Developing Innovative and Attractive CVET programmes in industrial shoe production

Train-the-Trainer Manual

Design

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Content

1 Introduction

1.1 Aims of the DIA-CVET Project

The aims of the Erasmus+ project «Developing Innovative and Attractive CVET programmes in industrial shoe production» are

- to develop, pilot and implement comprehensive courses for the Spheres of Activity (SoA) of foremen in industrial shoe production on European level; available in English (EN) as well as in DE, RO and PT,
- and to develop a sector qualification framework level 5 and 6 and to reference existing or newly drafted national qualifications from Germany, Portugal and Romania.

1.2 Manuals to Guide Tutors and Trainers

The purpose of the manuals is to prepare designated trainers for their role and to provide content and support. Due to the nature of the SoA of foremen, they do not include specific forms of training; but we suggest a blended approach. Successful Continuous Vocational Education and Training (CVET) programmes combine theoretical lessons with application of the acquired Knowledge, Skills and Competences (KSC) in real work environments. The tasks of a trainer are to

- impart SoA-specific KSC,
- demonstrate operations which the learners are expected to learn to perform,
- introduce the learners to each new task and supervise them during their first approaches,
- organise and supervise blended activities (i. e. projects),
- guide them towards an independent performance of the tasks of the respective SoA.

The manuals are not meant to replace a textbook. They are meant to provide support to the trainers to plan and execute their teaching. The trainers are invited to gather more information from other sources.

1.3 Refer your training to the business process of industrial shoe production

Industrial production is a complex process, where the Sphere of Activity, described in this manual, is embedded in the business process. Before you start the training on a specific SoA, please make sure that the learners are familiar with the other SoA of industrial foremen in shoe production.

For example, the learners should be introduced to the types of products the company manufactures and their intended use, the different customer segments, the distribution channels etc. They should be aware of the product creation and manufacturing processes, i.e. product design, pattern making, purchasing department, production planning, and all production departments to warehouse and logistics.

The production process (not part of DIA-CVET, for insights see: http://icsas-project.eu/) is in the core of the business process; the SoA of DIA-CVET play a preparatory, supporting or accompanying role (see Fig. 1).

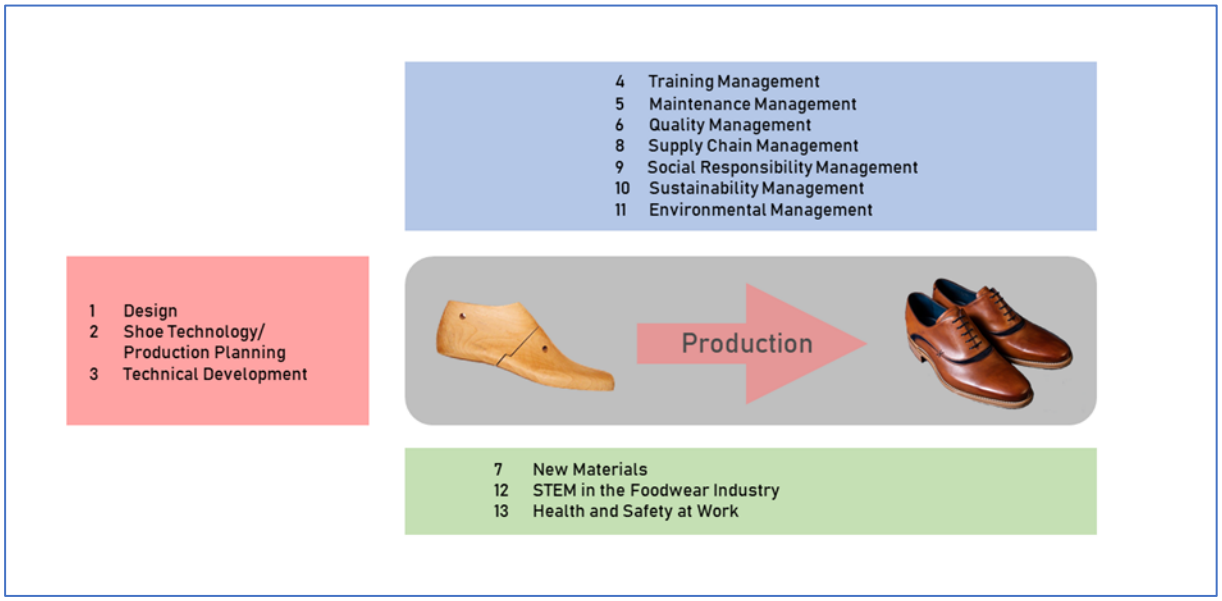

Fig. 1: Spheres of Activity of DIA-CVET and their relation to the production process.

