

# Road to Digital Careers

comparing different ways of categorization

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**Abstract:** *Matching skill sets of individuals with highly demanded skill sets of jobs or occupations in the IT area is a great challenge – adding necessary learning items and visualizing the result is a very promising end to end approach. With the “Open Skill Match Maker” (OpenSKIMR) young people will be able to plan and simulate their individual learning and career routes to their desired destination like with classical route planning software ([www.openskimr.eu](http://www.openskimr.eu)). Using ESCO, a multilingual classification of occupations, skills, competences and qualifications, will ensure a consistent understanding of the skills and qualification of the talents. This article shows the concept of the end to end approach of the possibility to declare existing, individual skills and get a first match to possible IT professions and potential learnings in order to understand the concrete options in the labor market and in a second step visualize it like a route map to a destination. This playful approach, supported by algorithms and visualization, supports young people to find their way.*

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## **Keywords:**

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### **1. Introduction:**

Youth unemployment is still a major issue in the European Union. "Young people are a priority for European Union's social vision" Young people are a priority for European Union's social vision, and the current crisis compounds the need to sustain the young human capital. Developing the ESCO framework was a cornerstone of managing and identifying relevant skills, this endeavor was also linked to relevant international classifications and frameworks, such as NACE, ISCO and EQF [1].

In November 2009, the Council of Youth Ministers adopted the EU Youth Strategy for 2010-2018 which has two overall objectives: To provide more and equal opportunities for young people in education and in the labour market and to promote the active citizenship, social inclusion for all young people". [2] In order to support a well-functioning labor market private and public internet search platforms are on their rise. From an abstract level according to Gehrings work, indirect and direct search markets can be distinguished. The role of the intermediary is to provide services in order to reduce search costs on both sides. Intermediaries post bid and ask prices whereas in search markets buyers and sellers negotiate. [3, p. 99] In the job market exists the choice between using indirect search markets or direct search. The more service and transaction cost an intermediary is able to provide the higher the chance, that this service will be regarded as useful for both sides. Assuming that the job and labor market is intransparent, the costs for identifying valid information is relatively high for job seekers and job vacancies. Intermediaries like job boards operate typically from a neutral position, offering different information about both sides. Counselling and job search assistance – there is substantial evidence from the USA, The Netherlands and the UK that counselling and job search assistance are effective, but the evidence for young people is limited. Matching to options – matching people to options, as shown by French and UK studies, is likely to achieve better outcomes. Integrative person-centered approaches are more effective where there is an element of choice and interventions are related closely to need. [4] The focus of OpenSKIMR is primarily addressing young people offering options for their career in a more and more digitalized work environment. The susceptibility of jobs to computerization was well described by Benedict et al. arguing that 45% of US jobs are at risk and that educational attainment is negatively related to the possibility of computerization. [5, p. 254] At the same time complexity in jobs per se is increasing, which means graduates have to adopt to different

tasks and fast development in the profession, with leads to confusion and disorientation and the feeling to constantly update knowledge or learn something new. [6]

## **2. Core idea and concept:**

The OpenSKIMR pilot project, funded by the European Commission<sup>2</sup> addresses current challenges of the European labor market like the persistent skill shortages and mismatches in the IT area and targets to develop a prototype of an European-wide skill matching supporting system. The approach aims to bring together people, jobs and learnings to support people in creating individual learning and career routes. The target should be reached by the enablement of efficient upskilling and the opportunity to plan and simulate individual/personalized learning and career routes to desired job destinations like classical route planner software. The tool is based on a set of algorithms which enable the matching of the people's skill sets with demanded skill sets of occupations and their assigned jobs in the ICT areas and provides information about the existent skill gaps. An occupation can be defined as a grouping of jobs involving similar tasks and which require similar skill sets, can be understood as common characteristics of a group of jobs [7]. The learning and career route automatically addresses the calculated skill gaps by closing it with recommended learning and trainings which are offered through a link to specific learning content platforms. These learning and career routes are based on available learning offers or skill enhancements providing the qualifications required to reach the desired career destination. The OpenSKIMR routes can be adapted to the preferences of a talent by using parameters like duration, location, costs or learning type. This innovative functionality enables talents to acquire the required skills or knowledges for a specific job or an area. The OpenSKIMR functionality in the pilot project is tested on a crosscut of eight specific ESCO occupations and required generated data. One aim of the pilot project is to describe and to make the ESCO skills of these eight selected occupations scalable, understandable and applicable for end-users. Another aim of this pilot is to proof that the researched and developed set of algorithms work based on the following eight ESCO occupations in the IT area. These selected occupations are: Data Scientist; ICT Business Analyst; ICT Consultant; ICT Project Manager; Network Engineer; ICT Security Administrator; Software Developer; Mobile APP Developer.

