TRAINING NEEDS AND SKILLS GAPS ACROSS THE TRANSPORTATION SECTOR

WP2 ‘Benchmarking and critical review of training schemes, curricula and tools’

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Objectives

- Identify the current training requirements in place across Europe and outside of Europe in different transportation careers and for different modes of transport
- Identify through a literature review and interviews with experts innovative and state of the art training methodologies and schemes in place across Europe
- Identify and benchmark through an extensive review of literature, innovative and state of the art training tools in existence across Europe
- Assess gaps that currently exist in training for transportation careers, through interviews with stakeholders and a series of workshops for each mode

Methodology

- Review of training across 16 countries using data collected through templates
- Interviews with experts in transport and education, focusing on new training tools, schemes and methodologies
- Workshops with stakeholders from air, rail, road, maritime and intermodal transport sectors.

Work package activities:

- Activity 2.1 :Critical Review of the educational and training systems and mechanisms in the transportation sector
- Activity 2.2: Review of innovative training methodologies and schemes
- Activity 2.3 Review of innovative training tools
- Activity 2.4 Gaps in training for transportation careers
- Activity 2.5 Selection of best practices and mapping to the training requirements and scenarios

Activity 2.1: Critical Review of the educational and training systems and mechanisms in the transport sector

- Templates were distributed to partners to collect information on training available at 3 management levels:
  - Strategic
  - Tactical
  - Operational
- Information was collected for
  - Maritime
  - air
  - Road
  - Rail

A2.1: Results

- Data was gathered and analysed for 16 countries: Australia, Belgium, Bulgaria, China, Germany, Greece, Ireland, Italy, The Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden and the UK
- The same information could not be collected for every country
- Data available on training courses was limited.
- Results seem to indicate quite a number of countries without formalised training for many positions, and substantial amount of “in-house” training in companies.
- Professions, such as civil engineering, have high levels of training in place. However, the level of specialisation available varies across countries (for example railway engineering).

A2.1: Results

- There is significant variations across countries in terms of available training/education and availability of information: UK has a lot of training/education schemes and a lot of information readily available.
- In-house training in many jobs in the transport sector is common.
- Monopolies of single companies providing training was evident across many countries.
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A2.2 and A2.3: New and emerging tools, methodologies and schemes

- Activities 2.2 and 2.3 were carried out concurrently in order to avoid overlap or participant fatigue for interviewees.

- Methodology:
  - Consultation with 32 experts in transport and/or education from 13 countries
  - Review of scientific literature: 112 papers were reviewed
  - Review of grey literature: 38 papers were reviewed

Results: A2.2, A2.3

- Experts:
  - Hard and technical skills are of most importance to low to middle skilled workers
  - All skills rated as important for engineers/researchers and managers, except interpersonal skills which were rated as “fairly important” for engineers/researchers
  - Experts identified the need for wider use of new training methods and better training in soft/transversal skills (in particular for highly skilled workers).
  - Experts saw e-learning, augmented and virtual reality and blended learning (amongst others) as promising new and emerging training methodologies.

Results: A2.2, A2.3

- Literature Reviews:
  - 3 types of resources: (a) Tools and techniques (b) Settings (C) Pedagogical Approach
  - In total 16 teaching resources identified and classified under each of the above categories.
  - These were similar to the tools identified by the experts and included game learning, virtual/augmented reality and virtual learning environments.
  - Conclusion: A blended learning approach to teaching, using both new and traditional tools, and a student-centric approach are recommended as the most likely to have a successful impact on learning.

A2.4: Gaps in training for transportation careers

- Methodology:
  - Interviews (to identify education gaps and training needs) with 30 interviewees from 10 countries and from Education, Research and the Transport Industry
  - 5 workshops: Stakeholders from industry (Maritime, air, Road, Rail and Intermodal):
    - Future job needs
    - Gaps in education
    - New technologies
    - Necessary skills for all modes

Workshops

Mode	Partner	Date	Location	Stakeholders
Rail	EURNEX	6th April	Potsdam, Germany	11
Intermodal	VIAS , Dee Blue	23rd May	Brussels, Belgium	17
air	Deep Blue, VPF, UCD	29th August	Brussels, Belgium	20
Road	CERTH	27th September	Thessaloniki, Greece	16
Maritime	VPF	25th September	Valencia, Spain	9

Rail Workshop

- Better training in new technologies was seen to be necessary to meet future requirements.
- Augmented reality (AR) will certainly become an important element of future job environments. There are plans to include AR in education and training, but they are still in their early stages.
- The industry tends to develop training methods of their own, which are designed to meet their particular requirements, but industry tends to restrict information exchange with other players.
- The Rail sector is facing the challenge of increasing automation.