2 Design

Footwear design is a complex process that involves a variety of individuals, including consumers, retailers, marketing, designers, product developers, engineers, technicians and even scientists and doctors.

Footwear design stages:

- Research – brand identity, consumer requirements, current trends, materials, technologies, innovations, competitors etc.;
- Brief – establishing parameters like features, characteristics, construction, technical solutions, materials, design constraints, target group, target price;
- Design – inspiration, concept, sketches, virtual modelling, renderings;
- Develop – patternmaking, technical sheets;
- Prototype – rapid prototyping, samples, testing, modifications;
- Validate – final products approval by company management, marketing team and customers.

2.1 Footwear trends

Footwear has to be both functional and aesthetic appealing in the same time and has to offer consumers a way to express themselves.

Trends that are shaping the footwear industry:

- **Sustainability** - consumers are growing more aware of global and ecological issues and start to prioritize brands that make a positive impact by recycling, using eco-friendly materials, adopting sustainable manufacturing technologies and promoting durability and quality over fast-fashion.
- **Comfort** - manufacturers should focus on comfort and health features, for footwear categories occasion and formal, by adopting innovative materials and constructions.
- **Multifunctional and smart -** consumers want more from their products, to cover both leisure and outdoor activities by merging style and performance and also by incorporating smart wearable technologies.
- **Personalization** - customers are willing to pay for the possibility to express themselves and to have something specifically designed by them and for them.

2.2 Virtual prototyping

Virtual prototyping (VP) is defined as a computer-aided design process that implies the construction of digital product models and realistic graphical simulations that address the broad issues of physical layout, operational concept, functional specifications, and dynamics analysis under various operating environments.

Virtual Prototyping has several benefits like flexible design, short development time, reduced time to market, easy detect errors, realistic simulation, reduced costs, reduced number of physical prototypes and increased productivity.

Fig. 2: Footwear Virtual Prototype. Source: www.compasslist.com/insights/4d-shoetech-digital-design-platform-helps-shoemakers-to-slash-production-time-by-over-60

2.3 Digital Materials and Rendering

True realism in virtual design and prototyping can be achieved by using rendering software and digital materials that reproduce the aspect (brightness, roughness, transparency) and texture of real materials (textile, leather).

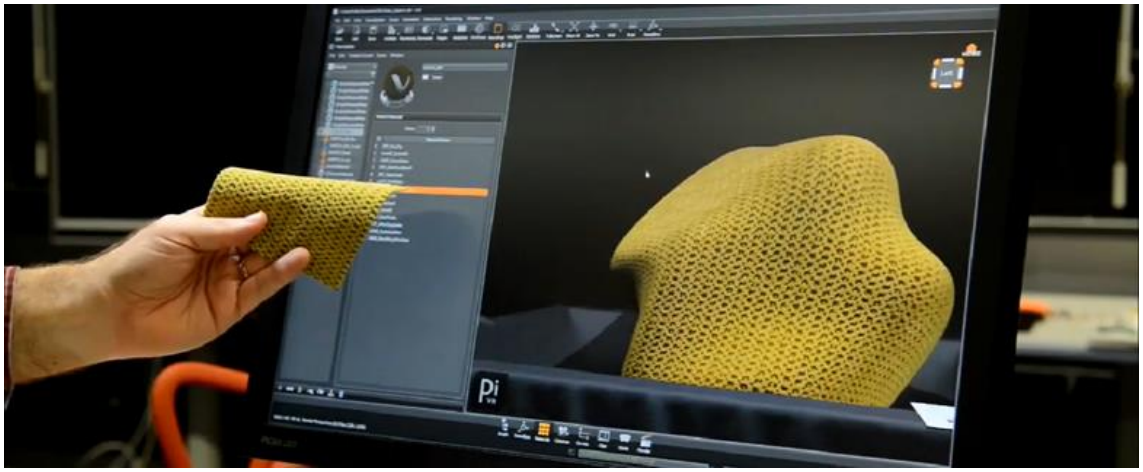

Fig. 3: Digital material. Source: https://blog.ranchcomputing.com/capture-of-real-materials-next-step-of-photorealism

