Innovative Skills for an Old Vocation

Results of the workshops (WS) in Romania on the influences of the sub-dimensions of the trends globalisation, digitalisation and sustainability on the spheres of activity in the sector

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Editor: Andreas Saniter

Authors: ISOV-Team

Content

1 Method

To determine the possible influences of the sub-dimensions of the trends globalisation, digitalisation and sustainability on the fields of activity in the industrial footwear sector, three workshops in Romania were held in spring 2025 with a total of ~30 experts. This product documents the results.

2 Sustainability

Dimension	Green Awareness		
Subdimension	Sustainability education & consumer empowerment	Industry partnerships	Eco-labelling for footwear & digital transparency
Description	Providing training for employees and consumers about sustainable practices in footwear manufacturing and use. Sustainability education ensures stakeholders understand the environmental impacts of their actions, fostering eco-conscious behaviour. Ensuring that consumers have access to clear, accurate, and meaningful information about the environmental, social, and ethical aspects of footwear products. This subdimension aims to empower consumers to make informed purchasing decisions that align with their values and sustainability goals, namely sustainable consumption.	Collaborating with NGOs and green organisations to promote sustainable practices. Partnerships amplify the industry's efforts to raise awareness and enhance sustainability standards.	Clear and certified environmental labels for shoes. Certified eco-labels provide transparency, helping consumers easily identify sustainable options and discouraging deceptive greenwashing practices. Blockchain technology ensures traceability and transparency, providing consumers with verifiable information about product origins and sustainability. Apps showing product lifecycle impact. Interactive digital platforms provide detailed insights into a product's environmental footprint, enabling informed consumer choices. An example is Digital Product Passport (DPP), a digital identity card for products, components, and materials, which will store relevant information to support products' sustainability, promote their circularity and strengthen legal compliance.
Cutting			
Stitching			
Lasting			
Assembly			
Finish			
Design	9.4 Communication of sustainable values through product, packaging, and labelling.	9.4 Communication of sustainable values through product, packaging, and labelling.	9.4 Communication of sustainable values through product, packaging, and labelling.
Production Planning			
Technical Development			
Training Management			
Maintenance Management	9.6 Integrate educational content related to sustainability.	9.6 Integrate educational content related to sustainability.	9.6 Integrate educational content related to sustainability.
Quality Management			
New Materials			
Supply Chain Management			
Social Responsibility Management			
Sustainability Management			
Environmental Management	9.4 Promote sustainable values in relations with employees and the community.	9.4 Promote sustainable values in relations with employees and the community.	9.4 Promote sustainable values in relations with employees and the community.
STEM			
Health and Safety at Work Management	9.5 Coordinate environmental, social development and governance awareness campaigns and strategies.	9.5 Coordinate environmental, social development and governance awareness campaigns and strategies.	9.5 Coordinate environmental, social development and governance awareness campaigns and strategies.

Dimension	Energy and Process Efficiency			
Subdimension	Green energy integration & smart energy systems	Efficient machinery & Lean manufacturing	Digital manufacturing & automation	Emission, water & electricity reduction
Description	Green energy for factory operations. Incorporating renewable energy sources such as solar, wind, and others reduces carbon emissions and aligns with global climate objectives. Real-time monitoring of energy use. Implementing intelligent energy systems ensures real-time optimisation, reducing waste and enhancing energy efficiency across manufacturing processes.	Upgrading equipment for energy-efficient production. Modernising production equipment minimises energy use, reduces costs, and enhances operational efficiency in high-volume manufacturing. Minimising production waste in shoe assembly and packaging. Streamlining production processes reduces material waste, lowers costs, and improves efficiency while maintaining high-quality standards.	The integration of technologies into the production process to make plant operations more flexible, efficient and resilient in the face of changing market demands. For instance, technologies like 3D printing to create footwear enables precise material use and efficient prototyping. Utilising digital twins and automation improves precision, reduces errors, and minimises waste in footwear manufacturing.	Implementing measures to decrease greenhouse gas (GHG) emissions throughout the product lifecycle. Examples include adopting low-emission transportation, using energy-efficient technologies, and offsetting carbon footprints through reforestation projects. Streamlining supply chains to reduce carbon emissions. Optimising logistics for raw materials and finished products decreases transportation emissions, contributing to greener supply chains. Strategies to reduce electricity usage include implementing energy-efficient equipment, utilising automated systems, and adopting renewable energy solutions such as solar and wind power. Strategies to reduce electricity usage include implementing energy-efficient equipment, utilising automated systems, and adopting renewable energy solutions such as solar and wind power.
Cutting				
Stitching	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.
Lasting				
Assembly	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.
Finish				
Design	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.
Production Planning				
Technical Development	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.
Training Management				
Maintenance Management	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.	9.3 Direct resource and energy processors.
Quality Management				
New Materials	9.4 Optimising flows and reducing waste is about efficiency.	9.4 Optimising flows and reducing waste is about efficiency.	9.4 Optimising flows and reducing waste is about efficiency.	9.4 Optimising flows and reducing waste is about efficiency.
Supply Chain Management				
Social Responsibility Management				
Sustainability Management				
Environmental Management	9.2 Ensure efficiency of equipment and energy consumption.	9.2 Ensure efficiency of equipment and energy consumption.	9.2 Ensure efficiency of equipment and energy consumption.	9.2 Ensure efficiency of equipment and energy consumption.
STEM	9.2 Link performance with waste reduction.	9.2 Link performance with waste reduction.	9.2 Link performance with waste reduction.	9.2 Link performance with waste reduction.
Health and Safety at Work Management				

