Developing Innovative and Attractive CVET programmes in industrial shoe production

Spheres of Activity (SoA)

IO 1

This project is funded with support from the European Commission.
The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Co-funded by the Erasmus+ Programme of the European Union

This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. To view a copy of this license, visit:

http://creativecommons.org/licenses/by-nc-sa/4.0/

or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

Project data:
Programme: Erasmus+
Project title: Developing Innovative and Attractive CVET programmes in industrial shoe production
Acronym: DIA-CVET
Project 2020-1-DE02-KA202-007600
Duration: 01.09.2020- 31.08.2023
Website: www.dia-cvet.eu

Editor: Andreas Saniter

Authors: DE: Sabina Krebs, Tatjana Hubel (PFI Pirmasens);
Klaus Ruth, Andreas Saniter, Vivian Harberts (ITB);
PT: Rita Souto, Cristina Marques (CTCP), Fátima Martins,
Ricardo Sousa (CFPIC), André Fernandes (CARITÉ);
RO: Aura Mihai, Bogdan Sarghie, Arina Seul (TU Iasi).

Content

1 DESIGN / How to develop a shoe collection 3
2 Shoe Technology - Production Planning 4
3 Technical Development 5
4 Training management 6
5 Maintenance Management 7
6 Quality Management 9
7 New Materials 11
8 Supply Chain Management 13
9 Social Responsibility Management 14
10 Sustainability Management 15
11 Environmental Management 16
12 STEM in the Footwear Industry – New Technologies 17
13 Health and Safety at Work Management 18

1 DESIGN / How to develop a shoe collection

In order to create a shoe design, guided, among other things, by international Fashion & Style and Fashion institutes forecasts and various Trade fairs (materials, components, accessories) for the coming summer or winter season, trend analyses for the respective product are determined and a concept is created: A reason - a story - an inspiration based on a theme that may be a date, an event, a city..., etc.

Ladies, men, children's shoes, and various types of shoes are to be shown in the collection by drawing a collection plan, which includes the following:

1. a complete number of shoe groups/floor variants
2. various fashion types/styles
3. price groups, factory price and recommended retail prices (entry prices for basic groups and further price ranges); one possibility is to define the target segment of the collection by gender or social class, age and choose the materials and complexity of the collection according to these points
4. timeline for sample collection - production run
5. date for handing over the collections to the sales department
6. dates for collection templates at customers

Shoe lasts, upper materials, outsoles and various accessories are selected, and the designer(s) start to draw the first ideas on paper or on so-called deep-drawn copies. As soon as a shoe group of approx. 5 -10 types/styles has been drawn, a decision is made on the further realization of a physical shoe or, more recently, a 3D printed shoe model.

This new 3D printing process allows a very good reproduction of last shapes, outsoles, accessories, and materials - without the need to produce a physical shoe.

Of course, this means that all these components such as last scans, material textures or decorative parts, have to be incorporated into a 3D program in advance. This also requires a lead time for processing.

AND: “old school skills” are still necessary to work out i.e. make a copy of the last, create a basic pattern and determine all important measurements of foot anatomy.

In the further collection process, it will be also decided which 3D models will be produced as physical samples in order to visit various customers and get first feedback on the collections.

At the same time, the purchasing department order all materials types and colours, and all other components for the sample collection.

Time schedules for sample production and sample flow charts for the individual models are determined for the collections, in a team of the design department and plant management.

Different colour- and material variants are additionally determined for the sales department/customer as an aid to decision-making, and are worked out e.g. as Photoshop/3D renderings or produced as physical shoes and added to the final collection.

At the collection handover date, a framework plan for the production capacities of all shoe/bottom (soles or heels) groups over a period of the next 8-12 months is agreed with the production and sales team, in which the newly developed collections / shoes are produced and delivered to the customers.

2 Shoe Technology - Production Planning

After the collection handover is completed, the technical department /CAD department works out the model according to priorities.

The priorities are generally based on the availability of various materials and components.

For a smooth production flow and production transition, so-called basic groups with existing models, lasts, soles etc. in e.g. new material combinations are added to the collection or sold, thus ensuring a smooth production transition - until the NEW lasts, outsoles, heels etc. are available.

