

PROMOTING DYNAMIC SKILLS MATCHING: CHALLENGES AND EVIDENCES FROM THE SMART PROJECT

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Abstract

The need of dynamically matching educational system offer and job market demand represents a relevant challenge to promote and sustain an inclusive and competitive society in Europe. Stimulating open, accessible and flexible learning on one side and promoting partnerships between public and private institutions on the other one represent the main pillars of the "Rethinking Education 2030" EU strategy and frame (also confirmed in the EaSI programme). Furthermore, the ECVET frame boosts the transparency and recognition of the learning outcomes and confirms the need to implement innovative and dynamic tools to improve employment and educational excellence.

SMART (Skill MATCHing for Regional development) is a LLP-Leonardo da Vinci TOI project aimed at addressing these challenges with special reference to the competence dynamic alignment in the Andalusia region with special focus to the Tourism Industry (Hospitality, Catering and Travels). The overall objective of the SMART system is to provide a methodology and a tool to harmonize the VET offer with the demand of the Labour market in a timely, effective and localized manner. The dynamic matching of competences and jobs demand is intended to be realized by addressing two main dimensions: 1) the skill matching model and technology enhanced system design and implementation in order to be able to identify competences, knowledge and skills required and adapting the learning outcomes in the Educational regional system; 2) the definition of an innovative approach to curricula design and professional scenarios forecasting sustained by a more organic industry-education-institution governance model, based on a trust and knowledge based multi-actor cooperation frame.

The technology enhanced SMART system (and tools) will be ontology based, articulating knowledge, skills and capacities as learning outcomes; the system is envisaged to provide periodic review on how the regional educational output meets the labour market demand articulated in job postings and other strategic sources. The report will provide feedback for the individual VET providers and educational institutions on the compliance of their curricula (in terms of competencies acquired) with the real labour market needs (in terms of competencies required). To this extent, the project aims to contribute to the skill matching frame and challenges by providing: common models, procedures and tools for the competences' matching process; an ontology-based adaptive tool that maps and validates companies' and education competences (also boosting the employability dimension); forecasts on new emerging jobs and competences needs in the Andalusian market. The project ongoing evidences also confirm - and highlight- the need of contemporary address institutional (organic cooperation models), methodological (ECVET, ontologies, learning outcomes), technological (knowledge sharing, communication and learning system) issues.

Keywords: Competence Evaluation; eLearning;Curriculum Design and Innovation; Forecasting of labour market and skill needs; Employability.

1 INTRODUCTION

After giving a short overview of the relevant challenges and evidences on skill matching, emerging from the comparative -desk and on field- research carried on within the first phase of the project, the

paper presents the main finding and results related to the design of the SMART model and system. The potential of the system to support an effective, dynamic and organic job balance has being validated in the Andalusian region, with special refer to the tourism sector. The SMART project emerging evidences and on-going results confirm the complexity of designing and implementing effective alignment system, the number and variety of challenges to be organically and jointly dealt. It strongly recommend the need of actively involve all relevant actors to guarantee the system sustainability and the necessary dynamism of the alignment, according to the changing job market need and the overall socio economical evolution.

2 A COMPARATIVE ANALYSIS THE SKILLS MATCHING CHALLENGES AND EVIDENCES

The relationship between labour market supply and demand is changing dynamically due to the socio, economical and technological trends and challenges. Education can surely play a strategic role; however, challenge is not only improve skills, but to dynamically match, foresee and valorize them, dealing with very diverse dimensions. National and regional policy makers have only recently begun to focus on the matching of skills supply and demand in many EU countries; resources and attention are devoted to developing skills supply (training) and demand (R&D, innovation), rather than promoting a supply-demand balance. The mismatching indeed has an impact on unemployment and can reduce the productivity and competitiveness of an economy; it can take many forms of various kinds. It's possible to find a discrepancy not only in cases of shortage or gap between the demand and the supply of skills, but also in situations where qualifications, the knowledge and skills of a person exceed the requirements necessary for the performance of his job. The following table (Table 1) reports the main emerging drivers and the kind of skills demand/supply mismatching, as emerging from desk and in field research carried on by SMART project team [1].

