one of low-tech, low-wage, and declining sectors, which discourages young people (and their parents) from pursuing education or jobs in these fields. The desk research pointed out that the attractiveness of the TCLF sectors to younger generations is critical for the future labour force. However, field research conversations repeatedly returned to the issue that enrolment in textile or leather training programs has dropped, and companies struggle to recruit apprentices or entry-level workers. This is an institutional challenge because even if excellent new curricula are developed, they will not have impact unless there are students enrolling and completing the programs. Likewise, companies might offer training positions but find too few takers. Part of the problem is also regional – in some partner countries, TCLF industries were once major employers but have contracted, leaving a perception of instability or lack of opportunity. Additionally, these sectors have been associated with labour-intensive work environments that are less appealing compared to emerging high-tech sectors. This barrier is being tackled in the project by emphasising innovation and modernity (as reflected in the project’s full name focusing on “Innovation and Resilience”), but it remains a tough challenge. Overcoming it may require concerted awareness campaigns, rebranding of the sector, and showcasing success stories of modern, digitalised, and sustainable TCLF businesses to change

perceptions. Without a more attractive image, the pipeline of new talent will remain thin, exacerbating skill shortages over time.

5.4 Geographical and Regional Disparities in Training Access

Another structural barrier is the uneven geographical distribution of training infrastructure. In several partner countries, the historical locations of textile or footwear industries (often specific regions) have educational institutes, but if industry has shifted or new hubs emerge, training might not be available locally. Field research brought up cases such as rural manufacturing areas where the nearest specialised textile training centre is far away in a major city, making it difficult for local youth to get sector-specific education. Conversely, some vocational schools in areas where the industry has declined are struggling to attract students or update their equipment due to reduced funding and industry support. This mismatch means that in some regions where jobs are available, people lack training opportunities, and in others where training exists, there may be fewer jobs – leading to inefficient outcomes like unemployment or skill underutilisation. Addressing this might involve mobile training units, online training modules, or inter-regional agreements to ensure people can access needed training without relocating – but these solutions require policy support and investment. Additionally, EU-level mobility initiatives (like encouraging exchange of students or apprentices among countries) could mitigate some regional skill imbalances, but language and recognition of qualifications become factors to manage.

5.5 SME Constraints in Training and Upskilling

The TCLF sector in Europe is dominated by small and medium-sized enterprises (SMEs). This reality poses an institutional barrier because SMEs often have limited capacity to invest in training. Many SMEs cannot afford dedicated training departments, and releasing employees for extended training is difficult when teams are very small (each worker's absence is felt in production). The qualitative evidence suggests that SMEs tend to do on-the-job, ad-hoc training and rely on recruiting already-experienced workers, when possible, rather than engaging with formal upskilling programs. There is also a **lack of structured support for SMEs** in terms of sector-specific consulting or joint training programs. While larger companies might collaborate with local colleges or have the resources to run in-house academies, SMEs frequently operate in isolation. This barrier means that any new curricula or training modules developed need to be delivered in a very flexible way (short courses, modular

training, perhaps outside of peak production periods) to be usable by SMEs. Field stakeholders advocated for more sector-wide initiatives that pool resources – for example, a regional training centre that serves multiple small companies, or e-learning platforms that SMEs can subscribe to at low cost. Without such collective solutions, many SMEs will continue to under-invest in workforce development, perpetuating skills gaps. Financial barriers are also relevant: even if courses exist, SMEs and their employees might find the cost (tuition fees, travel, time off work) prohibitive. This indicates a need for funding schemes or incentives (such as training subsidies or tax breaks) to lower the threshold for SME participation in skills development.

5.6 Slow Adaptation of Public Training Institutions

Institutional inertia in public education and training providers can be a barrier. Some focus group participants noted that public VET schools or universities offering TCLF-relevant programs often face bureaucratic constraints, lack of funding for new equipment, or insufficient exposure to industry's state-of-the-art. In some cases, instructors themselves may not be familiar with the newest technologies or business practices, especially if they have been in teaching positions for a long time without industry exchanges. As a result, even well-intentioned programs may not deliver the cutting-edge skills needed. For example, a leather technology institute might still be teaching manual pattern grading while the industry has moved to digital pattern software. This barrier is partly due to systemic issues in education systems (curriculum update cycles, procurement processes for new machines, etc.) and partly due to the relatively lower profile of TCLF sectors in national education priorities (compared to, say, ICT or automotive sectors). The AEQUALIS4TCLF project's focus on creating a network of VET and HE providers is one approach to surmount this – by networking, institutes can share knowledge and resources, and collectively press for updates. Another strategy is to involve industry experts directly in teaching (guest lecturers, dual professionals who both teach and work in industry). Some countries have regulatory hurdles for such arrangements (qualification requirements for teachers, etc.), which themselves become barriers to agile adaptation.

