

Skills and Competences Development for the Professionals of the Future Transportation Sector – The SKILLFUL Project

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Abstract. The transport industry accounts for 4.5% of total employment, and represents 4.6% of Gross Domestic Product (GDP). This paper analyses the future needs to be gained concerning the training and expertise of the professionals in transportation field mainly because of the continuous and dramatic development of technology and more specifically the development and penetration in the transportation sector of intelligent systems. Furthermore, this paper proposes the introduction of some new business roles in the transport sector and more particular in the education and training chain that would help to achieve European wide competence development and take-up in a sustainable way, according also to the European project SKILLFUL that aims to perform a structured foresight into the vocational and academic qualifications in the Transportation sector of the future, as well as to enhance employability and sustainable industrial development in the transportation sector in Europe.

Keywords: ITS; automation; employability; transport professionals; skills; competences; future requirements; training tools; lifelong training.

1 Introduction

The transport industry of Europe employs over 10 million people representing the 4.5% of total employment, as well as the 4.6% of the Gross Domestic Product (GDP) [1]. This fact, combined with the continuous technological developments and the ongoing growth of the transport sector, increases the need for seamless education, training and qualification improvement of professionals in this sector.

National and regional authorities have traditionally been responsible for the development and evolution of the educational standards, curricula, training tools and methods addressing mainly the needs of national and regional labour-markets. Neverthe-

less, during the last years a trend concerning the globalization of the transport professionals' competences has been witnessed, regarding though mainly fields with a more international range of cooperation, such as ITS [2].

The European Commission places great importance on the role of academic and vocational qualifications having a direct impact on employability [3] and this is also a crucial element of the Europe 2020 strategy. The Bologna Process [4] and Lisbon Strategy [5] in Europe are, among others, the clearest examples of international engagement, for more comparable, compatible and coherent systems of higher education, as well as for the development of a dynamic and competitive knowledge-based economy in Europe.

Given this, some international initiatives have already been developed for educational and vocational programmes regarding transport professionals, such as joint University degrees based on cooperation between Universities from different countries. However we are still a long from even Europe-wide common qualifications and standards.

Part of this effort is also the SKILLFUL project, whose vision is to analyse the emerging trends, to identify the skills and competences required by the Transport workforce of the future and define the training methods and tools to meet them. SKILLFUL will focus on employability for all transportation modes and for multi-modal chains (which by themselves constitute a key transport of the future trend), as well as for all levels/types of workers (blue collar, white collar, managers, operators, researchers, etc.).

2 The Development of Advanced Transport Systems and Their Impact on Employability

The Intelligent Transport Systems and Services (ITS) make the transportation of people and goods more efficient, economical and thus smarter. They resulted from the combination of information and telematics technologies and their applications in the transport area and cover all modes of transport and all kinds of parameters associated with driving. Intelligent Transport Systems (ITS) can be used in order to make transport safer, more efficient and more sustainable, tackling Europe's growing emission and congestion problems for all modes of passenger and freight transportation.

As the digitization of transport is moving forward, through the rapid development and evolution of the ITS sector, the European Commission is already working with Member States, industry and public authorities to find common solutions to the various barriers and difficulties that have already occurred and will occur in the future.

The employability of the transportation sector is also directly affected by the development and deployment of intelligent systems. As these systems are establishing in all transportation areas, jobs in the sector are rapidly changing. For example, as the driver's cabin of a high-speed train becomes increasingly similar to an aircraft cockpit, train drivers are required to have additionally other skills than they used to, usually more advanced technical and analytical skills [6].

While the transport sector offers a wide variety of jobs with different skills requirements due to ongoing technological developments, in combination with social and economic trends, new pressures and needs are arising for highly skilled workers throughout the sector.

The need of better and more specialized education and training becomes even more urgent considering also that the trend to automation features all employment sectors and continues to be driven by a corporate focus on cost competitiveness, outsourcing of engineering functions, thus increasing quality requirements and rising wage inflation across emerging markets [7]. According to the Oxford Martin Programme on the Impacts of Future Technology, nearly half of U.S. jobs could be susceptible to computerization over the next two decades and the jobs in transportation, logistics, and office/administrative support are at “high risk” of automation [8].

Thus, the issue of employment in the Transport sector is a major social phenomenon that affects the life of millions of people and requires sound and effective handling. This purpose and effort can be reinforced and promoted by the SKILLFUL project, through the development of new training/educational schemes, programs and tools taking under full consideration the existing needs but also those which will be derived in the future. On the expected innovation of the SKILLFUL project is the best practices and knowledge transfer in various technologies (i.e. in automation from air to road transport; in operator monitoring and vigilance support across all modes; in electrification from rail to maritime and road sectors, etc.) performed within the project with the focus on interdisciplinarity in automated maintenance application using extensively IT technologies.

3 Enhancing Employability of the Transportation Sector of the Future

3.1 Future trends in transport systems and their job impact assessment

The development of the employment sector and its alignment with the current and future requirements is an issue of great importance for the EU. Providing people with the right skills for employment, as well as matching these skills with the labour market requirements remains a challenge [9].

For the above purpose to be achieved, emphasis needs to be given to the intelligent transport systems and services (ITS) and supporting technologies which have been developed to such an extent that they constitute an integral part of the transport sector. Advances in the Internet of Things (IoT), Networking and Connected Car technologies are transforming almost its overall context.

For the promotion and further development of the transport sector proper education and training of professionals is required, in order to be able to cope with the introduction of new technologies and automation in all transport areas and modes. Proper education and training is also essential for safety reasons as the incorrect use of such systems or the misuse of technologies of this kind by professionals not adequately qualified may lead to accidents or even to loss of lives.