Dimension	Resource Efficiency & Sustainable Materials	
Subdimension	Emission, water & electricity reduction	Sustainable, biodegradable & regional materials selection
Description	Implementing measures to decrease greenhouse gas (GHG) emissions throughout the product lifecycle. Examples include adopting low-emission transportation, using energy-efficient technologies, and offsetting carbon footprints through reforestation projects. Streamlining supply chains to reduce carbon emissions. Optimising logistics for raw materials and finished products decreases transportation emissions, contributing to greener supply chains. Strategies to reduce electricity usage, including implementing energy-efficient equipment, using automated systems, and adopting renewable energy solutions like solar and wind power. Strategies to reduce electricity usage, including implementing energy-efficient equipment, using automated systems, and adopting renewable energy solutions like solar and wind power.	Utilising durable materials extends product lifespans, reduces consumption cycles, and conserves resources over time. Using materials that naturally decompose without harming the environment. Examples include plant-based polymers and natural rubbers, which break down into non-toxic by products under natural conditions. Sourcing materials locally to reduce transportation emissions and support regional economies. This approach often results in better traceability and lower environmental impact.
Cutting		
Stitching		
Lasting		
Assembly		
Finish		
Design		
Production Planning		
Technical Development		
Training Management		
Maintenance Management		
Quality Management		
New Materials		
Supply Chain Management		
Social Responsibility Management		
Sustainability Management		
Environmental Management		
STEM		
Health and Safety at Work Management		

Note:

During the workshop, it was decided to integrate the subdimensions of *Emission, water & electricity reduction* to the *Energy and Process Efficiency* dimension. The subdimension of *Sustainable, biodegradable & regional materials selection* was incorporated into the *Sustainable Design & Circular Economy* dimension.

Dimension	Sustainable Design & Circular Economy			
Subdimension	Reusability, reparability, disassembly & recycling	Material consumption optimisation	Recycling programs and post-consumer material use	Sustainable, biodegradable & regional materials selection
0,85	Designing footwear with replaceable parts encourages repairs, reduces waste, and promotes sustainable consumer behaviour. Designing shoes for easy disassembly facilitates full material recovery and reduces landfill waste.	Designing footwear to minimise material waste during cutting and assembly. Precision design techniques minimise waste, optimise material efficiency, and reduce the environmental impact of production processes.	Initiatives for recycling old footwear. Collection and recycling programs enable closed-loop systems, transforming old shoes into raw materials for the production of new products. Incorporating consumer waste into new shoes. Repurposing post-consumer waste supports a circular economy by reducing reliance on virgin materials.	Utilising durable materials extends product lifespans, reduces consumption cycles, and conserves resources over time. Using materials that naturally decompose without harming the environment. Examples include plant-based polymers and natural rubbers, which break down into non-toxic byproducts under natural conditions. Sourcing materials locally to reduce transportation emissions and support regional economies. This approach often yields better traceability and a lower environmental impact.
Cutting				
Stitching				
Lasting				
Assembly				
Finish				
Design				
Production Planning	8.8 Propose products based on circular design concepts.	8.8 Propose products based on circular design concepts.	8.8 Propose products based on circular design concepts.	8.8 Propose products based on circular design concepts.
Technical Development				
Training Management				
Maintenance Management	8 Integrate circularity requirements into the product structure.	8 Integrate circularity requirements into the product structure.	8 Integrate circularity requirements into the product structure.	8 Integrate circularity requirements into the product structure.
Quality Management				
New Materials				
Supply Chain Management				
Social Responsibility Management				
Sustainability Management	8.6 Select recyclable, sustainable and local materials.	8.6 Select recyclable, sustainable and local materials.	8.6 Select recyclable, sustainable and local materials.	8.6 Select recyclable, sustainable and local materials.
Environmental Management				
STEM	8.7 Ensure sustainable sourcing.	8.7 Ensure sustainable sourcing.	8.7 Ensure sustainable sourcing.	8.7 Ensure sustainable sourcing.
Health and Safety at Work Management				