5.7 Recognition of Skills and Qualifications

A more administrative barrier lies in the recognition of skills and qualifications across regions and for non-traditional learning pathways. If a worker picks up digital skills informally on the job, there may be no certification to prove it when they seek new employment. Conversely, if a migrant worker

holds a qualification from another country in garment manufacturing, employers or local authorities might not recognise it fully, leading to underemployment. The focus on inclusion (see Section 6) intersects here – creating systems for recognising prior learning and foreign qualifications can help address skill shortages by making existing skills visible and usable. Current systems for recognition can be cumbersome or inconsistent. This dissuades some workers from investing in further learning if they fear it won't be formally valued, and it dissuades employers from hiring from broader talent pools. Efforts under EU tools like the European Qualifications Framework (EQF) and sectoral qualification frameworks are meant to ease this, but awareness and implementation in the TCLF context appear limited. Field research did not deeply delve into this, but it surfaced as an anecdotal issue – for instance, a highly skilled tailor from outside the EU working in Europe might officially be classed as unskilled labour because their credentials aren't recognised, thus limiting their career progression and the utilisation of their full skill set.

5.8 Cultural Barriers to Lifelong Learning

Culturally, in some TCLF companies (especially older, family-run ones), there may be a perception that formal training is less useful than learning by doing. This attitude can be a subtle barrier to skill provision – if top management doesn't believe in the value of training, they are unlikely to support employees taking courses or bring in trainers. The field research encountered a few cases where management saw training primarily as a cost rather than an investment, reflecting a need to change mindsets at the leadership level. Convincing decision-makers of the ROI (return on investment) of skills development is part of the challenge. Often, demonstrating success stories or pressure from value-chain partners (e.g. a major brand requiring its supplier to have certified trained staff) can help overcome this.

In summary, the **structural and institutional barriers** to skills provision in the TCLF sectors form a complex web. They range from misalignments in education, to lack of cooperation, to economic constraints, to image problems. These barriers help explain why skills gaps persist: even when needs are well-known, the system struggles to respond effectively. Overcoming these barriers will require multi-faceted efforts. For example, better industry-education collaboration could be achieved by setting up formal partnership bodies or modern apprenticeship schemes co-designed by companies and schools. Improving the sector's attractiveness might involve national and European campaigns

to rebrand TCLF as a high-tech, creative, and sustainable career path (which, according to project materials, is indeed a priority, tied to promoting equality and inclusion as well). Supporting SMEs might require policy interventions like pooled training funds or regional training hubs. And public institutions might need capacity-building – for instance, train-the-trainer programs to ensure teachers know the latest industry practices, and agile mechanisms to update curricula in real time with industry input.

The project’s strategic approach, as outlined in its objectives, touches on many of these solutions: developing new skills strategies per country, fostering networks of providers, and addressing discrimination and diversity which includes broadening the talent pool. These efforts can mitigate structural barriers by introducing new ways of cooperation and by bringing more resources and attention to TCLF skills development. The final section of this report (Section 7) will provide strategic recommendations that build on this understanding of barriers and propose ways forward to ensure the TCLF sectors have the skilled workforce they need for the future.

6 CHALLENGES LINKED TO THE INCLUSION OF WOMEN AND MIGRANTS

Promoting equality and inclusion in the TCLF workforce is a core aim of the AEQUALIS4TCLF project, and the skills analysis has therefore paid special attention to challenges faced by women and migrant workers in these sectors. Historically, the TCLF industries have had a significant presence of women – for example, women have often made up the majority of the workforce in apparel manufacturing – and in some regions, migrant workers (including both intra-EU migrants and immigrants from outside Europe) form an important part of the labour force, particularly in lower-skilled jobs. However, despite this representation, both women and migrant workers encounter specific barriers and forms of disadvantage that can limit their full participation and career development in the industry. The research findings highlight several key challenges related to inclusion, which have implications for skills needs and training strategies.