These basic groups are accordingly also delivered with the earliest delivery dates.

For the NEW shoe lasts, and components, so-called group sizes are graded, i.e. pre fitting samples are produced for the later series production and “bottom” groups. (new soles, heels etc.)

The bottom components such as insoles, outsoles, heels and other parts, such as toe caps, heel reinforcements, are also graded - more or less simultaneously - in group sizes (small, medium, large) and manufactured in other supplier companies.

Once the group sizes/fitting samples have passed through production without any complaints and all departmental foremen agree to series production, all necessary measures and approvals are issued.

The production planning starts with the planning of the basic groups which can be produced with existing lasts and/or basics materials and sufficient materials for the production are available. These basic groups usually fill a large part of the total collection and production.

In the meantime, all other materials, components and accessories such as sewing threads, eyelets, shoeboxes, various small parts and materials arrive at the warehouse are scheduled and prepared for the respective production plans.

Considerable effort is required even if production is carried out in several plants in Europe or worldwide. For this purpose, the production groups must first be divided into production sites.

All materials and components must be assigned separately to the respective production sites. Either the materials are separated or split up again in the main plant immediately after receipt of goods. Or the materials are already delivered by the suppliers directly to the production sites.

The organizational, and logistical effort is considerably high!

3 Technical Development

Shoe technicians work with all styles or models in the sample collections right from the start. Once the sales figures are more or less fixed, the technical department works in two lines to prepare the shoe production:

- First line is pattern making and grading of the „shoe uppers“, including reinforces for different parts, toecaps and heel counters as well.
- Second line is the development and grading of insoles, soles, heels – called: „bottom components“

The bottom components usually have to be developed and graded, at an earlier stage, as moulds and different tools have to be produced in advance. CAD-Systems and new 3D-printing processes also support these technical developments.

Those component suppliers have to produce these bottom components in advance that the articles can be pre-ordered from the Purchasing department and kept in stock to be sent “right in time” to each department in the shoe production.

The development and grading of shoe uppers are worked out with CAD programs and this is usually much faster done - because the results of the sample collections are included - than the all the bottom parts.

CAD-data are transferred to the cutting table and all upper parts were cut in a fast and efficient way.

After the so-called group sizes (small, medium, large) have passed all production departments "faultlessly", the production lines are “fed” with orders successively and according to priorities.

Never forget the shoe lasts! According to the sales of each style- or last group the sizes are mostly ordered in a separate last factory. The design and fit have matured over the sample collections, the design and fit has matured through the sample collections, so the data can be transferred relatively quickly to series production. The gradations of lasts, soles and patterns must match the respective size systems- UK-size or French-size, etc.

A shoe technician follows the processes in the shoe production closely and is the contact person for foremen and plant managers.

4 Training management

The fields of action or Spheres of activity-(SOA) in shoe production are basically the same for all product groups.

One Shoe Company is specialized for example, in outdoor shoes, which then work with different leathers, cow hides are thicker and in a heavy quality, than children's shoes or exclusive lady shoes produced in fine goatskin.

Experienced and long-standing employees of a company are best able to pass on valuable processes. They know exactly how to process different materials or machine settings to produce good quality. Long-standing employees and workers are the most valuable asset of a company. No good product can be achieved without good expertise

Most of these employees are also already in management positions such as foreman/woman, head of design, plant manager or team leader.

Usually, in each department, a foreman/woman is responsible for introducing new employees to the specific working methods and characteristics of the company product, often he is supported by highly qualified staff, called trainers or tutors.

New trainees are taught or trained in all areas/departments of a shoe production: Cutting, Pre-stitching, Stitching, Pre-lasting, Lasting, Assembling, Finishing, Design, Technical Development, Production Planning, Quality Assurance, Warehouse and Shipping.

Technical skills in the field of footwear are not sufficient because lack of soft skills can limit the employees' potential. Soft skills are personal attributes that complement how well a person can work or interact with others. Soft skills can influence the success of a company.