Dimension	Chemical Safety	
Subdimension	Restricted substances compliance	Green chemistry innovations
Description	Meeting EU REACH regulations. Adhering to strict substance restrictions eliminates harmful chemicals, ensuring safety and regulatory compliance.	Biodegradable and eco-friendly chemical alternatives. Developing and using sustainable chemicals reduces environmental toxicity and enhances the eco-performance of footwear products.
Cutting		
Stitching		
Lasting		
Assembly		
Finish	9.3 Use adhesives, paints - direct impact.	9.3 Use adhesives, paints - direct impact.
Design		
Production Planning	9.3 Use adhesives, paints - direct impact.	9.3 Use adhesives, paints - direct impact.
Technical Development		
Training Management		
Maintenance Management		
Quality Management		
New Materials		
Supply Chain Management	9.4 Test compliance with REACH, ZDHC etc.	9.4 Test compliance with REACH, ZDHC etc.
Social Responsibility Management		
Sustainability Management	9.6 Identify and implement safe chemical alternatives.	9.6 Identify and implement safe chemical alternatives.
Environmental Management		
STEM	8.3 Verify supplier compliance.	8.3 Verify supplier compliance.
Health and Safety at Work Management		

Dimension	Social Responsibility		
Subdimension	Fair labour practices	Ethical sourcing	Community engagement & diversity, equity, and inclusion
Description	Promoting fair wages and ethical working conditions supports social sustainability and enhances the well-being of workers in global supply chains.	Ensuring raw materials are obtained responsibly, with respect for environmental and social standards. Ethical sourcing includes fair labour practices, biodiversity conservation, and avoiding exploitative suppliers.	Supporting local communities around manufacturing hubs. Investing in community programs fosters goodwill, strengthens business-community relations, and enhances social equity. Diversity, equality and inclusion in labour practices ensure fair opportunities and treatment across gender, age, and orientation in the footwear industry. It promotes diversity in leadership, equitable hiring practices, inclusive workplace policies, and product designs that cater to diverse consumer needs.
Cutting			
Stitching			
Lasting			
Assembly			
Finish			
Design			
Production Planning			
Technical Development			
Training Management			
Maintenance Management	8.4 Train employees on ethical issues.	8.4 Train employees on ethical issues.	8.4 Train employees on ethical issues.
Quality Management			
New Materials			
Supply Chain Management			
Social Responsibility Management			
Sustainability Management	7.6 Must ensure ethical sourcing.	7.6 Must ensure ethical sourcing.	7.6 Must ensure ethical sourcing.
Environmental Management	10 It is directly responsible for applying social principles.	10 It is directly responsible for applying social principles.	10 It is directly responsible for applying social principles.
STEM			
Health and Safety at Work Management	8.4 Monitor social impact.	8.4 Monitor social impact.	8.4 Monitor social impact.

3 Globalisation

Dimension	Demography		
Subdimension	Birth rate and Population ageing	Mutations in values and cultures	Demographic policies
Description	The increase in the world's population, the problem of the decline of the European population and the consequent demographic transition imply a more inclusive and flexible labour market, better adapted to the diversity of origins and qualifications of company employees. Aspects to consider also in the analysis of the sector, in the structuring of the training, in qualifications: the increase in life expectancy, the expansion of active life, the demands for better reconciliation between professional and personal life, the valorisation of professional careers and professionals in the final stages of professional exercise.	Emigration and immigration promote greater mobility of populations and changes in social and cultural values, which must be considered in the organization and development of companies, namely in adjusting their reception, training and job satisfaction standards.	Impact of demographic policies on the economic market and the labour market: More diverse and inclusive; Increased productivity through training and qualification; Improved quality of life; Better balance between professional and personal life; Equality of opportunities and gender; Opportunities for the older population; ...
Cutting	9.3 Indirect impact, related to labor availability.	9.3 Indirect impact, related to labor availability.	9.3 Indirect impact, related to labor availability.
Stitching	9.3 Indirect impact, related to labor availability.	9.3 Indirect impact, related to labor availability.	9.3 Indirect impact, related to labor availability.
Lasting	9.3 Indirect impact, related to labor availability.	9.3 Indirect impact, related to labor availability.	9.3 Indirect impact, related to labor availability.
Assembly	9.3 Indirect impact, related to labor availability.	9.3 Indirect impact, related to labor availability.	9.3 Indirect impact, related to labor availability.
Finish	9.3 Indirect impact, related to labor availability.	9.3 Indirect impact, related to labor availability.	9.3 Indirect impact, related to labor availability.
Design	9.1 Cultural values influence product aesthetics.	9.1 Cultural values influence product aesthetics.	9.1 Cultural values influence product aesthetics.
Production Planning			
Technical Development	9 Products must adapt to market demand.	9 Products must adapt to market demand.	9 Products must adapt to market demand.
Training management	8.9 An ageing pwork force and low birth rates require retraining.	8.9 An ageing pwork force and low birth rates require retraining.	8.9 An ageing pwork force and low birth rates require retraining.
Maintenance Management			
Quality Management			
New Materials			
Supply Chain Management			
Social Responsibility Management			
Sustainability Management			
Environmental Management			
STEM			
Health and Safety at Work Management	8.8 An ageing work force calls for adapted protection measures.	8.8 An ageing work force calls for adapted protection measures.	8.8 An ageing work force calls for adapted protection measures.