6.1 Women in TCLF: Representation vs. Segmentation

It is well documented that women are heavily represented in certain roles of TCLF (sewing machine operators, quality checkers, etc.), yet they are often underrepresented in others (technical, leadership, and innovation roles). The desk research notes the project's emphasis on *addressing discrimination against migrants and women*, indicating that unequal treatment or opportunities persist. One challenge is the **occupational segmentation by gender**. Women in TCLF may find themselves concentrated in lower-paying, lower-skill positions, with fewer opportunities for advancement. Field research discussions revealed anecdotes such as women with strong technical skills being overlooked for promotion to supervisor roles in favour of male colleagues, or a lack of women in roles like machine maintenance, IT, or production management – roles that are increasingly important with digitalisation. Traditional gender norms and stereotyping contribute to this; for instance, there can be a perception that engineering or machine-related tasks are “men’s work” and sewing or detail-oriented tasks are “women’s work,” which discourages women from pursuing training in certain technical skills and likewise may bias hiring/promotion decisions.

Another challenge is **work-life balance and working conditions**. The apparel and footwear sectors often involve shift work and peak seasons with overtime, which can be difficult for workers with family responsibilities – roles still largely carried by women in many societies. If workplaces are not flexible or supportive (e.g. lack childcare support, inflexible hours), women may be forced out or

choose not to advance to positions with greater responsibility that typically demand more time. Moreover, even though there are many women in the production workforce, leadership positions (e.g. factory owners, executives, lead designers at big houses) in some sub-sectors skew male. This indicates potential glass-ceiling effects or a lack of mentorship and networking for women to rise to top positions.

The field research did provide some positive examples – for instance, in one partner country it was noted that a significant number of small apparel businesses are actually led by women, and women entrepreneurs are making their mark in sustainable fashion startups. However, these cases are not yet the norm. A specific finding from the earlier blueprint (Skills4Smart TCLF) in Spain even showed *a significant female presence in leadership and decision-making* in some instances, suggesting that context matters. In certain countries or segments, women have broken through to higher roles, possibly due to supportive policies or cultural factors. The inclusion challenge, then, is partly about **learning from those contexts to replicate success**, and partly about tackling persistent bias elsewhere.

From a skills perspective, addressing women’s inclusion involves ensuring equal access to training and upskilling opportunities. Field evidence highlighted instances where women workers might not be offered technical training as readily as men, either due to conscious bias or assumptions about their career plans (for example, an employer assuming a young woman might leave to start a family and thus not investing in her development – a discriminatory practice). Ensuring that women in the TCLF sectors get the same training in new digital and green skills is vital; otherwise, the digital transformation could inadvertently widen gender gaps (with men more likely to occupy the new skilled technical roles, and women left in roles that might eventually be automated or devalued). The project’s focus on inclusivity suggests recommending proactive measures: e.g., mentorship programs to encourage women to pursue technical careers, or training modules designed to re-skill women from declining roles (like manual sewing) into emerging roles (like operating digital sewing equipment or performing quality control with digital tools).

6.2 Migrant Workers: Integration and Skill Utilisation

Migrant workers in TCLF face their own set of challenges. Many migrants fill labour shortages in jobs such as sewing, cutting, or low-tier processing, often because these jobs are less attractive to the local workforce due to relatively low wages or status. While migrants help sustain the industry by providing needed labour, they often encounter **language barriers, limited social integration, and recognition issues**. A common scenario mentioned in focus groups is that migrant workers, even if skilled (some could have been trained tailors or technicians in their home country), may be employed only at the helper or manual labour level because of language differences and lack of local certification of their skills. This underutilisation is a loss both for the individual and the industry. For instance, a migrant might have excellent patternmaking skills but works only in a warehouse role due to inability to communicate well or non-recognition of their qualifications.

The **language barrier** is one of the most immediate challenges. If training materials and workplace communication are only in the local language, non-native speakers struggle to learn new skills or even understand instructions fully. This can affect safety (misunderstanding safety instructions) and productivity. Some companies tackle this by providing basic language classes or using bilingual supervisors, but such practices are not universal. The research suggests that where migrant labour is significant, tailoring training methods – such as providing translations, visual instructions, or bilingual training staff – could greatly improve skill acquisition for those workers.