Main categories of Soft Skills:

- **Communication** (Listening, Persuasion, Verbal communication, Writing reports/proposals)
- **Critical Thinking** (Adaptability, Creativity, Flexibility, Logical thinking, Problem solving, Research, Thinking outside the box)
- **Leadership** (Conflict management, Conflict resolution, Decision making, Delegation, Facilitation, Inspiring people, Managing difficult conversations, Mentoring, Motivating, Resolving issues, Supervising, Talent management)
- **Teamwork** (Accepting feedback, Collaboration, Dealing with difficult situations, Disability awareness, Emotional intelligence, Empathy, Dealing with difficult personalities, Interpersonal skills, Self-awareness)
- **Work Ethic** (Attentiveness, Business ethics, Competitiveness, Dedication, Dependability, Following direction, Independence, Meeting deadlines, Motivation, Multitasking, Organization, Perseverance, Planning, Punctuality, Results-oriented, Scheduling, Self-monitoring, Time management)

Tasks to reduce soft skills gap:

- Survey workforce to identify the current climate and the required soft skills;
- Change company culture by making soft skills a priority;
- Organize training to improve employees' satisfaction, performance and reliability.

5 Maintenance Management

The Maintenance Management of assets, installations and equipment, is an essential component in the management and operational activity of the footwear company.

Currently, it is essential to create a structural system that allows: ensuring the company's operational activity, ensuring the effective maintenance of facilities and equipment, enhancing efficiency, productivity and quality gains, diagnosing risks and preventing problems, assessing costs and contributing to a circular economy.

The main advantages of Maintenance Management are:

- Efficiency: Using maintenance management software is essential to ensure an organized management and efficiency in processes, to be able of correcting errors / deviations and preventing production stoppage.
- Cost control: Maintenance management costs are defined during the company's strategic planning, but the maintenance manager permanently decides which investments to make and which aspects to improve.
- Planning: It is essential to know the equipment and costs related to preventive maintenance, avoiding unnecessary costs and ensuring an efficient execution of tasks. Planning in time: the intervention, necessary human and technical resources and procedures.
- Quality: Ensuring the quality of the infrastructures and the functioning of the equipment, considering the legislation and regulations.

Maintenance Management tasks:

- Select and organize the maintenance model in accordance with the company's general management;
- Define a General Maintenance Plan and guidelines for intervention;
- Define / select management resources: software, legislation, regulations, documentation, ...;
- Define a costing system to determine the maintenance cost of each equipment;
- Organize preventive maintenance plans;
- Define indicators, intervention and evaluation criteria;
- Define essential documents in the process, such as Service Orders, various records;
- Guarantee the execution of maintenance works;
- Organize a Technical Library;
- Organize and define the general lines of a Maintenance Warehouse.
- Ensure safety at work;
- Ensure the follow-up and monitoring of the execution of tasks;
- Ensure the continuous training of human resources in this area;
- Control the quality of maintenance - Maintenance Performance Indicators
- Organize and archive the department's documentation: technical documentation, guarantees, materials, ...

The maintenance manager considers and selects the maintenance system and processes, with a view on an integrated maintenance in the general management of the company, shared, globalizing and attributing responsibility to all employees. It is intended to develop a management philosophy focused on total quality management - TPM / Total Productive Maintenance. The maintenance of quality depends on several variables such as the best technologies, innovation and methodologies, considered that they can contribute to generate greater value in each task.

6 Quality Management

Quality Management is often confused with Quality Assurance, however is much broader and encompasses all business processes that in all its activities contribute to customer satisfaction. Quality Assurance of footwear relates mainly to three aspects: visual appearance, fit and functional characteristics (e.g. durability, performance, absence of harmful substances). Sensibly, these controls should not only be performed on the finished footwear, but at all manufacturing stages.

The Quality Management System (QMS) can be defined as the set of methods (operational and management) implemented in a systematic way, which allow comply with the policy and objectives of the quality. The QMS focuses on obtaining customer satisfaction and improving internal processes, aiming at greater effectiveness and efficiency.

The development and implementation of a QMS should be focused on organization culture and its needs. To this end, the following steps should be considered:

- Determination of the needs of the customers and other interested parties;
- Establishment of policy and objectives of the organization;
- Definition of the necessary processes to comply with policy and objectives of the organization;
- Establishment of operational control methods for processes, including those means of preventing non-conformities. The greater the degree of risk associated to non-conformities, larger ones should be the associated means of prevention.
- Establishment of methods for measuring the efficiency and effectiveness of each process.
- Continuous improvement of the QMS.