2.4 Rapid prototyping

Rapid prototyping is the fast fabrication of physical components and models by using virtual tools and additive manufacturing. The use of additive manufacturing shortens the development process time and also represents a more viable solution than traditional manufacturing techniques by enabling complex parts to be manufactured directly from a digital format without using specific tooling.

An example of using rapid prototyping for 3D printing of footwear components (sole, heel and counter) is given in the following figure:

Fig. 4: 3D printed prototypes of footwear components. Source: TUIASI

2.5 Virtual Reality and Augmented Reality

Virtual reality (VR) and Augmented reality (AR) are technologies that enhance and simulate physical environments by using virtual computer-generated information. Augmented reality enhances/augments the environment by adding digital elements to a live view. Virtual reality is a completely immersive experience that replaces and simulates a real-life environment.

Virtual prototyping applications can incorporate virtual reality technologies, augmented reality or mixed reality technologies.

Fig. 5: Augmented reality application. Source: https://scanblue.com/augmented-reality-and-shoes/

Fig. 6: Virtual reality technology in footwear design. Source: https://www.worldviz.com/post/footwear-company-deckers-uses-vr-to-reduce-travel-and-drive-collaboration

2.6 Virtual testing

Testing footwear is an expensive and time-consuming process, each concept has to be manufactured, tested and if it does not meet the desired performance requirements it is sent back to the drawing board and the entire development process is started all over again. One solution is to use virtual testing.

For each footwear design a prototype must be manufactured, and tested and if it does not meet stipulated performance criteria, another design iteration is required. One method to reduce the number of iterations, improve efficiency, and improve the pre-production process, is to use virtual testing. For example, Finite Element Analysis (FEA) software can be used to test the performance of different footwear geometries and footwear materials.

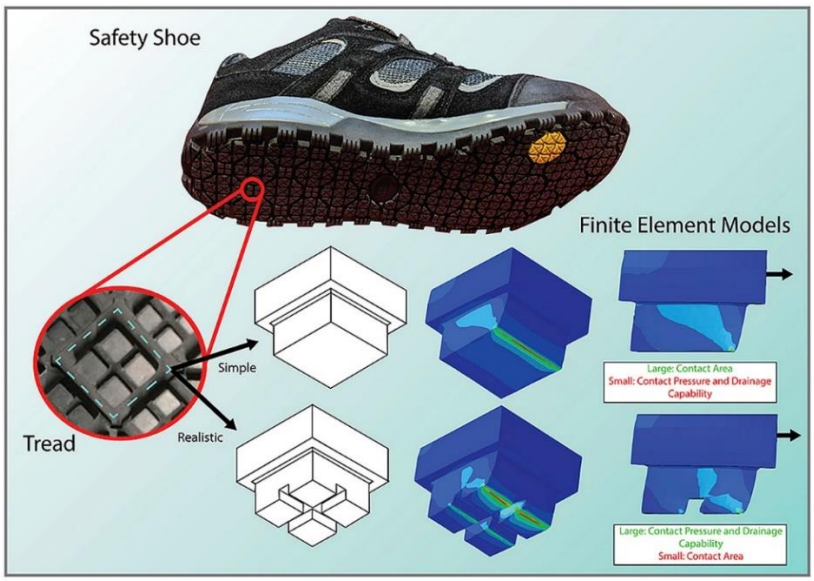

Fig. 7: Virtual testing of footwear outsole. Source: J. Hale, A. O'Connell, R. Lewis, M.J. Carré, J.A. Rongong, An Evaluation of Shoe Tread Parameters using FEM, Tribology International, Volume 153, 2021, 106570, ISSN 0301-679X, https://doi.org/10.1016/j.triboint.2020.106570.

3 List of Figures