Integrating Companies in a Sustainable Apprenticeship System

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Intellectual Output 6A

The German Qualification Framework (Deutscher Qualifikationsrahmen, DQR) and initial qualifications from footwear sector

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Contents

1. Introduction

Aim of IO 6 of ICSAS project is to develop, validate and publish a Sector Qualification Framework (SQF, levels 2-4) for initial qualifications of industrial shoe production and to integrate all qualifications on these levels of our sector from Portugal (PT), Spain (ES), Romania (RO) and Germany (DE) into this SQF.

Our first step was to explore an overview of what happened in the development of National Qualification Frameworks (NQF) in these four countries, how these NQFs are linked to the European QF (EQF) and what qualifications of our sector are of relevance for this aim. Thus four separate national reports were produced; here you can read the one for Germany. A separate product will be a comparative report; the latter will be available not only in English, but also in our four languages.

The national reports are subdivided into four chapters; the first one of this report describes briefly the history and the implementation of a qualification framework (QF) in Germany ("Deutscher Qualifikationsrahmen", DQR) and its linkage to EQF.

All non-sector related Qualification Frameworks refer to broad and open descriptors like "A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study" (EQF, level 4, skills, EU 2008, updated EU 2017). A SQF offers the option to specify this broad "field of work"; our joint transnational decision on this were the nine relevant spheres of activity within the sector of industrial shoe production, already mentioned in IO1 reports. These spheres of activity are described in more detail in chapter 2.

Third chapter sketches briefly the relevant qualifications from industrial shoe production in Germany on Initial Vocational and Training (IVET) levels (<=4). Additionally, it specifies the "range of cognitive and practical skills" (or comparable descriptors for other levels) with respect to German curricula.

Fourth chapter consists of a transparent structure/visualisation of the German qualifications, only – to facilitate the transnational comparison and to offer a comprehensive visualisation of our Sector Qualification Framework, levels 2-4, for industrial shoe production.

2. Main issues of the „German Qualification Framework“ (Deutscher Qualifikationsrahmen, DQR)

Differing from Anglo-Saxon countries, Germany has no tradition with qualification frameworks. Discussions on this started in the late 2000 years; initiated by the development of the European Qualification Framework (EQF) that was published in 2008 (EU 2008).

Amongst German stakeholders, no one saw any need of a qualification framework; but politicians decided that there should be one for our country, too. Thus, there was not much enthusiasm during the development; even the responsible authority stated: “The DQR has undergone a somewhat lengthy process of development. In October 2006, the Federal Ministry of Education and Research (BMBF) and the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK) agreed to work together on the development of a German Qualifications Framework for Lifelong Learning (known by its German abbreviation of DQR).” (AK DQR 2011, p.2)

First step was to develop and approve the DQR, this process took place from 2006-2009. (AK DQR 2011, p.2-4). Delegates from all relevant institutions (national and federal ministries, social partners, chambers, universities, General Education (GE), Vocational Education and Training (VET), Higher Education (HE), Adult Education (AE), and others) spent a lot of time (and resources) to develop the following structure: Differing from EQR, that divides between 3 abilities:

EQF	*Knowledge*	*Skills*	*Competences*

German stakeholders decided to focus on 2 abilities, each one sub-divided into 2 concrete descriptors:

DQR	Professional competence		Personal competence	
	Knowledge	*Skills*	*Social competence*	*Autonomy*

Table 1: Differences in descriptors between EQF and DQR

Additionally, it was agreed that DQR has -like EQF- 8 levels – but without referencing (at this time) levels from DQR to EQF.