Dimension	Economic and Social Factors (part I)			
Subdimension	Migrations	Geopolitical conflicts	Communication and culture	Labour market changes (relocation of production, global competition...) and Innovation and competitiveness of organisations
Description	Demographic transition processes - changes in population standards and values. And consequently, in the commercial and labour markets, as well as, in the qualification of HR for the sector.	Changes in international relations. Competition, conflicts, increased competitiveness, changing markets, changing trade policies, disruption of supply chains, relocation of production, reduced consumption, ...	The globalisation, culture and technological evolution are characterised by an enormous articulation of the face-to-face and the digital, which is why it increasingly implies greater fluidity in communication and ensuring the veracity and effectiveness of information. It requires ongoing improvement in digital literacy and accountability.	Changes in values and cultures - excellence, productivity and competitiveness. Changes in the labour market (relocation of production, global competition, technological innovation, sociocultural diversity, etc.). Organisations must integrate innovation to remain competitive. The technological innovation is an imperative factor for the evolution of organisations.
Cutting				
Stitching				
Lasting				
Assembly				
Finish				
Design	9.2 Migration and conflict affect supply chains.	9.2 Migration and conflict affect supply chains.	9.2 Migration and conflict affect supply chains.	9.2 Migration and conflict affect supply chains.
Production Planning				
Technical Development				
Training Management				
Maintenance Management				
Quality Management				
New Materials	7.4 Energy revolution and international competitiveness demand solutions that are efficient.	7.4 Energy revolution and international competitiveness demand solutions that are efficient.	7.4 Energy revolution and international competitiveness demand solutions that are efficient.	7.4 Energy revolution and international competitiveness demand solutions that are efficient.
Supply Chain Management	8.7 Strong impact, given the geopolitical and migration context.	8.7 Strong impact, given the geopolitical and migration context.	8.7 Strong impact, given the geopolitical and migration context.	8.7 Strong impact, given the geopolitical and migration context.
Social Responsibility Management	8.2 Social and geopolitical trends call for new strategies.	8.2 Social and geopolitical trends call for new strategies.	8.2 Social and geopolitical trends call for new strategies.	8.2 Social and geopolitical trends call for new strategies.
Sustainability Management	8.2 Renewable energy and responsible consumption become priorities.	8.2 Renewable energy and responsible consumption become priorities.	8.2 Renewable energy and responsible consumption become priorities.	8.2 Renewable energy and responsible consumption become priorities.
Environmental Management				
STEM				
Health and Safety at Work Management				

Dimension	Economic and Social Factors (part II)			
Subdimension	Energy revolution	Consumption mutations	Economic evolution and international competitivity	International agreements
Description	Transformation in the way energy is produced, consumed and managed. Integration of renewable sources, investments in clean and sustainable technologies. It involves changes in products, production processes, logistics and consumption.	Economic and social changes - globalisation of the economy (new political and economic models). It involves the adaptation of models, structures, products and processes in the commercial, industrial and training sectors. International evolution of footwear consumption with emerging markets. According to World Footwear, consumption is expected to grow significantly in Oceania (+25%), followed by Africa (+13.3%), Asia (+9.2%) and North America (+8.3%). More modest increases are projected for South America (+3.2%). Europe (+0.5%) is expected to stagnate.	Political and economic changes - globalisation of the economy (new political and economic models). Elements to consider: Macroeconomic vision, impacts on global supply chains, diversity, competitiveness, sustainability. How can Europe compete with Asia, with its technical capacity, productivity, cost advantages and access to raw materials and qualified and available labour? How can Europe compete with Africa as an emerging centre for footwear production?	International agreements (EU and other international trade agreements, agreements on international and national economic activities, ...).
Cutting				
Stitching				
Lasting				
Assembly				
Finish				
Design	9.2 Migration and conflict affect supply chains.	9.2 Migration and conflict affect supply chains.	9.2 Migration and conflict affect supply chains.	9.2 Migration and conflict affect supply chains.
Production Planning				
Technical Development				
Training Management				
Maintenance Management				
Quality Management				
New Materials	7.4 Energy revolution and international competitiveness demand solutions that are efficient.	7.4 Energy revolution and international competitiveness demand solutions that are efficient.	7.4 Energy revolution and international competitiveness demand solutions that are efficient.	7.4 Energy revolution and international competitiveness demand solutions that are efficient.
Supply Chain Management	8.7 Strong impact, given the geopolitical and migration context.	8.7 Strong impact, given the geopolitical and migration context.	8.7 Strong impact, given the geopolitical and migration context.	8.7 Strong impact, given the geopolitical and migration context.
Social Responsibility Management	8.2 Social and geopolitical trends call for new strategies.	8.2 Social and geopolitical trends call for new strategies.	8.2 Social and geopolitical trends call for new strategies.	8.2 Social and geopolitical trends call for new strategies.
Sustainability Management	8.2 Renewable energy and responsible consumption become priorities.	8.2 Renewable energy and responsible consumption become priorities.	8.2 Renewable energy and responsible consumption become priorities.	8.2 Renewable energy and responsible consumption become priorities.
Environmental Management				
STEM				
Health and Safety at Work Management				