The Quality Management System is structured in terms of compliance with ISO 9001: 2015 requirements and customer requirements of the company's processes (Strategic, Business, Design and Development, Planning, Purchasing, Production, Maintenance, Human Resources and Administrative, Quality).

Quality Management main tasks:

- Ensure that each responsible of the different processes, complies with the updated, whenever necessary, established procedures and in particular the monitoring of the performance of their process
- Follow closely the quality controllers of the productive sections
- Statistically treat data collected at quality control stations
- Ensure the company's response to customer complaints by directing corrective action
- Provide regular meetings with management and process managers to follow the established objectives, analysis of deviations and definition of measures to implement
- Prepare and monitor external audits and client audits.

As support for these activities, it is very important to integrate all the information in the company's information management system, allowing its sharing, processing and analysis in a timely manner and as a basis for decision making.

The implementation of management systems often implies a change in working methods and attitudes, including greater rigor and systematization in compliance with established rules. Such

usually generates some resistance by employees. To break this resistance, and ensure active collaboration by all, it is necessary to convey that this is an option strategy of top management and that this will bring benefits to the entire company, namely an increase in competitiveness. Even if one or more persons responsible for the implementation of the management systems are defined, monitoring by the Top Management is essential, which should assume a leading role, encouraging the implementation and improvement of the system.

7 New Materials

The trends on digitalisation and sustainable technologies requires a new approach for producing/selecting materials for footwear industry. The 3D printed soles, for example, ask for materials and soling technologies that are different comparing to the traditional ones. The environmental impact of the footwear manufacturing could be substantially reduced by selecting sustainable materials and processes and assessing the potential re-use of products and materials to valorise the wastes resulting from the manufacturing process.

The company must promote the development of new skills related to the selection of materials for the production of footwear.

Furthermore, it´s important to know about environmentally-friendly materials that may replace other materials that have an impact on the environment, environmentally-friendly packaging techniques and materials, as well as distribution and commercialisation techniques that minimise environmental impacts.

Therefore, in the selection process of materials, there are several aspects that must be within the domain of the company's knowledge, highlighting:

Use of environmentally-friendly materials

- Extensive knowledge of the types of materials used in footwear;
- Knowledge of suppliers of raw materials with ecological characteristics:
    - water based adhesives
    - metal free leathers
    - biodegradable materials
- To be able to decide on the substitution of certain materials by eco-friendly ones, maintaining the same level of functionality and other characteristics of the model.
- Supplier selection.

To make decisions at the design stage in order to define the eco-efficient production characteristics

- To manage environmental information relating to the footwear sector, including raw materials;
- To know how to use raw materials with eco-friendly characteristics;
- To be able to optimise consumptions and production time – suggest changes to the models in order to achieve a better material and production time optimisation;
- To minimise the variety of materials in one single product.

Eco-processes and technologies

- To minimise the variety and quantity of materials;
- To minimise the number of components;
- To promote the use of local materials and prevent their transportation;
- To use materials that do not require additional treatments (eg. surface treatments for soles);

- To have knowledge of legislation applicable to materials and products, national and European legislation;
- To have knowledge about restricted substances and their restriction limits;
- To know raw material suppliers that certify compliance with the legislation about hazardous substances.

Knowledge on new materials will be framed in several departments that contribute to the selection of materials, from design and development, to commercial, purchasing and quality.

8 Supply Chain Management

The main activities of Supply Chain Management are related to acquisition of materials and components to supply the various production sections, through production orders, weekly planning and stock consultation and to selection and evaluation of suppliers.

The necessary information comes from other internal departments such as Development and Technical sheets and Planning of the production.

The supply chain management is a very dynamic activity in terms of orders received, delivery times, requests of materials, performance of suppliers.

These actions have to be continuously monitored given the various variables involved that change rapidly and imply adjustments to the information internally made available, namely to planning.