Table 1 – Discrepancies between demand and supply of skills

Kinds of discrepancies between demand and supply of skills	
Excess of education	The number of years of education is higher than that required by the current job.
Insufficient Education	The number of years of education is less than that required by the current job.
Over-qualification	The qualification is higher than that required by the current job.
Lack of qualification	The qualification is less than that required by the current job.
Over-training	Inability to make full use of skills and abilities in the current work.
Lack of training	Lack of skills and abilities needed to perform the current job in acceptable manner.
Excess of skills	The supply of people with a particular skill is higher than demand.
Skills gap	The skill level of the person employed is less than that required for perform the work adequately, or the type of expertise does not match the requirements of the job.
Economic obsolescence of skills	Skills previously used in a job are no longer required or are less important.
Physical (technical) obsolescence	Skills and physical or mental capacities deteriorate due to atrophy or wear.
Vertical discrepancy	The level of education or skills is below or above the level of education or competence required.
Horizontal discrepancy	The level of education or skills match the required work, but the type education or competence is inadequate for the current job.
Exclusion / reverse	Workers with better qualifications are hired for jobs that could be also carried out by less skilled workers, who are therefore excluded from the possibility of traditional use for their level of competence. The decline refers to a top-down process in which skilled workers are forced to work in lower levels, some workers in lower level may become unemployed.

The vertical discrepancy, commonly referred to the excess of education, occurs when a person is employed in a job that requires a lower level of education; in Northern Ireland, for instance, a third of workers are in possession of a qualification which is higher than the qualification required for the job they currently occupy. The horizontal discrepancy occurs when the type, rather than the level, of

education or skills, is inadequate to the employment. People with specific qualifications, for example, normally find occupations more suitable than people with more generic degrees. In periods of economic prosperity, imbalances depend from skill shortages, for example is not available a sufficient number of persons with a specific type of skills to meet the demand. Skills shortages are due to a lack of people with the skills and experience necessary rather than a lack of years of education. If skills shortages occur when workers have a higher level of education or competence, is a clear signal that the supply of education and training is not aligned to the demands of the labour market [1].

According to the “Project Europe 2030” report, it must be a mandate of HEI (High Education Institution) to correct the existing skills mismatch by providing graduates with all the tools and techniques necessary to meet the industry’s needs. This should be achieved by creating an educational environment that ensures a life-long learning culture paired with flexible skill upgrading measures for individuals [2]. This strongly requires a robust and systematic dialogue among the educational systems and their stakeholders to jointly define comparable and transparent standards. Learning outcomes is a key concept in designing EU instruments fostering transparency, comparability, transferability and recognition of qualifications, among countries, among levels. If this “learning outcomes” approach is being followed, priorities are expected to change for learners [3,4]. The more transparent the development is the more focused standards can be set to increase the educational value as a whole. “This illustrates that transparency of learning is not only about making it easier to ‘read’ qualifications, systems and institutions, but it is also about having a common language for a dialogue about the objectives of education and training” [3]. The European Centre for the Development of Vocational Training (CEDEFOP) elaborated a methodology to discover the skill discrepancies between both sides of the labour market using forecasting models [5] and many EU initiatives and programs have been launched with the aim of improving labour market competence demand and supply match.

The main national and EU actions and goals are aimed (or should be aimed to, as highlighted also by the recent strategic and programmatic frame related to both the European employment strategy and the EasY program and the Education and lifelong learning one, and the Erasmus plus program) to:

- ^ dynamically aligning VET content, infrastructure and methods, employing an outcome-oriented (more responsive to labour market needs) and work-based learning approach, also in terms of supporting the apprenticeship development [6].
- ^ cooperation with the relevant stakeholders –representatives of professional sectors, social partners, relevant civil society organisations, and education and training providers “to review occupational and education/training standard which define what is to be expected from the holder of a certificate or diploma”.