Second step was the referencing of all qualifications of four pilot sectors (metal/electro, health, information technologies (IT), and trade) until 2012 to DQR. (cp. Sperle 2012, p. 8.) Again a lengthy procedure; outcomes of the working groups were quite diverse. At the end of this period, a political decision took place, again: All VET qualifications that last 2 years are on level 3; all VET qualifications that last 3 or 3.5 years are on level 4. Main challenging discussion item during this period was the question of the level of “Abitur” (university entrance certificate) – should it be below/on the same level/or above 3 year VET qualifications? And: Does it really make sense to include “Abitur” in a qualification framework, as it has no relevance for labour market as it offers “only” access to additional educational tracks? This

discussion was really high tide in these years, the decision was abandoned and 5 years later, in 2017, "Abitur" was levelled on level 4 – and almost nobody noticed.

Third step, formal referencing of DQR to EQF took place in 12.2012; a qualification on level X of DQR is on the same level X of EQF (cp. DQR 2013, p.11); as both QF have 8 levels was this referencing not very surprisingly, as it was implicitly clear from 2009 on.

ICSAS project refers to Initial Vocational Education and Training (IVET); these qualifications were referenced in Germany to level 3 (all qualifications lasting 2 years) respective level 4 (all qualifications lasting 3 or 3.5 years). In a narrow sense, in the German context the word "qualification" refers to ***labour*** market; qualifications offer access to qualified work and/or increase opportunities on labour market. Other certificates or measures that offer access to educational tracks or increase chances to get an apprenticeship were originally not foreseen in the DQR -but in 2014 the "entry training" was included (DQR 2014, cp. chapter 3).

Table 2 illustrates the internal structure of DQR by presenting the descriptions of level 4:

Level 4 describes competences required for the autonomous planning and processing of technical tasks assigned within a comprehensive field of study or field of occupational activity which is subject to change.			
Professional competence		Personal competence	
Knowledge	*Skills*	*Social competence*	*Autonomy*
Be in possession of in-depth general knowledge or professional theoretical knowledge within a field of study or one field of occupational activity.	Be in possession of a broad range of cognitive and practical skills which enable tasks to be processed and problems to be solved autonomously, and which enable the assessment of work outcomes and processes taking into account alternative actions and interactions with related areas. Perform learning transfers.	Contribute to the organisation of work in a group and the group's learning or working environment - and provide ongoing support. Justify processes and outcomes. Communicate facts in a comprehensive manner.	Set own learning and working objectives, reflect on and achieve these objects, and take responsibility for them.

Table 2: Descriptions of DQR level 4, source: DQF 2019

As sketched above, most activities related to DQR were approximately 10 years ago; both the fears (like an imbalance between academic and vocational qualifications) and the hopes (that a Qualification Framework might lead to equal pay between different sectors) were baseless until now; and there is no evidence that this will change soon.

But, to put this differently: A general framework seems to be useless in the German context – could a Sector Qualification Framework (SQF) be of added value?

A meaningful SQF requires a concretisation of what is meant by “a field of work or study” (EQF, level 4, skills, EU 2008). Specifying our field is simple (industrial shoe production); but what are the elements within?

We decided to specify our “field” by the spheres of activity of industrial shoemakers, a comprehensive description of both, the core spheres (main working areas) as well as the peripheral spheres (IVET qualified have only an insight) are described in the next chapter.

3. Spheres of Activity in industrial shoe production

Brief Outlines of the Spheres of Activities of Industrial Shoemakers

Depending on design and make, a shoe consists of several dozen components and its manufacture requires up to 150 work steps. In that sense, shoe production is a relatively complex process, which is mainly characterized by various joining methods. Experienced skilled workers are needed in all departments of a shoe factory, especially at key operations such as cutting, stitching and lasting.

3.1. Cutting and Clicking of Materials for Upper Manufacturing ("Cutting")

The task of the cutting department staff is to cut the shoe parts from upper, lining, interlining and reinforcement materials (leather, synthetic leather, natural or synthetic textiles) in the required geometries.

The following cutting techniques are used:

- Hand cutting with knife and pattern stencils: Mainly used for sample and small series production.
- Clicking machines and cutting dies (swing arm cutting presses for cutting upper and lining leather, travelling head and beam cutting presses for natural and synthetic textile materials): typically used for serial production.
- Dieless cutting on automated CAM cutting tables (oscillating blade / punching / roughing tool, water jet or laser): mainly used for prototyping and small series production, but also for serial production. The cutting geometries are provided by the CAD system.