Another challenge is **discrimination and workplace inclusion**. Migrant workers can face prejudice or isolation at work. They might not be considered for advancement or training because of assumptions about their permanence or capabilities. The project documentation explicitly calls out discrimination as a problem to be addressed. In focus group conversations, some participants noted that creating a truly inclusive workplace culture requires effort from management – for example, celebrating cultural diversity, ensuring anti-discrimination policies are in place, and encouraging mixed teams. These softer aspects have a bearing on skills because a worker who feels included and valued is more likely to seek training and more likely to effectively share their own knowledge.

6.3 Intersecting Challenges – Women Migrants

It's also worth noting that a particularly vulnerable group is women who are migrants, as they can experience a double disadvantage. They may be concentrated in the lowest-paid positions and have very limited opportunities to advance. Any strategies for inclusion should pay attention to such intersections (gender, migrant status, possibly ethnicity or minority status) to ensure no group is overlooked.

The inclusion challenges of women and migrants have several implications for skills needs and provision. First, there may be untapped skills in these groups that could help alleviate skill shortages if recognised and developed. For example, a migrant with tailoring expertise might, with some language and technical upskilling, become a much-needed master craftsman or trainer for others – but only if their prior skills are acknowledged and built upon. Similarly, women on the production floor often develop a deep tacit knowledge of product quality and process efficiency; involving them in more formal continuous improvement training or roles (like quality management) could benefit companies, but often they are not invited into those skill development pathways.

Secondly, inclusion is itself a skill for organisations – managers and teams need what could be called **diversity management skills**. This includes understanding how to create inclusive training environments, how to mentor underrepresented employees, and how to address biases. The field research suggests that many TCLF companies have not historically focused on this, as they were more concerned with immediate production issues. However, as labour pools tighten and diversity increases, companies must learn these “soft” management skills. There were examples where a company, needing workers, actively recruited migrant workers and then learned the hard way that without proper integration (translations, cultural sensitivity, etc.), turnover remained high. Those that succeeded appointed a workplace integration officer or partnered with local migrant support groups to improve inclusion – essentially acquiring new competencies as an organisation.

From the perspective of recommendations, overcoming inclusion challenges might involve actions such as offering targeted training programs for women and migrants (for instance, upskilling courses aimed at women returners who left for childcare and are coming back to work, or bridge courses that teach technical language and vocabulary in the local language to migrant workers in parallel with vocational training). The project's commitment to diversity implies encouraging such measures. It is

also recommended to ensure **equal access** – all training initiatives under WP4 and WP5 should be designed to be accessible to women and migrant workers. This can be as simple as scheduling training at times that are feasible for women with family duties or providing language support in training materials for migrants.

Lastly, it's important to monitor and measure progress in inclusion. The qualitative evidence collected is a baseline showing issues; as interventions occur (within this project or by other policies), data on women's and migrants' participation in upskilling and their career progression in TCLF should be tracked. Only with such data can we confirm that the inclusion gap is closing. The project documentation positions equality and inclusion not just as social goals but as integral to building the future workforce. Embracing that, the TCLF sectors stand to gain a larger and more diverse talent pool: for example, encouraging more women to move into tech-oriented roles could help fill digital skill gaps, and properly integrating migrants can alleviate labour shortages and bring new perspectives that spur innovation.

In summary, the challenges for inclusion of women and migrants in TCLF are multi-faceted. Women face glass ceilings and segregation in roles and often have to contend with work environments not tailored to their needs, while migrant workers face language, recognition, and sometimes discrimination barriers. Both groups are essential to the industry's present and future, so addressing these challenges is not only a matter of social equity but also one of economic necessity – the sectors cannot afford to waste available human resources. The next section will provide strategic recommendations that incorporate solutions for these inclusion issues alongside broader skills development strategies, ensuring that the future skills ecosystem in TCLF is both competent and fair.