SMART (Skills Matching for Regional Development) aims at supporting the dynamic matching of competences and jobs demand by addressing both dimensions: the skill matching models and the anticipation of professional scenarios. SMART model and system are based on the need of getting a systematic fit among learning outcomes and job requirements by dynamically identifying competences, knowledge and skills required and adapting the learning outcomes in the Educational regional system.

The first stage of the SMART project has been aimed at carry on a national and comparative research articulated in:

- desk study (data collection, analysis of literature and documentary sources, analysis of best practices, identification and description of job classifications and of skill matching models, practices and experiences);
- field research (focus groups with experts on the experiences, practices and perspectives of job skill matching at national and local levels).

The research aims to describe and analyse the national contexts of the countries involved in SMART Project, describing models, policies, practices and initiatives taken to facilitate the matching of demand and supply of labour [1]. The aim of the research stage is twofold:

- ^ analysing and comparing “skill matching” practices, initiatives and models in order to verify the conditions for the development and validation of an ontology-based adaptive tool matching and define a “SMART MODEL”, effectively underpinning the structure and the dynamics of the SMART system;

- ⤴ targeting more relevant -in terms of emerging skill needs- job profiles and labour market segments for the SMART model and system pilot run.

The situations of the labour market in the partner countries are heterogeneous and represent different trends in European employment. Moreover, despite the measures undertaken to encourage employment in almost all European countries, there has been a progressive increase in the unemployment rate, as shown in the comparison between Eurostat data of 2012 and 2013 [7].

There is a range of initiatives which have been set up to facilitate the matching between the demand and supply of labour in the partners countries.

Among the others, in Andalusia (Spain), where the research and the project activities are focused on, the skill mismatch is a double consequence of under qualification and over qualification and of low involvement of key players of the labour market (with special refer to the business representatives) in designing training paths. Some relevant initiative undertaken to deal with these trends by targeting the need of improving skills alignment are, among the others: the “Andalucía Orienta” programme, for instance, is a specialized network for vocational guidance, linking offer and demand in the whole region, valorising the public/private cooperation. The need of enhancing cooperation represent the core action of initiatives carried on in other partners countries, such us the Austrian MISLEM project (aimed to improve the quality of the training offer matching it to the real needs of the labour market) or the Italian skill matching system -deployed by ISFOL, ISTAT and Ministry of Labour- aimed at supporting the communication among labour market demand and supply actors). Moreover, in all partners countries, an institutional wide action on defining a (learning outcome based) national qualification frame and competences transparency and validation system is carried on. Skill matching sectoral initiatives are also relevant, such us the Northern Ireland project “CITB-Construction Skills NI- Qualifying the existing workforce” on construction skills challenge or the Hungarian National Tourist Office services supporting the labour demand and supply match in the tourism sector. There are other institutions that are also providing innovative programmes such as “Quiero Empleo”, providing the evaluation of competences for candidates, giving as outcome a report of the concrete needs of qualification or training to enter in the labour market (According to the preference of the candidate).A more extensive comparative analysis on skill matching challenges, evidences and practices is reported in the SMART project research report [1].

3 BUILDING THE SMART MODEL

The evidences emerging from this comparative research has been enriched by targeted focus group discussions organised at each partner country with the main labour market stakeholders (education, VET, University and research; labour market institutions; public and private employment services; social parties; business representatives and so on). The focus groups addressed the need of a shared analysis of models and regional systems of job skill needs and matching among relevant actors, with special reference to the tourism sector in each partner country [1].

