Towards an ESCO skills hierarchy

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Purpose of the document

The purpose of this document is to provide the ESCO Maintenance Committee with a short overview of the ESCO skills hierarchy[1] pilot which was carried out between 10 November 2017 and 15 March 2018. This would allow the ESCO Maintenance Committee to become more familiar with the ESCO skills hierarchy in view of the June 2018 meeting, where the Commission intends to discuss with the committee the further development of the skills pillar. The detailed report of the pilot will be uploaded to the ESCO portal as soon as it is available.

Current status of the skills pillar

The skills pillar of ESCO v1 structures 13,485 concepts in four different manners:

- through their **relationship with occupations**, by using occupations as an entry point;
- through a **hierarchy (only for transversal** knowledge, skills and competences);
- through **associative[2] and contextualised[3] relations** (not consistently applied throughout the entire classification);
- through **functional collections** grouping only a subset of the skills available that is of interest for examples of use cases. ESCO v1 includes three functional collections: digital competences (identical to the Digital Competence Framework[4]); language skills and transversal skills.

Covering certain user needs requires the improvement of ESCO's current structure. Such user needs would include searching for specific skills, doing semantic search, filtering search results, clustering skills in groups (e.g. language skills, digital skills or management skills) to work at a more aggregated level, identifying related concepts, identifying concepts of a specific interest for the user, using only part-subset of the classification, getting statistics etc. To address this need, the ESCO team developed and carried out a pilot to arrive at a structure of the ESCO skills pillar that would better serve such functionalities.

[1] Pyramid-like ranking of skill where every level (except the top and the bottom ones) has one higher and one lower neighbour. Lower level means more granularity.
[2] Associative relations indicate how knowledge, skills and competences are relevant to other knowledge, skills and competences.
[3] Skill contextualisation is a method to create knowledge or skill and competence concepts by analysing how transversal skills, competences or knowledge are applied in the specific context of a sector or an occupation. For more information and example, you can visit the ESCO portal: https://ec.europa.eu/esco/portal/escopedia/Skill_contextualisation
[4] https://ec.europa.eu/jrc/en/digcomp

Scope of the pilot

In the context of the skills hierarchy pilot, the ESCO team tested various approaches to structure further the ESCO skills and assess how well those approaches can support the user needs described above. Those needs are reflected in examples of use cases, as follows:

- ***Find a concept in the classification***
  Example: an education provider searches for skills to insert into the learning outcomes description of a qualification
- ***Select groups of concepts for a specific action***
  Example: an employer wants to select a group of skills when preparing a job vacancy description, instead of picking all skills individually
- ***The system suggests related concepts***
  Example: A candidate receives suggestions for skills to complement her/his CV.

Within the framework of this pilot, the ESCO team tested several structuring approaches on a sample of the ESCO skills pillar. These are the following:

- **Skills hierarchy:**
  - Applying the hierarchy of **DISCO** (European Dictionary of Skills and Competences) to ESCO skills[5];
  - Applying the hierarchy of **Kompetenzklassifikation** (the skills classification used by the German PES) to ESCO skills[6];
- **Grouping skills by using other domains as structure/collections:**
  - By economic activity using **NACE** (Statistical Classification of Economic Activities in the European Union)[7];
  - By fields of education and training using **ISCED-F** (International Standard Classification of Education - Fields of Education and Training)
  - By product domain using **CPA** (Statistical classification of products by activity)
  - By work context using the work location ("Arbeitsorte") in the **Kompetenzklassifikation**
- **Contextualisation:** analysis of how transversal skills, competences or knowledge are applied in the specific context of a sector or an occupation.

[5] DISCO is a structured vocabulary for the description of skills and competences in different contexts. Its development was co-financed by the Commission. The top level of DISCO is divided into domain-specific skills and non-domain specific skills. http://disco-tools.eu/disco2_portal/

6Kompetenzklassifikation lists occupations and professional activities in various labour market and socio-economic contexts.
https://berufenet.arbeitsagentur.de/berufenet/faces/index;BERUFENETJSESSIONID=4EZ16arPZ9VHK8807Z7DihYjl2Uv_swUl5TI619mlkATWaxzAITQ!-132602081?path=null

[7] NACE classifies economic activities in the EU. It is organised in 21 sections and indicates 4-digit codes common to all European countries.
http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_(NACE)

Results and lessons learnt

Skills hierarchy

The results of structuring skills with the hierarchy of **Kompetenzklassifikation** and **DISCO** are similar since both classifications i) follow a similar approach to structuring skill concepts, ii) use a hierarchical grouping of concepts and iii) use sectors of economic activity to structure sector-specific skills.

Neither contains detailed descriptions of their skill groups that could clarify their scope, which makes it difficult to assign ESCO skills to the respective groups. Furthermore, both classifications use economic sectors to classify domain-specific skills. Due to this, they cannot be easily used as a mono-hierarchical structure, where each skill fits exactly in one skill group. Certain ESCO skills could be assigned to more than one skill group as they are not mutually exclusive.