Material, colour, number of pairs and special requirements can be found in the accompanying specifications that come with each work batch.

Prior to cutting, the leather hides and skins must be checked in terms of differences in thickness and colour, quality zones and eventual defects. Crucial in leather cutting – whether manual, machine cutting or computer-aided – is the compliance with the cutting rules (quality rule, pairing rule, stretch direction) because they influence the quality of the final product. Skill and experience in creating a cutting layout on a hide or skin are also imperative to minimise waste, because the upper leather represents by far the largest single cost item in shoe production.

Further operations in the cutting room are splitting of the cut parts (to reduce them to the required even thickness) and stamping of the parts (article number etc.). The quality control of the cuts is carried out directly in the department.

3.2. Preparation of Upper Parts and Upper Stitching ("Pre-Stitching and Stitching")

Upper manufacturing is time- and labour-intensive and can only be automated to a limited extent, at least in leather street shoe production. Upper manufacturing (the term used for sewing operations in the footwear industry is "stitching") represents the biggest item in terms of value creation in footwear production. Experienced stitching operators are particularly sought-after.

In upper manufacturing, a distinction is made between preparatory work ("pre-stitching") and the actual upper assembly ("stitching").

The stitching work to be done on a shoe depends on the model. Essentially, upper manufacturing consists of assembling all lining parts, assembling all outer upper parts, and then stitching together lining and outer upper with some subsequent final operations.

The necessary pre-stitching operations depend on the type of shoe, the specific model and the material. Typical pre-stitching operations are:

- Skiving (bevelling respectively thickness reduction of the edges of shoe parts)
- Splitting (to achieve homogenous thickness)
- Marking (e.g. to provide guidance for stitching or punching)
- Edge inking (open edges of non through-dyed leathers)
- Cementing (applying adhesive to parts and joining them together)
- Folding (to fold down previously skived edges with adhesive)
- Perforating, punching, embossing
- Reinforcing (with adhesive or ironing-on)
- Crimping (pre-moulding for better shape, e.g. for boot legs)

Pre-stitching operations are done partly manual, partly on machines. They can be decisive for the quality of the final product.

Upper assembly is done on stitching machines. There are various types: Flat-bed, post-bed or cylinder-arm machines, as well as single-needle, two- and three-needle machines to perform the numerous stitch types for closing and decorative seams.

3.3. Preparation of Uppers and Bottom Parts for Lasting and Lasting ("Lasting")

"Lasting" means attaching the lasting margin (i.e. the lower edge of an upper) by means of tacks and/or adhesives to the insole, which can be considered as the constructive backbone of footwear, although it is not at all visible on the final product. Lasting is one of the crucial operations in footwear production. Depending on the construction method, the lasting proceedings can differ.

Prior to lasting, toe puffs and heel counters must be inserted into the finished uppers in between upper and lining material in order to reinforce toe and heel. Toe puffs are usually ironed in. Leather fibre-board heel counters are dipped into latex adhesive, dried and then inserted by hand; another type of heel counters are thermoplastic heel counters. Some shoe types require crimping of the vamp, and most shoe types require back part moulding (hot and cold, depending on the type of heel counter). In parallel, lasts and insoles are prepared. The insoles are stapled to the last.

Thicker upper leathers should be treated with tempered water vapour or softener in order to prevent the grain from cracking (during the toe lasting process, the material must endure an elongation of up to 30%). Next to the toe lasting machine, a toe activating device is positioned, which heat-activates the toe puff (some devices work with tempered water vapour to soften the leather and toe puff, and with a mould shaped like the front part of the last to increase mouldability and to pre-mould the toe area).

Lasting starts with pulling the upper in the correct position over the last. Most companies use the two-machine-lasting system, i.e. toe lasting is performed on the first machine and then side-and heel lasting on the second machine. The machine pincers pull the upper material close to the last and the lasting edge is attached under the insole.