In all focus groups it has been highlighted that “tourism” is very broad (which results in establishments often being unsure about the competences they need) and needs a continuous adaptation (also due to the increasing diversity of its business segments and to the evolving customer expectations; lifelong learning concept must be applied in all levels of the Industry). This requires:

- ⤴ redefining competences of tourism professionals. Basic competences to tackle have been referred to: Language; ICT (Social networks, Internet and Marketing sales); Interpersonal skills;
- ⤴ improving the recruitment process of staff. Nowadays, in many countries, employment agencies intermediate the 25% of the matching between demand and supply of labour; temp agencies intermediate the 3%, job application the 30%, and open competitive exams the 25%. The remainder 17% is covered by interpersonal relationship and networks: companies tend to hire workers presented by acquaintances.
- ⤴ rethinking the “skill supply” system, also in terms of improved responsiveness of the educational system (including VET) and a stronger involvement of the employers. The weakness in the matching between demand and supply of labour have been always identified can be identified in the tendency to work on supply rather than on the demand;

The lack of alignment between the tourism Industry job requirements and the existing educational system has been so confirmed and strongly addressed as relevant challenge to be addressed in order to foster employment and development.

Focus group evidences allowed (together with the indication of the MISLEM experience, core resource of SMART transfer of innovation project) the definition of a SMART model, supporting the system effectiveness in enhancing the skill needs anticipation and matching. A job skill matching system, even if advanced and technology enhanced, doesn't produce the expected outputs if: it is not based on reciprocal trust and knowledge (and communication) among the actors; there is not a timely alignment and/or work based training adaptation.

The systems must be created from the bottom, through the collaboration between actors, also by defining tools and procedures supporting information sharing and communication, across the job supply and demand, operating toward simplicity and transparency. In order to make effective the adoption of a job skill matching system, it is critical to [1] :

- ^ create trust among the actors, by their involvement in the agreement on reciprocal obligations, in the planning of training pathways based on a common vision of development, strictly related to the local productive system and based on the reciprocal recognition of credits;
- ^ effectively/efficiently "re-engineer" the match of job requirements and skills offer by integrating the existent data base systems already adopted by different actors (such as, the Universities, the orienteering centers, the public and private employment centers and so on);
- ^ improve the communication among them. The focus is on the integration and not on the intermediation and the expected output is the make the interaction among the cited actors systematic and organized;
- ^ apply and reproduce the system integration also for the empowerment of the local development, by creating net agreements of short distribution chain and clustering competences.

With these premises an advanced database system of job/skills matching, ontology based, such as the proposed SMART system, ought to mirror and virtualize the actual integration of actors, systems, aims competences and expectations of the local productive context. The database could support a real time communication among actors and systems that have previously shared a common vision and strategy. That is actually the innovative effort and attempt of SMART, combining an advanced database and tool for the job/skills matching, ontology based, with the experimentation of local active polices of work, bottom up based, starting from the exploitation of local productive opportunities and from the valorisation of a short distribution chain. The result of this original and innovative combination could represent the forward-looking approach to a changing reference system of access to the work world and for the local development.

4 THE SMART SYSTEM

As stated, the main goal of the SMART project is to investigate the compliance between job market expectations and educational/training offers. The project focuses, particularly, on the education/job balance in Andalusia region featured by high rates of unemployment and the mismatch of qualifications. This system will be ontology based, articulating knowledge, skills and capacities as learning outcomes required by the world of labour and adapting the learning outcomes in the Educational regional system. The SMART system is envisaged to provide periodic review on how the regional educational output meets the labor market demand articulated in job postings and other strategic documents. The development of the SMART system is based on the personalization and integration of STUDIO, a competence-based system which provides support in exploring missing knowledge areas of users in the frames of an ontology driven learning environment. STUDIO infrastructure consists of an Ontology Repository and a Content Repository -that are its two major pillars-, a Content Presentation tool, a Test Bank, an Adaptive Testing Engine, and some additional support tools as well. The figure below presents (Fig. 1) how the above mentioned system elements are connected to each other to provide a comprehensive solution [1, 12].