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## **2.1 Theories and Hypothesis**

The authors state that the option of realizing a platform that opens up the possibility to test new classifications on the occupation or skill side from concept to the fingertips of end users, visualizing their individual career plans and learning from their user behavior, supported by algorithms is a very useful end to end approach. It supports the main players of the labor market – policy makers, individual job seekers, educational providers and employers as well, to optimize their input and interpretation of job relevant information.

## **2.2 OpenSKIMR & ESCO and other frameworks**

OpenSKIMR is build up on the latest version of the European classification system ESCO (European Skills, Competences, Qualifications and Occupations). ESCO is the multilingual classification of European skills, competences, qualifications and occupations. It is an important deliverable to support the Europe 2020 strategy and the New Skills Agenda for Europe. It can be described as a standardized terminology for skills, competences, qualifications and occupations. Responsible for its development are DG Employment, Social Affairs and Inclusion. Furthermore, this development is supported by European Centre for the Development of Vocational Training (Cedefop).

ESCO targets to bridge the gap between the world of education, training and the labor market by creating a common understandable terms for skills and knowledges. The first demo version of ESCO has been published in October 2013. This year the release in October 2017 the first full version V1 is expected. "... ESCO will enhance the functioning of the labour market, help to build an integrated European labour market and bridge the communication gap between the world of work and the world of education and training." [7].

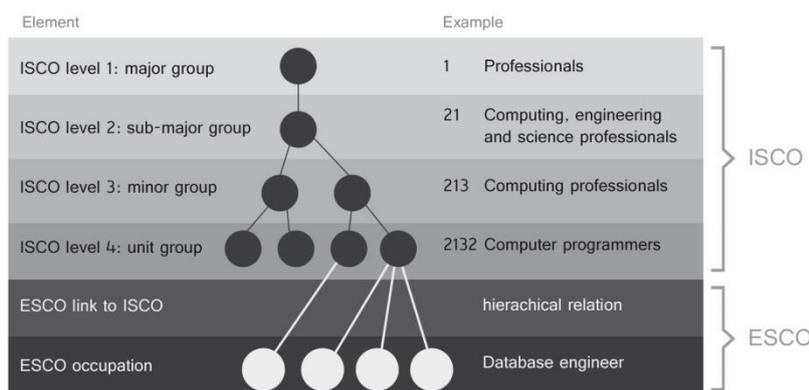
OpenSKIMR is one of the first pilots of ESCO and also tries to support the creation of a consistent understanding of the skills and qualification within Europe. However, the integration of ESCO has brought along several interesting challenges for the practical implementation in a pilot project.



Figure 1: European Union 2013, ESCO in practice [1, p. 4]

### 2.3 ESCO Annotation Guide- Alignment with other frameworks (EQF, EUROPASS)

In order to enable a matching between user's skills and ESCO occupations and, in the very end, also real assigned job postings, the technology needs to enable users to assign themselves ESCO skills. Furthermore, it is also essential to assign real job postings with ESCO skills. Finally, to enable the route planner functionality, it is necessary to assign each learning with appropriate ESCO skills as well. The idea to optimize the information quality in the labor market needs the integration of educational experts in industry and education. The understanding that the labor market becomes more and more global connects ESCO to the four level ISCO occupation groups, the International Classification of Occupations, published by the International Labor Organization.



Source: Connection between ESCO and ISCO [8]

Following the hierarchical structure of ISCO the ESCO occupation groups are adding two levels in the occupational tree, becoming more precise. This approach helps to narrow down the options of possible, fitting occupations for job seekers, based on their current skills or competences.