7 SUMMARY ANALYSIS AND STRATEGIC RECOMMENDATIONS

The skills needs analysis for the TCLF sectors reveals an industry in flux, driven by powerful forces of technological innovation, sustainability imperatives, evolving market demands, and external shocks. These drivers of change (outlined in Section 2) are reshaping the competency profile required of the TCLF workforce. On the one hand, there are **urgent skills gaps** – particularly in digital and green domains (Section 3) – that must be addressed in the short term to maintain industry competitiveness and support the twin transitions. On the other hand, there are **emerging skills needs** on the horizon (more advanced or niche competencies) that call for forward-looking training strategies to future-proof the workforce. In tandem, the analysis identified deficiencies in **transversal skills** (Section 4) such as communication, problem-solving, and leadership, which are just as crucial to overall performance and adaptability. Furthermore, **structural barriers** (Section 5) in the current skills ecosystem – including misalignments between training supply and industry demand, limited collaboration, and the unattractive image of the sector – hamper efforts to fill skills gaps. Lastly, persistent **inclusion challenges** (Section 6) mean that the industry is not fully capitalising on its human capital potential, especially regarding women and migrant workers, who face specific obstacles in training and career advancement.

Bringing these findings together, it is clear that a multi-pronged approach is needed to ensure the TCLF sectors have the skilled workforce necessary for a sustainable and innovative future. This approach should combine immediate remedial actions with longer-term capacity building, and it should engage all relevant stakeholders (industry, education providers, policy makers, and workers themselves). The following strategic recommendations are grounded in the evidence gathered (desk research, field research, and stakeholder inputs) and are intended to guide the design of future curricula (WP4 and WP5) as well as broader skills initiatives within AEQUALIS4TCLF and beyond:

1. **Modernise Curricula with Focus on Digital and Green Skills:** It is imperative to update and modernise educational curricula and training programs to reflect the new skill requirements in digital technology and sustainability. According to the project’s objectives, developing new or revised curricula that embed these competencies is a top priority. Concretely, this means integrating modules on topics such as industrial digitalisation (e.g. CAD, automation, data analytics, e-commerce) and on sustainable manufacturing (e.g. circular design, sustainable

materials, environmental compliance) into existing courses or creating new specialised courses. The curricula should balance theory with hands-on practice using modern equipment, ensuring that graduates are job-ready. Given the urgency of these skills, fast-tracking curriculum reform is recommended – potentially through short-cycle courses or post-diploma certificates that can upskill current workers quickly. The evidence suggests that **rapid response training programmes** can be effective for urgent needs. For instance, a focused bootcamp in digital patternmaking or a crash course in sustainable footwear design could quickly equip a group of workers or jobseekers with in-demand skills. In the medium term, formal vocational qualifications should be revised with input from industry to permanently incorporate these skill areas. Collaboration at the European level can facilitate the sharing of updated curriculum content across countries (so that, for example, a module on “Textile Circular Economy” developed in one country can be adapted and adopted in another). This curriculum modernisation will address the root cause of current skill gaps by ensuring new entrants to the labour market are better prepared, and by providing structured upskilling pathways for the existing workforce.

2. **Strengthen Industry-Education Partnerships and Work-Based Learning:** To overcome the alignment issue and keep training relevant, structured partnerships between TCLF companies and education/training providers should be established or reinforced. The evidence indicates that when industry and educators co-design training, it yields more effective skill outcomes. Therefore, it is recommended to create **sector skills councils or working groups** at national or regional level (if not already existing) that include representatives from employers, VET colleges, universities, and possibly unions or professional associations. These bodies can continuously review skill needs, advise on curriculum updates, and facilitate exchange of knowledge. One practical measure is to expand **work-based learning opportunities** such as apprenticeships, internships, and dual training programs in the TCLF sectors. Apprenticeships, in particular, directly link training with real-world experience and can attract youth by offering paid learning. Where traditional apprenticeships are not feasible, shorter internships or cooperative education models can be used. Companies should be encouraged (and given support if needed) to host apprentices/interns, and training institutions should adjust schedules to allow alternation between classroom and workplace learning. Successful partnership models from other

sectors or countries can be adapted – for example, a “training consortium” where several small companies pool to sponsor apprenticeship slots that rotate among them. The AEQUALIS4TCLF project itself can pilot some of these collaborative models under its network of VET and HE providers. Ultimately, closer partnerships will ensure that training content stays current (because companies will communicate new developments to schools) and that students acquire practical skills alongside theoretical ones, thus smoothing the school-to-work transition.