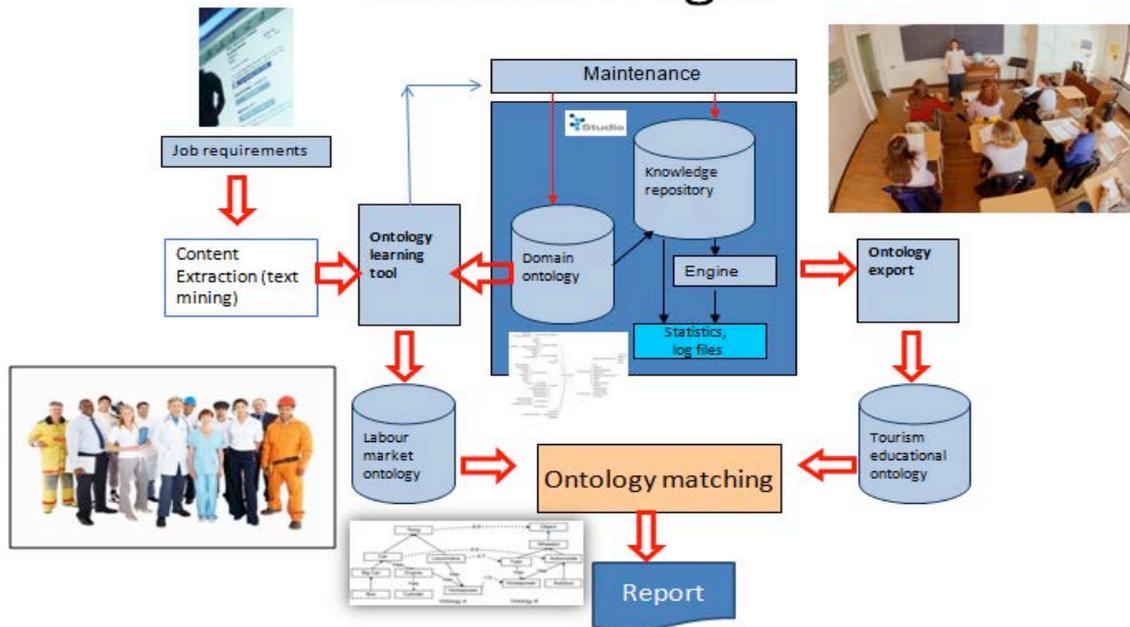


Fig.1 – SMART system architecture

The system had been adapted to SMART scenarios and needs; it will gather and process the targeted competences and knowledge areas. SMART will also integrate functionalities, interfaces and tools according to the SMART project goals and targets. As shown, the domain Ontology is the core of this system; it contains competences, mostly knowledge elements, in structured manner. Based on the MISLEM project's methodology, the new competence elements will be identified to support a dynamic job balance through the systematic comparison between VET providers and educational institutions curricula (in terms of competencies acquired) and the real labor market needs (in terms of competencies required) [1; 12].

The objective of SMART is to investigate the compliance between job market expectations and educational offers, in a timely and localized manner. Therefore a demand and a supply specific view will be created from the ontology, referring to a given time period and place. The demand will be represented by job vacancies published and collected from job portals. Another source of information is the national qualification, occupational and classification frameworks (such as, for instance, relevant for SMART are: ISFOL system (www.isfol.it), O*NET (www.onetonline.org), BDC Catalogue of Incual <https://www.educacion.gob.es/iceextranet/bdqCualificacionesAction.do>.)

The frameworks characterize the occupations in a standard manner. The online job offers contain information about the position name, the working place, the validity period and the job description. In some cases, the job descriptions are ill-defined. In order to avoid potential mistakes, an occupation is characterized by standard description originated from occupational classification framework or other relevant official sources, and information from job offers is added to the general description. The supply is represented by the competencies offered by the educational institutions. Competencies may be explicitly given or derived from training programs, syllabi, etc. The latter mentioned activities are assumed as 'manual' contributions of the local staff.