During the lasting process, the upper is exposed to high tensile forces in order to shape it to the last.

Some factories use a pounding machine or just manual hammering to improve the lasting result (i.e. flatten the lasting edge and get rid of eventual creases).

The subsequent steps are throughput of the lasted uppers through heat- and cool-setting tunnel transport systems which improve the shape retention of the materials as well as the fit of the final product.

3.4. Assembly of Uppers and Bottom Parts ("Assembly")

In the assembly room, upper and bottom parts are joined. By the time the batch of lasted uppers enters the assembly room, the bottom parts in the correct sizes and numbers have been prepared and put on the rack shelves together with the uppers.

First, the staples fixing the insole to the last bottom need to be removed. The next step is roughing the lasting edge as a surface preparation for the adhesive bond. The objective of roughing is to smoothen potential creases, to remove the grain layer of the leather because it contains oils or other greases or surface treatments which will weaken the bonding strength, and to increase the bonding surface. Roughing can be performed on machines (roughing machines or combined roughing/cementing machines); however, manual roughing remains widespread. It is imperative to precisely respect the roughing contours and to remove just the grain layer in order to preserve the structural strength of the material. Roughing dust must be thoroughly blown off.

Then a filler is inserted into the cavity on the last bottom in order to compensate for the height difference between last bottom and lasting edge.

The next step is cementing, i.e. to apply adhesive onto the roughened shoe bottom (with a cementing or a combined roughing/cementing machine) as well as onto the sole. Although robotised adhesive application solutions for sole cementing exist, manual application with a brush is still common. Depending on the type of soling material, the appropriate adhesive needs to be chosen. Each adhesive type requires a specific surface treatment; the objective of pre-treatments is to clean the bonding surface and to create ideal conditions for the adhesive to adhere to the material.

After the mandatory drying times, the soles can be pressed. Therefore, the adhesive (sole and upper) is re-activated, the soles are positioned manually onto the last bottoms and the whole is then inserted into a sole press (hydraulic or pneumatic depending on their application suitability).

Alternatively, soles can be sewn-on, vulcanised or direct-injected depending on the construction method.

The subsequent operations are delasting and attaching the heel – if the shoe model provides for a heel. The soles of stitch-down or welt-sewn footwear require finishing operations such as scouring and/or polishing of the edges.

3.5. Finishing

In the finishing room, the shoes are prepared for sale and boxed.

Finishing operations include various work steps.

Depending on the type of upper material (leather finish and colours) the shoes must be cleaned and – if necessary – repaired. For this purpose, a wide range of tools and auxiliaries are available, which must be selected very carefully, especially for sensitive upper materials such as aniline leather or suede. Wrinkles are ironed out or smoothed-out with a blow-drier.

Spray-finishes, waxes and creams are applied, insocks or seat sock pieces are inserted, and decorative elements fixed.

A task of particular importance is the final quality control prior to shipment (please see also sphere 6; “Quality Assurance”.).

Finally, the shoes are boxed in individual boxes and 10 or 12 or more pair boxes put in shipping cartons (preparation for shipping is often done in the dispatch warehouse).

3.6. Quality Assurance

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. All operators should systematically self-check their work, and all work batches should undergo a quality check before leaving each production department to avoid problems in subsequent processes. A visual quality control before boxing the shoes is standard.

When a customer performs pre-shipment inspections of shoes that were produced by a supplier, the visual control is carried out according to a sampling plan which defines how many shoes must be inspected and in order to be able to decide whether a production batch can be accepted or not.

Fit and wear testing is done by a panel of reliable and product sensible testers who will fill in a test questionnaire. This is commonly organised by the product development team. Bigger companies have dedicated fit and wear testing departments.