Dimension	Qualification / Training / Knowledge			
Subdimension	Educational systems	Qualifications' evolution and employability	Technological evolution	Ethical challenges and Integration of values
Description	Political, social and structural changes in educational systems. New dynamics and activities within a broader framework of values, objectives and needs. Values to promote: equity, quality, efficiency. Consider methodologies that promote self-training. Validation and certification of knowledge and skills.	Impact on all areas of work and also on training management - technology transfer and innovation. Integrate knowledge of the use of digital environments, collaborative learning, the development of soft skills, upskilling and reskilling actions. Reindustrialization of the cluster (from tradition to sustainable engineering): market study and consumer behaviour, design, materials, processes/industrialization (Kaizen, Lean methodologies, new technologies), competitiveness, digital marketing, purchasing and export logistics, product BI, end of life. The constant and rapid socioeconomics and technological changes require increasingly qualified, adaptable, entrepreneurial and autonomous people. Thus, training involves the development of dynamics in this register.	The technological evolution requires people to constantly develop skills, otherwise, it is a factor of social, cultural and professional exclusion - digital education. It requires ongoing improvement in digital literacy and accountability. Technological evolution must be considered in the models and resources applicable in education/training: Online training; Didactic and management applications;	Guarantee privacy and digital security rights; Permanent reinforcement of digital literacy; HR requalification; Responsible digital culture; Accountability in information and platform management; Equal access to technology (inclusion and equal opportunities); ethical standards and regulation of AI; Integrate the following values into training/qualifications: universality, quality, equity and inclusion.
Cutting				
Stitching				
Lasting				
Assembly				
Finish				
Design				
Production Planning	8.4 New technologies require advanced skills.	8.4 New technologies require advanced skills.	8.4 New technologies require advanced skills.	8.4 New technologies require advanced skills.
Technical Development				
Training Management	8.8 Requires continuous adaptation of skills.	8.8 Requires continuous adaptation of skills.	8.8 Requires continuous adaptation of skills.	8.8 Requires continuous adaptation of skills.
Maintenance Management				
Quality Management	8.1 Qualifications directly affect rigour in execution.	8.1 Qualifications directly affect rigour in execution.	8.1 Qualifications directly affect rigour in execution.	8.1 Qualifications directly affect rigour in execution.
New Materials				
Supply Chain Management				
Social Responsibility Management				
Sustainability Management				
Environmental Management				
STEM	9.8 Technological developments and the integration of ethical values are essential.	9.8 Technological developments and the integration of ethical values are essential.	9.8 Technological developments and the integration of ethical values are essential.	9.8 Technological developments and the integration of ethical values are essential.
Health and Safety at Work Management				