To overcome the challenge of different skill levels an annotation *Guide-reference* has been developed, because EQF aims to increase the comparability of levels of qualifications across borders. Thus, this has been selected to be used for the Annotation Guide. “The EQF helps to compare national qualifications systems and enable communication among them. The core of the EQF are eight common European reference levels, which are described in learning outcomes: knowledge, skills and competences.” [9] As it is important - mainly for mathematical calculations - to define the point in time, when a skill is acquired, the EQF model points directly to the end of the learning process. [9] Levels 1 and 2 are the lowest ones, and represent someone without any particular skills or knowledge. The task is done with direct supervision in a structured context, applying only general knowledge and simple everyday skills. Level 3 till 8 represent skills and knowledge that need to be learned before the task, generally through educational process or training. Skills, knowledge and competence are increasing from level 3 to 8, and also does autonomy of tasks. In connection with Framework for the qualifications of the European higher education area, which provides description for educational cycles according to Bologna process, EQF levels 5 to 8 can be connected to this cycles: The description for the higher education short cycle (within or linked to the first cycle) corresponds to the learning outcomes for EQF level 5. The First cycle (Bachelor’s Degree) corresponds to learning outcomes for EQF level 6. The second cycle (Master’s degree) corresponds to learning outcomes for EQF level 7 and the third cycle (Ph.D.) corresponds to learning outcomes for EQF 8 [10].

EQF Level	Knowledge	Skills	Competence
	In the context of EQF, knowledge is described as <i>theoretical and/or factual</i> .	In the context of EQF, skills are described as <i>cognitive</i> (involving the use of logical, intuitive and creative thinking), and <i>practical</i> (involving manual dexterity and the use of methods, materials, tools and instruments)	In the context of EQF, competence is described in terms of <i>responsibility and autonomy</i> .
Level 1	Basic general knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured context

Source: EQF Level, Knowledge, Skills and Competences [10]

Nevertheless, ESCO works with more than 14.000 skills and knowledges, also assigned to the ISCO hierarchy. The eight EQF levels add to the complexity of categorization and identification of an appropriate job or educational offer needed to get there. While ESCO is describing the tasks and duties that are embodied in an occupation respectively in a specific job, the EQF helps to understand in which level of proficiency the tasks are expected to be fulfilled in order to be successful. Learning and learning outcomes fit the gap between the current statuses of a talent and the status which is expected.

This has been addressed by the pilot project through mathematical methods/approaches: the occupational level clustering as well as skill clustering and the mapping to optional learnings. The

following table shows this combination based on the described frameworks and applied to specific learnings of two global IT companies.

The European e-Competence Framework (e-CF) provides a reference of 40 competences as applied at the Information and Communication Technology (ICT) workplace. It uses a common language for competences, skills, knowledge and proficiency levels, so it can be understood in all of Europe's Member States. Main goal of e-CF is to enable communication Technology (ICT) stakeholders – ICT demand and supply companies, the public sector, ICT managers and practitioners, HR developers, ICT job seekers, policy makers, educational institutions and social partners – across Europe, to adopt, apply and use the framework in their environment [11].

Since OpenSKIMR will be developed according to ESCO and EQF, which connection was already explained, the team wants to also connect ECTS with EQF. EQF describes “levels of qualification” (without indicating any credit ranges) – to promote common reference framework which assists in the comparing the NQF and their levels. ECTS its not directly connected to EQF but mapping of those two can be made through another standard QF-EHEA (Framework for Qualifications of the European Higher Education Area). Both QF-EHEA and EQF are using learning outcomes as descriptions of qualifications (e.g. Bachelor, Master, Ph.D.) and are compatible with each other as far as higher education is concerned (QF-EHEA cycles 1, 2 and 3 correspond to EQF levels 6, 7 and 8). QF-EHEA is then directly connected to ECTS connecting first and second cycles to credit ranges:

- Short cycle qualifications typically include approx. 120ECTS. First cycle qualifications typically include 180 or 240 ECTS.
- Second cycle qualifications typically include 90 or 120 ECTS credits, with a minimum of 60 ECTS at the level of the second cycle.
- The use of ECTS in the third cycle varies [12].