Supply chanin Management main tasks:

- According to production planning (delivery dates and expected dates of production start-up), analyze the material requirements for the production orders and after checking the materials in stock, define the purchase orders and their deadlines to selected suppliers, including suppliers of subcontracted operations
- Provide permanent follow-up of the planned deliveries of each supplier in order to ensure timely availability of materials
- Communicate to the planning responsible the expected delays that may interfere with the planning for the production
- Distribute, guide and control the execution of the work of the sector's employees, ensuring the supply of all productive sections and compliance with quality, environment, safety and health standards, taking into account production planning and proposing alternative measures in function of the detected deviations
- Supervise the receipt and control of materials, intervening where necessary, and coordinating the communication with those responsible for production, and in particular that of the Cutting, for validation of materials, especially leather, by conducting production tests.
- Ensure the identification of the materials, their arrangement according to the predefined criteria and the recording of all movements, carrying out periodic inventories for stock control
- Collaborate in the company's response to customer complaints related to material compliance and in taking corrective actions
- Collaborate in the preparation and follow-up of external audits and client audits.

As support for these activities, it is very important to integrate all the information in the company's information management system, allowing its sharing, faster processing and analysis in a timely manner and as a basis for decision making.

Efficient supply chain management maximizes competitiveness and customer appreciation. The goal is to control the product throughout the process from the source of the raw material to the final consumer. In this register, information flows and physical flows generated by the supply chain must be well managed. Information flows make it possible to coordinate the entire supply chain. Physical flows represent the visible part of the supply chain.

9 Social Responsibility Management

Social Responsibility Management refers on how to lead through communication, motivation, team working, delegation the tasks, conflict and problem solving. Additionally, it refers to the Corporate Social Responsibility (CSR) concepts, key actions, advantages and disadvantages. A footwear company should act for social responsibility on various levels: community, environment, market, relation with employees, suppliers and clients in three main areas: developing critical success actions, best practices for social responsibility/ethics and implementing a CSR plan.

The commitment for applying CSR practices drives footwear companies towards sustainability, competitiveness, and innovation. Also, modern consumers are more aware regarding products and services they use and seek organizations that have adopted CSR practices.

Corporate Social Responsibility generates internal benefits, at organizational level (Organizational commitment of employees, Learning, Operational effectiveness, Cost savings, Innovation, Improved quality, Increased productivity), but also external benefits (Reputation and publicity, Improved stakeholder relationships, Capital access, Market access, Risk reduction, Customer satisfaction and price premium and, Synergetic value creation).

The development and implementation of an CSR plan aims to align the company to the dynamic requirements of the economic and social environment by identifying and managing the expectations of stakeholders.

Social Responsibility Management focuses on the following categories:

- Environment (legislation, resources, energy efficiency, waste management, recycling and reusing);
- Community/philanthropic (charities, sponsorships, local economic growth, educational programs, health initiatives);
- Human rights (fair labour practices, employees' rights and interests, work conditions)
- Economic (ethical and moral regulations standards).

Social Responsibility (SR) Management tasks:

- Raise SR awareness inside the organization;
- Assess corporate purpose in its societal context;
- Establish a vision and a working definition of SR;
- Asses current SR status;
- Develop a SR integrated strategic plan;
- Implement SR integrated strategic plan;
- Communicate about SR commitments and performance;
- Evaluate SR integrated strategies and communication.

10 Sustainability Management

For the Footwear Industry, Sustainability brings significant opportunities and advantages through processes (design, development, manufacturing, distribution, and selling) that minimize negative environmental impacts, conserve energy and natural resources, are safe for employees, communities and consumers, and are economically.

Sustainability is a broad subject but it mainly focuses on environment, quality and social.

A sustainability management system (SMS) represents a systematic approach that provides guidelines for an organization to evaluate, manage, and improve sustainability and handles sustainability components as a package.

Relevant elements of a Sustainability Management System:

- Policies and rules (policy, code of conduct);
- Organisational structure (Managements Responsibilities, Sustainability officer);
- Processes (Integration in business processes, Systems to ensure compliance);
- Continuous improvement (Goals and measures (progress tracking), Monitoring / performance evaluation with sustainability indicators, Training);
- Communication (Sustainability reporting, Leadership, Internal communication, Stakeholders);
- Preparatory tasks (Determining relevant aspect and the scope of the management system).