- 3. Implement Lifelong Learning and Upskilling Programs for Current Workforce:** Given the rapid changes in required skills, current employees will need opportunities to continuously update their competencies. The analysis revealed that many in the existing workforce lack key digital or green skills, and waiting for generational turnover is neither desirable nor feasible. Therefore, a strategic recommendation is to develop and promote **lifelong learning programs** tailored to TCLF workers. This could include in-service training courses, evening or part-time programs, and online learning modules that workers can undertake without leaving their jobs. Importantly, these upskilling programs should be **modular and flexible**, focusing on specific skill sets (for example, a module on “Digital Marketing for Fashion SMEs” or “Energy Efficiency in Textile Production”) that can be completed in a short time frame. Micro-credentials or digital badges can be awarded for each module, allowing workers to accumulate new qualifications gradually. Field research indicates that such flexible upskilling is critical for SME employees who cannot be away for long. The project might consider setting up a platform or repository of courses accessible to workers from all seven partner countries, possibly in multiple languages, leveraging e-learning for wider reach.

Additionally, incentives for participation should be considered: companies might need subsidies or tax incentives to invest in employee training, and workers might need motivation such as certification that is recognised by the industry (which could lead to career advancement). National governments and EU funds (like the Just Transition Fund or ESF+) can potentially support these lifelong learning initiatives financially, but the content and structure should be driven by identified needs (as documented in this analysis). As part of this, it’s recommended to incorporate training on **transversal skills** (communication,

teamwork, etc.) into technical upskilling programs, thereby addressing the soft skills gap concurrently with technical training.

4. **Address Transversal Skills Gaps through Education and Workplace Practices:** To improve transversal skills, a combination of educational reform and workplace culture change is needed. On the education side, curricula (from secondary vocational through higher education) should explicitly include learning outcomes related to soft skills – for example, team projects to foster teamwork, presentations to build communication skills, and problem-based learning to enhance problem-solving. Many educational systems already aim to do this, but in TCLF-specific programs it should be emphasised, since employers have noted deficiencies. In training modules for current workers, even if the topic is technical, facilitators can integrate components that encourage participants to practice communication or leadership (e.g. group work, role-playing management scenarios).

Moreover, offering standalone workshops or short courses in areas like leadership, project management, or cross-cultural communication can help fill specific gaps, especially for new supervisors or those taking on more collaborative roles as the industry modernises. On the workplace side, management should be sensitised to the importance of transversal skills. Companies can be encouraged to implement mentorship schemes, where experienced staff mentor younger or new workers – this can improve communication and knowledge transfer skills for both mentors and mentees. Employers can also set objectives or include criteria related to teamwork and communication in performance evaluations, signalling that these skills are valued. According to field input, when companies begin to place premium on soft skills (for instance, rewarding teams rather than just individuals, or recognising employees who contribute to improvements through innovative ideas), employees are more likely to develop and exhibit those skills. Additionally, multi-disciplinary teams (mixing design, production, marketing personnel on a project) can organically build transversal competencies as individuals learn to understand each other’s perspectives. In summary, **embedding soft skills training in both formal education and in informal on-the-job learning processes** will gradually close the transversal skills gap. This in turn supports technical skill implementation, as highlighted earlier in the report.

5. **Enhance the Attractiveness of TCLF Careers and Promote Inclusion:** Tackling the image problem of TCLF sectors is a strategic necessity to attract fresh talent. This calls for a concerted **awareness and rebranding campaign**. The project, in collaboration with industry associations and public bodies, should disseminate the message that TCLF industries are evolving into high-tech, innovative, and sustainable fields – in other words, a viable and exciting career choice. Practical steps might include organising open days or “TCLF Innovation Days” at factories and schools, creating modern visual materials (videos, social media content) showcasing digital design studios, automated production lines, or sustainable labs in the TCLF sectors, and highlighting testimonials from young professionals (especially women and individuals from diverse backgrounds) who have built successful careers in these industries. Emphasising the **convergence of fashion and technology**, and the role of creativity and environmental impact, can help change perceptions among youth who may not realise how these sectors are connected to cutting-edge developments.