5 SMART VALIDATION

The validation of the SMART system prototype in the Andalusia Tourism Industry is ongoing. The precondition of the pilot run is the ontology development on the tourism domain. To this extent, the highest number possible of VET providers and educational institutions identified and their curricula mapped, and a vast number of job postings identified and processed. The first draft of "tourism" ontology (Fig. 2) has been created based on available specialized resource and documents [8, 9, 10, 11]. On the left side of the Domain Ontology figure general knowledge elements are illustrated, related

to tourism. On the right side tourism products and job roles appear which are constructed by the aforementioned knowledge elements as building blocks. Hence, nomenclature, job roles in the tourism sector are interpreted as a special view of the knowledge elements, knowledge blocks.

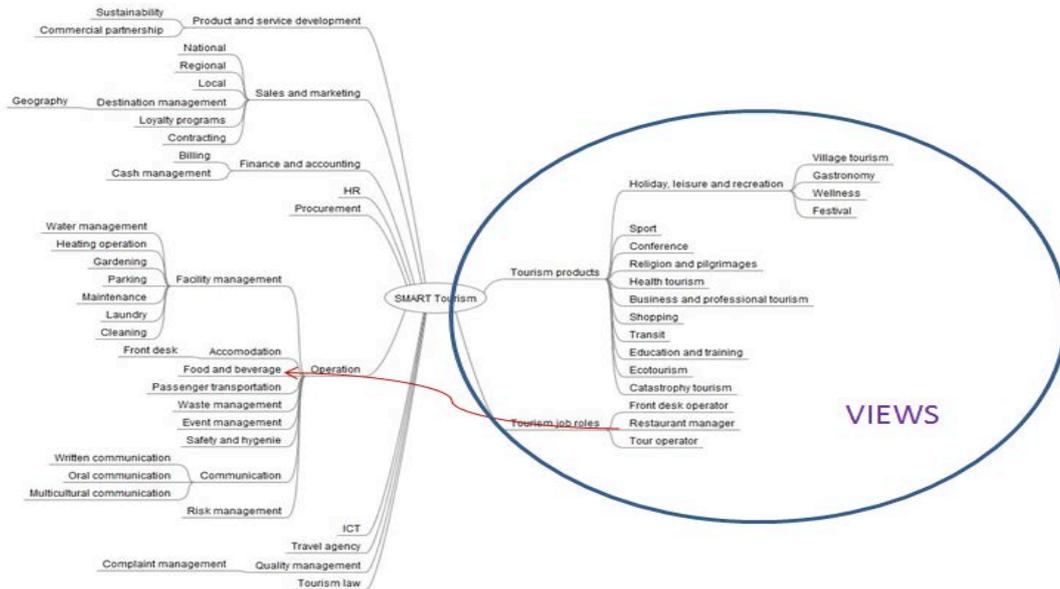


Figure 2 - First draft of the Domain Ontology

Time, volume and regional attributes are associated to the ontology elements which are extracted from the processed documents (in case of job offers the working place, validity period of the job offers; in case of educational institutions, the geographical position, output volume data). The demand and supply of the labor market is represented by the aforementioned knowledge elements as building blocks. Hence, nomenclature in the tourism sector and learning outcomes of training programs are interpreted as a special view of the knowledge elements, knowledge blocks (see in Fig. 3) [12].

The subontologies behind of the specific views enable the comparison, in other words the ontology matching. We are going to match the demand of the labour market with the supply of one or a set of regional educational institutions. With refer to skill supply of one specific job profile targeted in the project, according to the previous research activities, the following table shows the map of the main competences and knowledge elements of Tourist Lodge Management as emerging from the training program of EUSA university (Fig 4.).