Sustainability Management tasks:

- Plan (sustainability aspects, legal requirements, strategic objectives, customer needs etc.);
- Implement and Operate (structure and responsibility, training, awareness and competence, documentation, control etc.);
- Review and take corrective actions (monitoring and measurement, non-conformance and corrective actions, records, audits).

11 Environmental Management

Environmental Management relates to the use of ISO 14001 (International Standard for Environmental Management) and EMAS (Eco-Management and Audit Scheme).

ISO 14001 management system is a voluntary instrument aimed at companies or organisations who want to achieve a high level of environmental protection in their activities and provides assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved.

ISO 14001 benefits:

- Measure environment impact;
- Improve resource efficiency;
- Meet legal obligations;
- Manage environmental obligations

ISO 14001 advantages:

- Gain competitive advantage;
- Increase new business opportunities;
- Drive down costs;
- Increase stakeholder and customer trust;
- Improve overall environmental impact

Adopting ISO 14001 Management System has the following advantages: enhancement of environmental performance, fulfilment of compliance obligations and achievement of environmental objectives.

EMAS is a voluntary environmental management tool that can be used by companies to evaluate, report, and improve their environmental performance. EMAS Regulation integrates ISO 14001 management system and by taking into account additional elements, supports organisations to upgrade their environmental management system and to improve their environmental performance continuously.

EMAS benefits:

- credibility, transparency and reputation
- environmental risks and opportunities management
- environmental and financial performance
- employee empowerment and motivation

Tasks for implementing EMAS:

- Determine the organisational context of the existing Environmental Management System (EMS)
- Identify interested parties and their relevant needs and expectations,
- Consider a life-cycle perspective when assessing the significance of the organisation environmental aspects
- Determine the risks and opportunities related to the organisation EMS.

12 STEM in the Footwear Industry – New Technologies

Science, Technology, Engineering and Mathematics (STEM) is linked to footwear industry to demonstrate how the scientific methods can be applied to product design and manufacturing process by focusing on computational thinking and problem solving.

For the Footwear Industry, STEM relates to Industry 4.0 (Internet of things, Artificial Intelligence), Emerging technologies (Smart sensors, Nanotechnology, Knitting) and Digitalisation (Augmented and Virtual Reality, Additive Manufacturing).

STEM requires continuously acquisition of knowledge and skills on the following areas:

- Product design
    - nanomaterial
    - virtual prototyping
    - 3D printing
    - computational testing
    - smart sensors
    - customization
- Manufacturing
    - monitor and control (identify risks and take measures to increase workers well-being)
    - automate (Production flow, Inventory, Safety and Security, Quality Control, Packaging optimization, Logistics and Supply Chain)

13 Health and Safety at Work Management

Health and safety at work (HSW) is defined by regulations and procedures intended to prevent accident or injury in workplaces.

Companies have to assure to their workers a high level of protection of their health and safety at work, as well as the right to a working environment adapted to their professional needs and which enables them to prolong their participation in the labour market.

A Health and Safety Management System enable organizations to provide safe and healthy workplaces, prevent work-related injury and ill health, and continually improve its performance.

Health and Safety at Work Management focuses on the following main areas:

- risk prevention;
- technical prevention;
- training and education;
- preventive health care;
- personal and protective equipment;
- control activities.

Health and Safety at Work Management tasks:

- assure compliance with laws and regulations;
- prevent workplace injuries and illnesses;
- reduce the incidence of occupational diseases and accidents at work;
- minimize costs;
- improve business efficiency;
- adapt to changes in laws and regulations, safety requirements and changes within the organization (e.g. new technologies, organizational changes, etc.).

Risk Assessment is one of the components of an HSW management system, has the aim to improve working conditions for employees and create conditions for safer operation.

HSW Management Systems tasks:

- Comply with regulations;
- Identify and control risks:
    - Collect relevant information;
    - Identify possible hazards;
    - Assess risks arising from the hazards;
    - Plan actions to eliminate or reduce risks;
    - Document the risk assessment.
- Train Employees.