Connecting EQF with ECTS trough the QF-EHEA levels can be presented now as follows:

- Short-cycle qualifications in QF-EHEA = level 5 EQF = 120 ECTS
- First-cycle qualifications in QF-EHEA = level 6 EQF = 180 or 240 ECTS

Second-cycle qualifications in QF-EHEA = level 7 EQF = 90 or 120 ECTS [12]

Using these described standards and sources the following table showcases an expert driven categorization of an IS Project Manager.

Overview of e-CF competences regarding OpenSKIMR eight profiles - Comparison e-CF, EQF and ECTS			1. IS Project Manager			2. Network specialist (ICT Network engineer)		
			e-CF	EQF	ECTS	e-CF	EQF	ECTS
A. PLAN	A.1	IS and business strategy Alignment						
	A.2	Service lever Management						
	A.3	Business plan development						
	A.4	Product or project planning	4	7	90 or 120 (C2)			
	A.5	Architecture Design						
	A.6	Applicational Design						
	A.7	Technology watching						
	A.8	Sustainable development						
B. BUILD	B.1	Design and Development				2 to 3	4,5,6	120 (SC)
	B.2	System integration				2 to 3	4,5,6	120 (SC)
	B.3	Testing						
	B.4	Solution development				2 to 3	4,5,6	120 (SC)
	B.5	Documentation production						
C. RUN	C.1	User support						
	C.2	Change support						
	C.3	Service delivery						
	C.4	Problem Management				2 to 3	4,5,6	120 (SC)
D. ENABLE	D.1	Information Security strategy development						
	D.2	ICT Quality strategy development						
	D.3	Education and Training provision						
	D.4	Purchasing						
	D.5	Sales proposal development						
	D.6	Channel management						
	D.7	Sales Management						
	D.8	Contract management						
	D.9	Personnel development						
	D.10	Information and knowledge management						
E. MANAGE	E.1	Forecast development						
	E.2	Project and portfolio management	4	7	90 or 120 (C2)			
	E.3	Risk management	3	6	180 or 240 (C1)			
	E.4	Relationship management	3	6	180 or 240 (C1)			
	E.5	Process improvement						
	E.6	ICT Quality management						
	E.7	Business change management	3	6	180 or 240 (C1)			
	E.8	Information security management				2	4,5	120 (SC)
	E.9	IT Governance						
e-CF Level	EQF level	ECTS						
e-5	8	Ph.D. (different credits)						
e-4	7	90 or 120 ECTS (cycle 2 - Master)						
e-3	6	180 or 240 ECTS (cycle 1 - Bachelor)						
		120 (short cycle)						
e-2	4							
e-1	3							

Source: OpenSKIMR, combination of standards

### 3. Outlook

While OpenSKIMR includes the following main functionalities: User Profile Creation; Skill Assessment based on ESCO; Matching to Occupations: This means a user is can match its indicated skill set to occupations (job vacancy description of ESCO, with assigned skills & knowledges); Matching to Jobs: Based on the selected, matched occupation several jobs are matched to the users

indicated skill set. (Matches are shown from overqualified, perfect fit /underqualified); Skill Gap Calculation: OpenSKIMR also provides information about the skill gap between the users' skill set and the demanded skill set of a job; Route Planner Creation: This functionality offers the possibility for users to create their individual learning and career route to a specific target (job). According to Maurer, job seekers pursue either central or peripheral routes to decision processing and the idea of designing intermediate platform would be to address these needs accordingly. [13, p. 312]

So far the OpenSKIMR prototype shows that it is possible to combine these functionalities and even different categorization approaches in a platform that supports talents in their orientation towards the needs of the job market. Still it has to be stated that the reduction to a subset of eight professions, opens up space for improvement for the optimization of the algorithms, the usability and interpretation of more user data. Furthermore it can be said that using Semantic Web Technologies for online recruitment services is an upcoming issue as Mochol et al. describe in their work. The openSKIMR approach adds to this, as using Web Ontology Language can be highly useful for describing and analyzing specific job descriptions. In combination with our prototype a more accurate machine supported search will be possible. [14] Moreover the quality of the data has a severe impact on the outputs of the openSKIMR algorithms and the suggested career routes. Therefore the continuous assessment of the data set in selected dimensions is of high relevance and shall be addressed in terms of automated routines. [15]

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