The control of technical aspects consists in subjecting the shoes to a series of physical and mechanical tests to ensure their quality and safety. The absence of harmful substances is checked through chemical testing. There are legal standards for the performance of footwear testing, defining the requirements in terms of sampling, conditioning of the samples and test execution in order to facilitate comparison of the results. If the test results are intended to be communicated to customers or other stakeholders, it is recommended to commission an independent laboratory to perform the testing. For certain types of shoes, such as safety shoes, this is even mandatory.

Definition of INSPECTION (according to ISO 2859-1): “Activity such as measuring, examining, testing or gauging one or more characteristics of a product or service, and comparing the results with specified requirements in order to establish whether conformity is achieved for each characteristic.”

3.7. Footwear Design

Shoe designers do not only design individual models, but also concepts for entire collections. The main focus is always to meet the tastes and needs of future buyers, both in terms of fashion as well as of quality and fit.

Designers must be creative, able to draw, have a sense of emerging trends and an eye for harmonious lines and colors. The success of the entire company depends on the success of the models with the customers and thus the success and the employment situation for the entire company.

A shoe designer should be familiar with the shoe making process in order to design models in such a way that the effort in production remains proportionate to the achievable selling price and that the manufacturing can be done with the existing equipment and skills.

Many designers still draw on paper or on deep-drawn copies of the last surface. Younger designers are increasingly moving from initial manual design sketches to design on 3D CAD systems. 3D CAD systems save time and money by permitting to evaluate designs already at an early stage on the screen (which can be shared with co-workers no matter where on the globe) instead of going through the traditional time-consuming prototyping process. In addition, 3D CAD systems generate geometry data for computer-aided machines (CAM and CIM machines).

3.8. Technical Development

When the designer has completed his work, the results are sketches on paper or on deep-drawn last copies, at least in most small and medium-sized enterprises of footwear industry. Only few designers of SMEs in the field of leather street shoes work with digital tools. In the universe of sports shoes, things are often different, especially since global agreements and speed play an even greater role here and CAD systems are very helpful for gaining valuable time.

No matter whether the designer produces sketches on paper or on deep-drawn last copies, the result is an upper design in the first place. Typically, the designer specifies the upper materials to use. In addition, the designer also creates the shoe bottoms, i.e. outsoles and heels, to match the respective lasts (usually also on paper). Bottom parts can also be selected from respective suppliers.

Designers therefore often purely focus on the creative part. Once a design idea exists, this is when the technical developers come into play. They take care of the digitization and the technical development of the designs.

Their work focusses on the following questions: How can the idea sketch of a shoe be broken down into producible individual parts with the correct dimensions and the necessary additions and reductions for production? How do you get from a 3D design on a deep-drawn last copy to stencils or punching knives for upper parts, which are to be cut from 2D materials and then reassembled into 3D objects? Which types of seams, of lining and reinforcement materials and, more generally, which operations in production are necessary to convert the idea into a product that the company can actually manufacture with the existing machinery and the know-how of the production staff?

3.9. Production Planning

Footwear production planning is about distributing and coordinating all activities related to footwear manufacturing.

Production planning activities include the following functions:

- Product data management: Classification of products in terms of size, style, variants, design, target market, materials, components, technical specifications etc.
- Order management: Inventory, manufacturing and delivery planning according to deadlines and available resources
- Manufacturing planning and monitoring: Planning and coordinating all the manufacturing phases and tracking work in progress and consumption
- Materials and components planning and inventory management: Ordering materials and components according to work orders and managing bills and keeping inventory
- Delivery and finished products stock management: Plan, organise and monitor logistics and supply chain activities
- Workforce management: Organising workforce accordingly to availability and keeping daily records of work hours and productivity
- Financial Management: Accountancy system that provides accurate and on time information regarding cash flows, fund flows, recurring expenses, costing and efficiency of manufacturing systems, budgeting and fund allocations

Depending on the company (size, organisation of departments, distribution of activities etc.) part of the activities related to production planning can be included in other departments.