Dimension	Markets and Consumers			
Subdimension	Technological evolution in commercial and industrial processes and New business models	Emergent markets in the value chain	Product diversification	Change in consumption standards
Description	The technological evolution has caused changes in the global economy, as well as in commercial and industrial processes. From digital marketing, commercial transactions, e-commerce, Artificial Intelligence, digitalization, automation and robotics, ... to changes in financial transactions. New business models based on creating value through cost, differentiation, experience and through digital platforms - e-commerce. Strong focus on communication and digital marketing to internationalize more quickly, overcome competition and be globally competitive.	New markets, transfer of production activities; increasing internal fragmentation of production.	In the sector, the product diversification is essential due to changes in consumption patterns, short fashion cycles, ... Consider elements that foster diversity, creativity and innovation in HR qualifications and training.	Evolution of options: people buy less, buy better and buy in different ways. Consumers are prioritizing digital experiences and products over physical goods. Greater visibility of product information. Consider elements that promote sustainability, transparency, reuse, ...
Cutting				
Stitching				
Lasting				
Assembly				
Finish				
Design	8.7 It is at the center of adapting to new business models and tastes.	8.7 It is at the center of adapting to new business models and tastes.	8.7 It is at the center of adapting to new business models and tastes.	8.7 It is at the center of adapting to new business models and tastes.
Production Planning	9.3 Adjust according to market demand.	9.3 Adjust according to market demand.	9.3 Adjust according to market demand.	9.3 Adjust according to market demand.
Technical Development				
Training Management				
Maintenance Management				
Quality Management				
New Materials	8.6 Product diversification requires creative and sustainable solutions.	8.6 Product diversification requires creative and sustainable solutions.	8.6 Product diversification requires creative and sustainable solutions.	8.6 Product diversification requires creative and sustainable solutions.
Supply Chain Management	7.9 Emerging markets influence sourcing.	7.9 Emerging markets influence sourcing.	7.9 Emerging markets influence sourcing.	7.9 Emerging markets influence sourcing.
Social Responsibility Management				
Sustainability Management				
Environmental Management				
STEM				
Health and Safety at Work Management				

Dimension	Compliance	
Subdimension	Applicable regulations and legislation	Corporate Social Responsibility
Description	Policies, initiatives, instruments and measures for regulating people, organizations and products. Certification, audits, commercial and sustainable policies, ... human rights, labour rights, ...	Policies, initiatives, instruments and measures for the social responsibility of people, organizations and products. Certification, audits, commercial and sustainable policy, Quality, Environment, Safety, ... human rights, labour rights, ...
Cutting		
Stitching		
Lasting		
Assembly		
Finish		
Design		
Production Planning		
Technical Development		
Training Management		
Maintenance Management		
Quality Management	8.6 Regulations impose strict standards.	8.6 Regulations impose strict standards.
New Materials		
Supply Chain Management	7.9 Compliance with quality, social and environmental regulations and standards.	7.9 Compliance with quality, social and environmental regulations and standards.
Social Responsibility Management	8.6 Compliance includes legal social and ethical obligations.	8.6 Compliance includes legal social and ethical obligations.
Sustainability Management		
Environmental Management	8.4 Environmental legislation is becoming increasingly stringent.	8.4 Environmental legislation is becoming increasingly stringent.
STEM		
Health and Safety at Work Management	9.3 Regulations are essential.	9.3 Regulations are essential.

4 Digitalisation

Dimension	New Era of Robots		
Subdimension	2 Arm robots	Adaptive robots	Lightweight robots
Description	Dual arm robots are unique in their design because instead of a single robotic arm, they have two. Their arms extend outward from either side of their robotic base. Since these robots have two arms, they tend to have more axes than single six axis robots. The number of axes for a dual arm robot can range from four up to fifteen, for an enhanced range of motion.	Adaptive robotics is a field that goes one step further than collaborative robotics. It involves the development and manufacturing of robots capable of adapting to and learning from their environment, interacting with humans. In other words, adaptive robots are those with cognitive, sensing and decision-making capabilities to modify their behaviour and function in response to contextual changes.	In contrast to their bulky counterparts, lightweight robots are more compact, space-saving and - as the name suggests - lighter. They are used in laboratories, electronics production, packaging and precision mechanics, among other areas.
Cutting	8.6 Automated cutting by multi-arm robots increases accuracy and speed.	8.6 Automated cutting by multi-arm robots increases accuracy and speed.	8.6 Automated cutting by multi-arm robots increases accuracy and speed.
Stitching	8.4 Adaptive robots can support the sewing of repetitive parts, but require human intervention for fine details.	8.4 Adaptive robots can support the sewing of repetitive parts, but require human intervention for fine details.	8.4 Adaptive robots can support the sewing of repetitive parts, but require human intervention for fine details.
Lasting			
Assembly	8.9 Lightweight robots can perform controlled pressure and positioning trimming, improving quality.	8.9 Lightweight robots can perform controlled pressure and positioning trimming, improving quality.	8.9 Lightweight robots can perform controlled pressure and positioning trimming, improving quality.
Finish			
Design			
Production Planning	7.9 Robot integration involves adjusting planning to synchronize automated activities.	7.9 Robot integration involves adjusting planning to synchronize automated activities.	7.9 Robot integration involves adjusting planning to synchronize automated activities.
Technical Development			
Training Management			
Maintenance Management	9 The need for predictive maintenance for industrial robots is growing.	9 The need for predictive maintenance for industrial robots is growing.	9 The need for predictive maintenance for industrial robots is growing.
Quality Management			
New Materials			
Supply Chain Management			
Social Responsibility Management			
Sustainability Management			
Environmental Management			
STEM			
Health and Safety at Work Management			