During the SKILLFUL project, the most critical emerging technologies will be identified and analysed, in order for the connections between those technologies and future employment demands to be determined. Among the key technologies that are going to be analysed are the following:

- Information technologies and telematic applications.
- Cooperative Systems and V2X interfaces.
- Radars, lidars, machine vision and innovations in object recognition.
- Traffic big data handling methods.
- Pro-active traffic and incident management algorithms.
- Gamification concepts.
- Affective and Persuasive interfaces.
- Augmented Reality interfaces.
- New materials and processes.
- Logistic tracing and tracking.

Additionally, as the Transportation sector moves steadily from products to services, emphasis will also be devoted in the identification of relevant emerging novel service concepts and bundles. The most important service concepts will be recognized, as well as their impact to existing and emerging requirements of new jobs. Relevant key services and service concepts include:

- Mobility-as-a service (MaaS) enabling services (carpooling, carsharing, DRT and FMS schemes, etc.).
- Personalisation of services.
- Mobile services on the cloud.
- Context aware services.
- Support for on-the-fly decision making.
- Multimodal trip planners and routers.
- Payment mechanisms to facilitate easy transfers across different modes.
- Integration of social media into Public Transport.
- Novel tourism/recreational services, incorporating travel and mobility services.
- Integration of infrastructure-based and in-vehicle services.

Even more than technologies, new business schemes that accompany them will change the working ecosystem of transport. So, MaaS will push users from ownership to usership; thus creating a number of connected jobs and business opportunities to it. As major relevant business schemes the following ones are going to be analysed:

- Do-It-Yourself (DIY) schemes that changed the home furniture area some decades ago and are now migrating to the choice of vehicle and infomobility services sectors.
- Crowdfunding schemes that allow new transport related applications to emerge.
- Transport on demand schemes that adapt flexibly to the kind and number of objects to be transported.
- Fuel availability schemes that offer energy for transport vehicles available at the concrete time and the distinct localization.

- Retail and (e)commerce development.
- Transport workplace flexibility.
- Transport workforce flexicurity.

The identification, designation and analysis of all these technologies, services and business schemes is going to be the first and most crucial step that will trigger the procedures for the determination of required qualifications and competences for the future professionals of the transportation sector. During the SKILLFUL project these skills and competences are going to be prioritised, as well as gaps in the current and foreseen levels are going to be identified, in order to lay the foundations that will lead to the development of appropriate educational/ vocational system and program, accompanied by the relevant curricula, tools and methods. This whole procedure will, of course, take under consideration the current educational and training systems for workers in the transport sector (all modes).

3.2 The Introduction of New Business Roles in the Future Transportation Sector

Another factor that could contribute to the development and evolution of the future employability in the transport sector and which is a key element and objective of the SKILLFUL project is the creation of new business roles that will cover some of the new needs emerging by the overall change in the field of education and training of transport professionals. Some of these roles are the following:

- **“Knowledge aggregators”**: The technological advancements are so rapid that traditional players (i.e. VET organization and Universities, let alone Transport infrastructure or fleet operators) can’t follow them. On the other hand, Research Centers and performers that possess the relevant knowledge do not focus so much on training; especially as low to middle level skilled personnel is concerned. “Knowledge aggregators”, may thus be established as coalitions, spin-offs or other collaboration schemes between Research Institutes and Transport Associations or Universities/VET operators; to cover this need and become the Centers of Excellence on developing training material, tools and curricula, training the trainers and certifying the training processes.
- **“Training promoters”**: The need for the appropriate training to be continuous and make use of advanced tools (primarily ICT related, but also simulation ones) leads to a procedure that is more and more costly. And although “it pays off on the long run”, it may be difficult to be financially supported by individual SME’s or other entrepreneurs in the transport sector. Thus, alternative schemes may be established, utilizing existing or emerging stakeholders Associations but also PPP’s, in order to promote, guide and co-finance the necessary training schemes.
- **“Training certifiers”**: New courses and trainee/trainer competences need to be certified and accredited correspondingly at a Pan-European scale. In such a context, methodologies and policies should be implemented, in order to reach excellence and quality in education provision and harmonization throughout EU countries. Along with trainee requirement and trainer competences, trainer and educa-

tion providers would meet criteria for excellence through accreditation or other attests, agreements or certifications. A higher education institution at the EU level (similar to the European Consortium for Accreditation in Higher Education, ECA) may be mandated to assess requirements fulfilment and recognition of accreditation decisions.

The definition and analysis of new actor roles, such as ones described above may dramatically change the future training provision and become the catalyst for its sustainability.

4 Conclusions

Europe, potentially, will face a major skills problem in the near future. Over 20 million new jobs are expected to be created between 2006 and 2020. Expansion of high- and medium level skilled occupations is expected to continue over the next decade, while an increase is also anticipated for some jobs requiring lower level skills, like jobs that consist of simple and routine tasks and require basic education to carry them out [10].

The current paper deals with this important issue directly related to the sustainability of the transport sector, such as the proper and continuous education and training of its component members, so that they can meet the new and constantly alternating needs of the transport sector that are mainly deriving by the development of technology and of intelligent transport systems and services.

The SKILLFUL project is a new project which aims to utilize existing and emerging training/education methodologies, tools and knowledge, to design novel training/education schemes and pilot several of them, in order to prove their usefulness and assess their impact. SKILLFUL will also propose best practices, training application guidelines and policy recommendations to promote the novel training/learning schemes and their Europewide adoption.

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