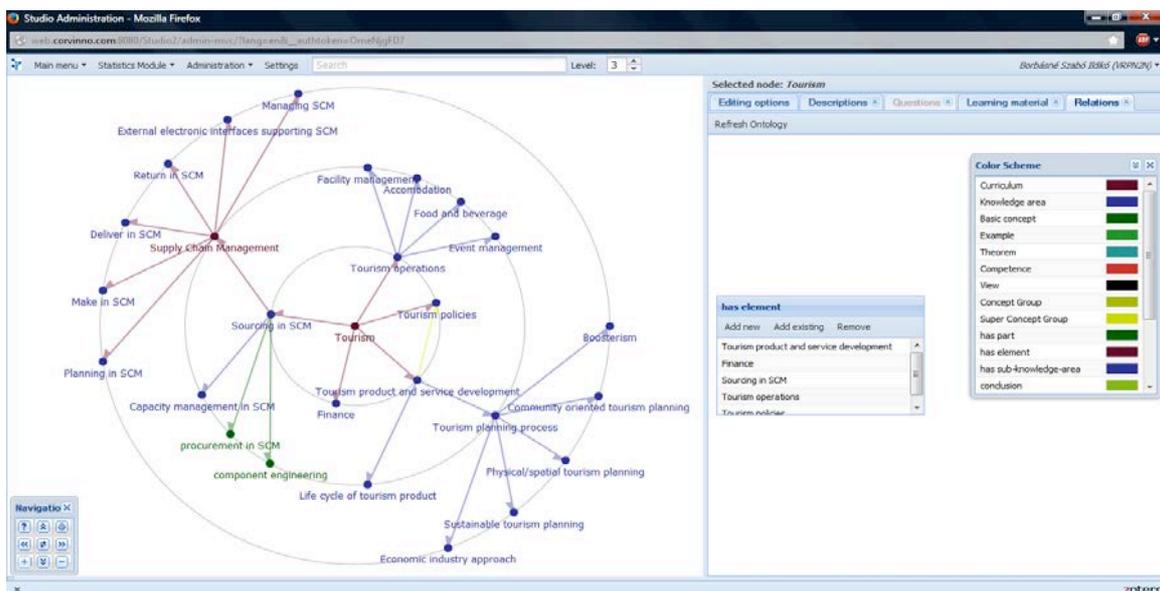


Fig. 3 - Tourism Ontology Development

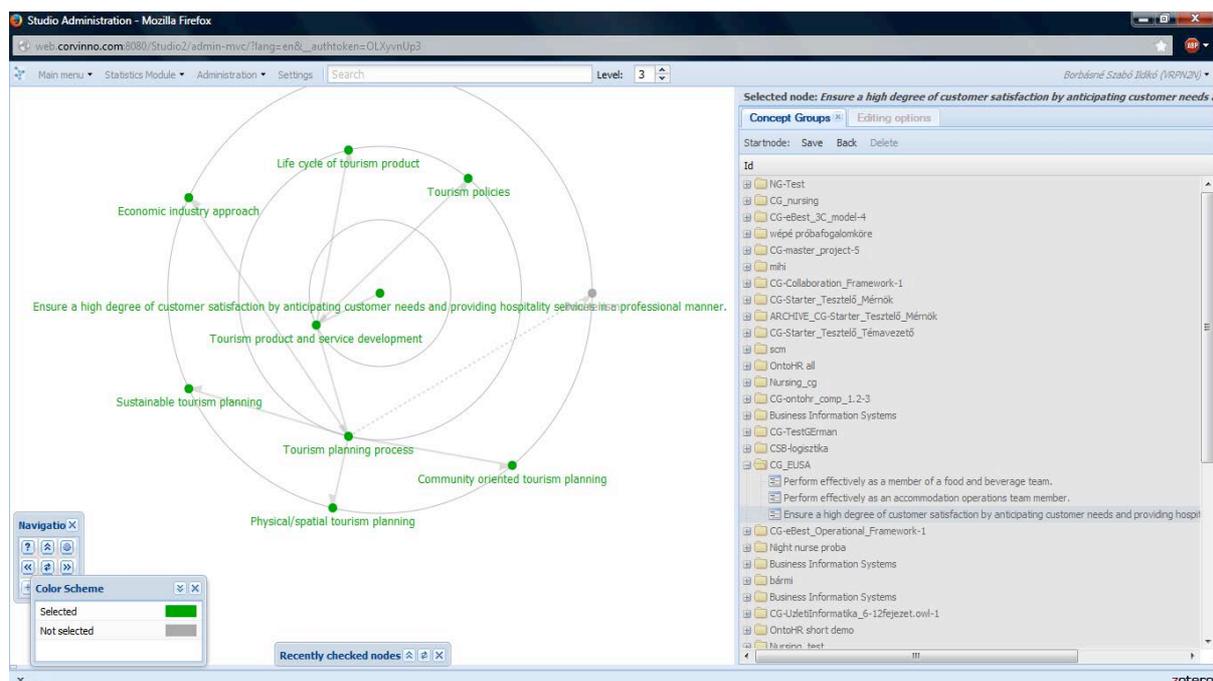


Fig. 4 - Tourist Lodge Management training program of EUSA university

Within the SMART validation process, the comparison -and ontology matching- between the skill demand and offer (with special reference to the Andalusian main educational and training specialized curricula and resources) has been carried on also with the Northern Ireland (NI) labour market emerging skills needs. The tourism sector is in fact one of Northern Ireland's largest employers, providing work for 45,000 people; moreover, a major industry report from People 1st, the skills expert for the tourism sector highlights that an additional 8,000 jobs including 3,900 managerial jobs will be created in Northern Ireland by 2017, rising to 29,200 if replacement demand is also taken into account. Consequently, tourism has been identified as a priority sector eligible for enhanced government support by the Northern Ireland Executive and Department of Enterprise.

The combination of these figures, alongside the projected growth of the sector, highlights the need for qualified and skilled workers who can fulfil the wide-ranging needs of Northern Ireland's hospitality and tourism businesses. The biggest skills gaps cited by employers within the hospitality, leisure, travel and tourism industry are around management and leadership, chef skills, and customer service skills. IT skills are also cited (social media, e-marketing, and so on).

The further SMART validation will allow to consolidate and integrate its ontology domains and to validate its potential in skill needs forecasting and anticipation; last, but not least, it aims to foster workers employability and mobility by building common curricula definition, competence transparency, shared learning resources. In this terms it is aimed to positively contribute to the achievement of LifeLong learning (and Erasmus Plus) strategic goals and expected impacts and, to the EURES system and the wider EaSI action and goals.