Additionally, updating job titles and descriptions to be more appealing (for instance, “Digital Fabrication Specialist” instead of “Knitting Machine Operator”) can make a difference in recruitment. These efforts tie into inclusion as well – portraying women and migrants in these promotional materials positively and in roles of responsibility will help break stereotypes.

For inclusion specifically, strategic recommendations focus on creating enabling conditions for women and migrant workers to develop and use their skills fully. **Equal opportunity policies and practices** must be strengthened at the company level: for example, ensuring that training and promotion processes are bias-free. One recommendation is for companies (perhaps supported by industry bodies) to adopt mentorship and sponsorship programs targeting underrepresented groups – e.g., pairing high-potential female employees with mentors in leadership, or assigning “buddies” to new migrant workers to help them integrate and learn workplace norms. Language support is also critical for migrants: training materials and safety instructions should be made available in the languages of the workforce where feasible, and offering language courses (with work-hour flexibility to attend them) will improve integration and upskilling capacity. The project partners could develop a basic technical glossary or toolkit in multiple languages as a resource for companies with migrant

staff. In terms of women's inclusion, policies such as flexible working arrangements, childcare support (where possible), and zero-tolerance of harassment will not only retain female talent but also make the sector more attractive to new female entrants. Moreover, encouraging women to enter and stay in STEM-related roles in TCLF (like textile engineering, IT, mechanical maintenance) is important – this might involve scholarship programs for women in these disciplines or special outreach to girls in secondary schools about opportunities in fashion-tech and sustainable design.

As the research indicates, diversity contributes to innovation and better problem-solving, so inclusion measures are not just about fairness but also about enhancing the skill pool and creativity of firms. It is recommended that each national partnership under AEQUALIS4TCLF include an **inclusion action plan** that sets targets (for instance, increasing female enrolment in certain training courses by X%, or doubling the number of migrant workers attaining a formal skill certification) and monitors progress.

6. **Build Networks and Knowledge-Sharing Platforms:** To sustain skills development momentum, the establishment of networks for continuous knowledge exchange is advised. The project has already initiated a network of VET and higher education providers across the countries. This should be leveraged to share best practices, curricula, and even instructors or resources. For example, if one institute develops an excellent module on 3D footwear design, it can be shared across the network rather than everyone reinventing it. Similarly, industry partners in different countries can learn from each other's approaches to training and inclusion (peer learning visits, joint workshops). Expanding this network to include companies (perhaps via an online platform) could also help SMEs that lack training expertise to find guidance or partners. A **Skills Knowledge Hub** for TCLF could be an outcome, serving as a repository of training content, case studies, and a directory of training providers and courses. The hub could align with the EU Pact for Skills for TCLF, ensuring that results of this project feed into a wider European platform. Such networking also feeds into **future foresight**: by keeping stakeholders connected, the sector can collectively anticipate new skill needs (for example, if a new technology emerges, the network can quickly disseminate information and adapt curricula). In essence, institutionalising the collaboration and

knowledge-sharing that AEQUALIS4TCLF has started will provide durability to the improvements achieved.

7. **Policy Support and Funding Alignment:** Finally, strategic recommendations must be underpinned by supportive policy measures and resource allocation. National and regional authorities should be informed by these skills needs analysis to align their education and labour policies with the identified needs. This could mean updating national qualification frameworks to include new specialisations in digital/green TCLF skills, or providing grants for institutions to invest in modern equipment (since training digital skills on outdated machines is ineffective). Active labour market policies might also target TCLF sectors – for example, retraining programs for unemployed workers to move into areas of shortage like technical footwear manufacturing or textile maintenance. European Social Fund (ESF+) and other EU instruments can co-fund many of the recommended actions (apprenticeships, lifelong learning schemes, inclusion projects, etc.), and the project partners should actively seek to influence and tap into these funds. The **Pact for Skills for the TCLF industries** offers a framework for scaling up these initiatives, and AEQUALIS4TCLF is well-positioned to contribute its findings and models to that broader effort. Strategic advocacy by project partners towards policy makers is recommended, emphasising that investing in TCLF skills is investing in a sector that can be a driver of sustainable innovation and regional employment (especially important in certain European regions reliant on these industries). Removing policy barriers, such as overly rigid curriculum regulations or difficulties in recognising micro-credentials, will also help implement the recommendations effectively.