While DISCO provides a breakdown of non-domain specific skills, Kompetenzklassifikation has only one group. DISCO is available in 15 EU languages, Kompetenzklassifikation only in German.

Using other domains as structure/collection

Another approach of structuring skills is by expressing how they relate to other types of concepts. This can be particularly useful for filtered search. The existing relationship between skills and occupations in ESCO is of this type: it expresses which skills are normally relevant in the context of an occupation and thus allows the user to filter the skills pillar by occupation.

Following desk research, the ESCO team selected and tested four domains in the pilot project: Economic activities (NACE), fields of education and training (ISCED-F), product domain (CPA), Work context (Kompetenzklassifikation).

NACE

The ESCO team assigned the ESCO skills to the relevant NACE groups of economic activities. This would allow users to filter on skills that typically contribute to a specific economic activity. "Load animals for transportation" could for example be a skill relevant among others in the economic activities "freight transport by road" and "animal production".

As NACE is a hierarchical four-level structure, skills can be assigned to economic sectors at different granularity levels. In the pilot, several transversal skills were assigned to all NACE sections since they apply to all sectors of economic activity. There was hardly any ESCO skill that could be related to only one single NACE section.

The definitions of the NACE sections and the indications of the scope of the section are very useful to delimit the scope and be accurate in assigning skills.

ISCED-F

The ESCO team assigned skills to the domains of education and training, where these skills are usually taught. "Load animals for transportation" could for example be a skill

taught in education and training programs in the field of "transport services" or "crop and livestock production".

At the lowest level ISCED-F 2013 contains 80 detailed fields. The results showed that the ISCED-F classification is valuable and would be particularly useful when annotating learning outcome descriptions.

CPA

The CPA classification lists services and products in 3,218 subcategories. It proved difficult to decide on the appropriate relation to skills. It could for example express that knowledge of a certain product or service category is useful for developing a skill. For example, knowledge of "road transport services of live animals" or of "dairy cattle, live" is useful for developing the skill "load animals for transportation".

Work context

The Kompetenzklassifikation work context classification is limited to 156 concepts which is a small number to assign to 13,485 ESCO skills, whereas it is usually not possible to assign a skill to a single work context. Skills are usually performed in a range of different locations. For example, the skill "load animals for transportation" can among others be performed at a "harbour / wharf", an "animal hospital" or at an "animal enclosure".

Contextualisation

Skill contextualisation is a method to create knowledge or skill and competence concepts by analysing how transversal skills, competences or knowledge are applied in the specific context of a sector or an occupation. This allows bringing transversal knowledge, skills and competences which are rather abstract to a more detailed level so that they can be directly used in occupational profiles.

Contextualisation can be implemented through different relations that are part of the ESCO data model. These are:

- Broader/narrower relation (=hierarchical relation)
- "Essential for" relations (=associative relation)
- "Optional for" relations (=associative relation)

These types of relations can be established if the description of the skills is clear enough to define its content and scope. The approach was used when developing ESCO v1, but it has not been applied consistently over the entire skills pillar. Therefore, the ESCO team proposes a set of rules for improving the skills descriptions. This will allow creating more precise and consistent relations. The rules will be listed in the final report of the pilot project.

Recommendations

Following the results of the pilot, the ESCO team recommends further exploring the use of **ISCED-F** and **NACE** as external classifications to structure ESCO.

Contextualisation is a useful methodology since it provides clear relations among skill concepts. It can be used for various purposes and the skills pillar is already annotated with such relations. Furthermore, revising the contextualisation and the methodological rules related to it would improve consistency of the skill pillar. On the other hand, it requires a high effort to manually maintain such relations due to high number of concepts in the skills pillar.

DISCO and **Kompetenzklassifikation**, the two hierarchical skills classifications evaluated within the scope of this project, use sectors of economic activity to structure skills. Sectors of economic activity are not suitable as a base for a hierarchical arrangement of concepts in which each concept can have only one broader concept (mono-hierarchy), which is the hierarchical arrangement of interest in the case of ESCO, because a single skill can inherently be related to several different sectors of economic activity.

Pending issues

The main pending issue identified during the pilot is the lack of an existing suitable mono-hierarchy that could be used for statistical labour market data purposes. This could be the default browsing mechanism of the skills pillar. Such classification would have to be composed of skill groups which are mutually exclusive, i.e. a single skill can be placed only in a single group, thanks to clear scoping of groups. For the ESCO occupational pillar, ISCO serves as such a mono-hierarchical structure.

In case a mono-hierarchy of skills would be the most suitable structure to address the user needs which are reflected in the use case examples, it would be necessary to build a custom solution for the purposes of ESCO.