6 CONCLUSIONS

The main expected project outcomes are represented by: the improvement of the cooperation among stakeholders (from VET, institutional and business sectors) by the definition of common models, procedures and tools for the competences' matching process; the design and realization of an ontology-based adaptive tool that map and validate companies' and education competences. Additional expected result are: the identification and anticipation of new emerging jobs and competences needs in the Andalusian labour market; the comparison with the NI system in order to further enrich the system (and its learning resources) and to enhance workers employability and mobility. SMART is aimed at enhance the -national and transnational- employability and mobility of labour force (including the targeted mobility schemes) according to: the common EU frame; the system potential of adapting the training pathways (and modules) according to the -national and European- labour market needs.

The robust and stakeholders involvement realised in the first project stages (and foreseen to be continued and further valorise in the final ones) is aimed to support both an effective system design and project results valorization. This last dimension represent itself SMART main cornerstone: actors involvement on an ongoing base, within a trust and knowledge based cooperation model, represents itself the key driver of the same SMART effectiveness since it provides information and expectations and, at the same, sustainability base. This dimension is coupled -and reinforced- by the project approach, confirmed by the same emerging evidences within its implementation, of contemporaneously address institutional (organic cooperation models), methodological (ECVET, ontologies, learning outcomes), technological (knowledge sharing, communication and learning system) issues [12].

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