In conclusion, the TCLF Skills Needs Analysis has provided a clear evidence base for action. **The strategy forward is to combine immediate skill gap filling with systemic changes:** equip current workers with needed skills (particularly in digital and green areas), prepare future workers through modern education curricula, and create an enabling environment (through partnerships, networks, and inclusive practices) that continually adapts to change. This approach will ensure the TCLF sectors have the human capital required to thrive in a context of rapid technological advancement and sustainability requirements. By following the recommendations – modernising training content, strengthening collaboration, fostering lifelong learning, improving transversal skills, making the sector attractive and inclusive, networking knowledge, and aligning policy support – the industry can



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address its current weaknesses and build a resilient, skilled workforce. As noted in the project documentation, addressing the skills dimension is a *“critical step to build a competitive TCLF industry in Europe.”* With the insights from this analysis and a commitment to action, the TCLF sectors can turn that critical step into concrete progress, ensuring that workers and companies alike are prepared for the challenges and opportunities of the coming years.

8 ANNEX 1: OVERVIEW OF METHODOLOGY

This report relies on a two-stage methodology developed under Work Package 3 of the AEQUALIS4TCLF project. The aim was to combine structured desk-based research (Deliverable 3.1) with field-based stakeholder engagement (Deliverable 3.2) in order to identify green and digital skills needs—and related inclusion challenges—across the textile, clothing, leather and footwear (TCLF) sectors in Croatia, Czechia, Finland, Lithuania, the Netherlands, Serbia and Slovenia.

Deliverable 3.1 (Desk research)

Each national partner conducted a systematic review of policy documents, labour-market analyses, education-and-training frameworks and sector-specific publications. That process mapped key drivers of change (digitalisation trends, sustainability imperatives, demographic shifts and regulatory pressures) and established preliminary hypotheses about skills gaps, curriculum misalignments and barriers to inclusion. The country-level reports were then synthesised into a comparative framework that informed the design of field research instruments.

Deliverable 3.2 (Field research)

Building on the desk findings, a transnational online survey and a series of national focus groups were undertaken:

1. Online survey.

- Open between 10 July and 23 October 2024.
- Distributed via partner networks to companies (various sizes), vocational and higher-education institutions, sectoral associations and public bodies.
- Received 222 total responses; after data cleaning and quality checks, 164 fully completed and valid responses were analysed.
- The questionnaire covered:
 - Current and anticipated green / digital skills gaps
 - Relevance of existing curricula
 - Institutional cooperation between industry and education providers
 - Barriers to recruitment and inclusion (particularly women and migrant workers)

2. Focus group discussions.

- Conducted between 20 October and 6 November 2024.
- Nine focus group sessions held across the seven participating countries (Croatia, Czechia, Finland, Lithuania, the Netherlands, Serbia, Slovenia).
- Total participants: 79 (representing industry, VET/HE centres, sectoral associations and local / regional authorities).
- Each session followed a common, semi-structured discussion guide addressing:
 - Skills and curriculum gaps (technical, digital and transversal)
 - Barriers to adopting new technologies and sustainable practices
 - Workforce diversity and inclusion challenges
 - Feedback on survey findings to validate and contextualise quantitative trends

All participant data were anonymised before analysis. Recordings and notes from each focus group session were compiled using a standard template to ensure consistency across countries.

Data analysis.

- **Survey data:** Cleaned and organised in Excel. Out of 222 responses, 164 were complete and valid (a completion rate of 74 percent). Descriptive statistics were used to identify common skill-gap patterns and differences by country and stakeholder type. Open-ended responses were manually translated into English (where necessary) and then coded thematically.
- **Focus group data:** Summaries of each session were compiled by national partners, capturing key discussion points and stakeholder narratives. These summaries were coded into thematic categories (e.g. “green skills gap,” “digital curriculum misalignment,” “inclusion barriers”).
- **Integration and triangulation:** Quantitative trends from the survey were validated and enriched with qualitative insights from the focus groups. Divergences between methods were examined to identify contextual factors or sector-specific dynamics. The combined analysis ensured that the conclusions in Deliverable 3.3 reflect both documented desk-level trends and real-world stakeholder perspectives.

Ethical considerations were strictly observed throughout: all participants provided informed consent; data were anonymised before analysis; and findings are reported in aggregate form only.