Dimension	Artificial Intelligence (AI)			
Subdimension	Image generation tools	Text generating and translating systems	Text-to-speech and speech-to-text systems	Data mining
Description	AI image generation tools allow you to quickly produce high-quality visuals by describing desired images in text prompts. With thoughtful use, these tools can enhance the creation of diagrams, illustrations, and graphics to engage students and enrich lectures and assignments.	Text generation is the process of automatically producing coherent and meaningful text, which can be in the form of sentences, paragraphs or even entire documents. It involves various techniques, which can be found under the field such as natural language processing (NLP), machine learning and deep learning algorithms, to analyse input data and generate human-like text.	Text to speech is a noble technology that reads text aloud. You may also know this tool as Read Aloud on products like eBooks and e-readers. Speech to text is a computational linguistics technology that uses speech recognition or an audio file to convert spoken language into text.	Data mining is the use of machine learning and statistical analysis to uncover patterns and other valuable information from large data sets.
Cutting				
Stitching				
Lasting				
Assembly				
Finish				
Design	8.3 AI tools for image generation accelerate the creation of innovative visual concepts.	8.3 AI tools for image generation accelerate the creation of innovative visual concepts.	8.3 AI tools for image generation accelerate the creation of innovative visual concepts.	8.3 AI tools for image generation accelerate the creation of innovative visual concepts.
Production Planning				
Technical Development	8.4 AI optimises design for functionality and aesthetics.	8.4 AI optimises design for functionality and aesthetics.	8.4 AI optimises design for functionality and aesthetics.	8.4 AI optimises design for functionality and aesthetics.
Training Management	8.6 AI solutions can personalise educational content for employees.	8.6 AI solutions can personalise educational content for employees.	8.6 AI solutions can personalise educational content for employees.	8.6 AI solutions can personalise educational content for employees.
Maintenance Management				
Quality Management				
New Materials				
Supply Chain Management				
Social Responsibility Management				
Sustainability Management				
Environmental Management				
STEM	9.1 AI is an essential digital competence for engineers and researchers in industry.	9.1 AI is an essential digital competence for engineers and researchers in industry.	9.1 AI is an essential digital competence for engineers and researchers in industry.	9.1 AI is an essential digital competence for engineers and researchers in industry.
Health and Safety at Work Management				

Dimension	Big Data				
Subdimension	Digital marketing and branding	Personalisation and mass customisation	Data-driven decision-making	Traceability	Internet of Things (IoT)
Description	Digital branding is the process of using digital assets to create an online brand identity that can be expressed on virtually any digital channel, like your website, social media profiles, digital ads, and content marketing. Done right, digital branding enables you to create richer digital marketing campaigns and build a powerful presence in the digital sphere.	The most common form of customization comes in the form of product customization and is typically found online. Product customization is particularly popular for clothing outlets. Mass customization is all about customer experience, sometimes referred to as CX, which marks an enormous shift from shopping habits that were once almost entirely about the product. One type of personalization is the recommendation engine, although it should be noted that personalization is not a type of recommendation.	Data-driven decision-making (DDDM) is defined as using facts, metrics, and data to guide strategic business decisions that align with your goals, objectives, and initiatives. When organizations realize the full value of their data, that means everyone—whether you're a business analyst, sales manager, or human resource specialist—is empowered to make better decisions with data, every day.	Traceability and supply chain mapping are essential for companies to be able to understand and address supply chain risks related to deforestation, ecosystem conversion, and human rights abuses. To support these processes, the Accountability Framework provides guidance on the appropriate level of traceability and how companies may achieve it.	The Internet of Things (IoT) refers to a network of physical devices, vehicles, appliances, and other physical objects that are embedded with sensors, software, and network connectivity, allowing them to collect and share data.
Cutting					
Stitching					
Lasting					
Assembly					
Finish					
Design	9.7 Consumer data helps to define the product concept.	9.7 Consumer data helps to define the product concept.	9.7 Consumer data helps to define the product concept.	9.7 Consumer data helps to define the product concept.	9.7 Consumer data helps to define the product concept.
Production Planning	9.1 Real-time data allows immediate adjustment of the production plan.	9.1 Real-time data allows immediate adjustment of the production plan.	9.1 Real-time data allows immediate adjustment of the production plan.	9.1 Real-time data allows immediate adjustment of the production plan.	9.1 Real-time data allows immediate adjustment of the production plan.
Technical Development					
Training Management					
Maintenance Management					
Quality Management	9.1 Data analysis helps to identify and correct faults.	9.1 Data analysis helps to identify and correct faults.	9.1 Data analysis helps to identify and correct faults.	9.1 Data analysis helps to identify and correct faults.	9.1 Data analysis helps to identify and correct faults.
New Materials					
Supply Chain Management	9.7 Big Data enables material traceability tracking and delivery optimization.	9.7 Big Data enables material traceability tracking and delivery optimization.	9.7 Big Data enables material traceability tracking and delivery optimization.	9.7 Big Data enables material traceability tracking and delivery optimization.	9.7 Big Data enables material traceability tracking and delivery optimization.
Social Responsibility Management					
Sustainability Management					
Environmental Management					
STEM					
Health and Safety at Work Management					