For increased efficiency, companies use software systems for production planning. The main software categories are ERP (Enterprise Resource Planning), PDM (Product Data Management) and PLM (Product Lifecycle Management) systems.

4. German qualification from the sector

German qualifications on level 2-4 (European Qualification Framework (EQF)/Deutscher Qualifikationsrahmen (DQR)) with relevance for industrial shoe production

Name of qualification (DE)	Name of qualification (EN)	DQR level	EQF level	Length	Permeability	Amount of learners
Einstiegsqualifizierung „Herstellung von Schuhen“* (IHK 2019)	Entry training “production of shoes” *	2	2	9 months	Might be (in fact: this option almost never occurs) recognised when starting an apprenticeship as an “industrial shoemaker” via a reduction of length by 6 months	Not published
Fachkraft Lederverarbeitung (BiBB 2011)	Assistant for leather processing	3	3	2 years	Fully recognised as the first 2 years when starting an apprenticeship as an “Industrial shoemaker”	6 new contracts in 2017 (according to BiBB)
Industrieller Schuhfertiger (BiBB 2017)	Industrial shoemaker	4	4	3 years	-	36 new contracts in 2017 (according to BiBB)

Table 3: German qualifications from shoe sector on level 2-4

* Remark: Not a qualification in terms of being relevant for labour market; only VET-propaedeutic

Main features of Entry training “production of shoes”:

- Very short curriculum (1 page!)
- Refers only to spheres of activity “cutting” and “stitching”.
- “basic cognitive and practical skills” or “largely under supervision” (from level 2) describe learning outcomes (LO) quite realistic.
- Includes the *option* to shorten a qualification as an “industrial shoemaker” by 6 months.

Main features of Assistant for leather processing

- Equals the first 2 years of the curriculum of the industrial shoemaker; curricula for learning venue school even states: “Common classes for both vocations are possible.” (and real, due to small amounts of apprentices)
- Fully *creditable* against “industrial shoemaker”; holders of “Assistant for leather works” need only 1 additional year of VET to become an industrial shoemaker.
- Refers to spheres of activity “cutting”, “stitching” and “finish” (only leather, not soles/shoes).
- “a broad spectrum of cognitive and practical skills” or “work autonomously” (from level 3) describe learning outcomes (LO) for these 3 core spheres quite realistic.

- Offers additionally insights into peripheral spheres “technical development” (station: “Technical_Pattern_Making_(Uppers)”, “design” (station: “upper coordination”) and production planning.

Main features of Industrial shoemaker:

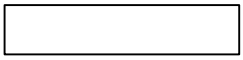
- Covers all 5 core spheres (cutting, stitching, lasting, assembly, finishing)
- “a spectrum of cognitive and practical skills” or “set own learning and work objectives” (from level 4) describe learning outcomes (LO) for these 5 core spheres quite realistic.
- Covers “production planning” and “quality assurance” in parts; only the planning of the production of a shoe (not a whole production line) resp. quality assurance of established materials and processes.
- Offers additionally insights into the other 2 peripheral spheres.

With respect to these (and comparable from other participating countries) descriptions we decided to sub-divide the “broad range” (EQF level 4, skills) or “basic cognitive and practical skills” (EQF level 2, skills) for our sector into three main categories:


autonomous performance


initiation


Partly; e. g. planning of a single product (not production line)


not tackled

5. German contribution to SQR

Level according to EQF (Qualification)	Spheres of activity in footwear sector								
Level 2 (Entry training)	Cutting	Stitching	Lasting	Assembly	Finishing	Design	Technical development	Production planning	Quality assurance
Level 3 (Leather processing)	Cutting	Stitching	Lasting	Assembly	Finishing	Design	Technical development	Production planning	Quality assurance
Level 4 (Shoemaker)	Cutting	Stitching	Lasting	Assembly	Finishing	Design	Technical development	Production planning	Quality assurance

Table 4: Coverage of peripheral spheres by German IVET qualifications

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All internet resources approved on the 20.03.2020.

7. List of tables