Dimension	3D Printing	
Subdimension	Plastics	Metals
Description	Material extrusion, also known as Fused Deposition Modelling (FDM), is the most common consumer 3D printing technology. It's used by affordable home 3D printers. The nozzle heats up the filament above its melting point and extrudes it onto the build platform (or the latest printed layer) where it hardens. The object is built up layer by layer, where each layer solidifies and adheres to the layer below. Supports structures are built-up during overhangs and bridging. After the print finishes, the support structure can be removed.	3D printing with metal (also known as metal 3D printing or metal additive manufacturing) is a process for manufacturing metal parts by applying and fusing metal powder or wire in layers. This method makes it possible to create complex geometries and customised components that would be difficult or impossible to produce using conventional methods.
Cutting		
Stitching		
Lasting		
Assembly		
Finish		
Design	9.7 Enables rapid prototyping and testing of complex shapes without expensive moulds.	9.7 Enables rapid prototyping and testing of complex shapes without expensive moulds.
Production Planning		
Technical Development	9.7 Enables rapid testing and optimisation of structural components.	9.7 Enables rapid testing and optimisation of structural components.
Training Management		
Maintenance Management		
Quality Management		
New Materials	9.3 Requires development of materials compatible with 3D printing technologies.	9.3 Requires development of materials compatible with 3D printing technologies.
Supply Chain Management		
Social Responsibility Management		
Sustainability Management		
Environmental Management		
STEM		
Health and Safety at Work Management		

Dimension	Combination of Digitalisation and Sciences	
Subdimension	Wearables	Cyber physical systems (CPS)
Description	Wearable technology is any kind of electronic device designed to be worn on the user's body. Such devices can take many different forms, including jewellery, accessories, medical devices, and clothing or elements of clothing. The term wearable computing implies processing or communications capabilities, but in reality, the sophistication among wearables can vary.	Cyber-physical systems (CPS) are networked information-processing systems that interact directly with their surrounding physical environment. CPSs record environmental information via sensors, process this information with computer support, and in turn influence their environment via actuators. CPS are therefore in a continuous control loop and in many application areas must perform time-critical and safety-relevant calculations and communicate with other technical systems or humans across domains.
Cutting		
Stitching		
Lasting		
Assembly		
Finish		
Design		
Production Planning		
Technical Development		
Training Management		
Maintenance Management		
Quality Management		
New Materials		
Supply Chain Management		
Social Responsibility Management		
Sustainability Management	8.9 Digital technologies provide data for ecological footprint monitoring.	8.9 Digital technologies provide data for ecological footprint monitoring.
Environmental Management		
STEM	9.6 Integration of cyber-physical technologies requires interdisciplinary expertise in science and engineering.	9.6 Integration of cyber-physical technologies requires interdisciplinary expertise in science and engineering.
Health and Safety at Work Management	8.9 Digital sensors can monitor working conditions in real time.	8.9 Digital sensors can monitor working conditions in real time.

Dimension	Virtual and Augmented Reality	
Subdimension	Virtual reality	Augmented reality
Description	Virtual reality (VR) is a technology that simulates a computer-generated environment and makes it possible to interact with it in a very realistic way. It has become increasingly popular in recent years, with applications in fields such as gaming, education, healthcare, and entertainment.	Augmented reality refers to a computer-based extension of our perceptible reality. Generally, all human senses are addressed, but often it is only about the visual or auditory depiction of information, i.e., in the form of an overlay. A commonly known example is the arrows and rings used in the analysis of soccer matches.
Cutting	9 AR can guide employees through the material cutting process more accurately.	9 AR can guide employees through the material cutting process more accurately.
Stitching		
Lasting		
Assembly		
Finish		
Design	9.2 Allows product simulation before prototyping.	9.2 Allows product simulation before prototyping.
Production Planning		
Technical Development		
Training Management	9.6 Training in simulated environments for employees without consumption of real resources.	9.6 Training in simulated environments for employees without consumption of real resources.
Maintenance Management		
Quality Management		
New Materials		
Supply Chain Management		
Social Responsibility Management		
Sustainability Management		
Environmental Management		
STEM		
Health and Safety at Work Management		