Air workshop

- Cyber security: there will be a stronger focus on cyber protection and skilled cyber security experts will be needed. Difficulties in recruiting cyber security experts are considered as a problem for the sector.

- Over the next three years it is also foreseen that air sector organizations will require additional skills and experience, particularly in the fields of Safety and Compliance, Marketing, and New Technologies.

Air workshop

- The air sector will require significant growth in the number of Licensed Engineers and Support and Training Staff for Air Traffic Controllers.

- New jobs will be requested in IT (software and security), engineering with architectural view, systems and aerodynamics, soft skills, project management and leadership skills, cyber security.

Air workshop

- Training methods could be improved by having short ‘booster’ courses from a day to a semester long.

Air workshop

- The emerging new technologies are listed as follows:
  - Technologies for developing alternative energy sources (Electrification and Hydrogen),
  - Autonomous transportation systems (Drones/UAV),
  - Smart Materials (composite materials, nanotechnologies, additive manufacturing/3D printing),
  - Adequate design of automation,
  - New apps and systems based on UCD (user centered design) principles, safety knowledge and principles,
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Air workshop

- Importance of soft skills for workers: This should be adequately integrated in the curricula. Soft skills can be taught also by using different educational format to stimulate them.

Intermodal workshop

- Over the next few years the intermodal industry will require additional skills, particularly in the fields of IT (data analysis, data sharing, software engineers), research and development, cybersecurity, logistics and transport (planners, infrastructure and equipment's developers, logistics specialist, specialist in interoperability in railways).

- The companies lack training in the fields of new mobility systems training for trainers, data protection, artificial intelligence and process auditing. The companies proposed earlier education about technologies and in particular for those which are relevant for the transport sector

Intermodal workshop

- The emerging new technologies in this sector are based on cybersecurity, automation across modes, connected vehicles and data market for personalized services.

- The skills that require new or additional training will be cybersecurity and automated driving.

Maritime workshop

- New jobs can be generated in the maritime sector related to green jobs (power engineers, alternative and new energy sources), IT (automation, remote operation and remote control) and data analyst (shipping market and economic analyst).

- Heavy electrical and power engineers are difficult to recruit because of the shortage and competition from other transport modes and utility companies.

- Companies lack maritime transport and logistics educational programmes at universities and specialist short courses to upgrade/update people that are more experienced.

Maritime workshop

- In order to reduce the gap between industry requirements and university educational programs, hybrid lecturers were proposed as a partial solution. Hybrid lecturers would be actively working in the industry therefore providing immediately applicable skills.

- Furthermore, internships as part of the current educational programmes should be taken into account in order to improve the practical skills of the students. This should be adequately integrated in the curricula.

Maritime workshop

- The emerging new technologies in maritime transport will focus on green technologies (new fuels, gas treatment, electrification of terminals and ships, offshore renewables, fuel cells and large-scale energy storage) and artificial intelligence.

- The skills that require new or additional training are related to flexibility and efficiency, negotiation and communication, management and customer relationships and regulation and rules.

Road workshop

- New jobs areas expected to emerge in road transport:

- MaaS (mobility as a service) related jobs
- Artificial Intelligence assistance engineers
- Internet of Things analytics
- Big Data analysts
- Mobility behavior experts
- HMI cognitive supporter (for example for prioritization issues for elderly drivers, etc.)

Road Workshop

- Current jobs need to be adapted to better integrated to future trends:

- Mobility planners (at city level) with the use of Sustainable Urban Management Plans (SUMPs)

- Urban freight planner with the use of Sustainable Urban Logistics Plans (SULPs)

- Intermediary cooperative – ITS expert/ facilitator, predictive road maintenance experts

Road workshop

- Gaps in education in road transport: There is a need for the development of a “Transport engineering” degree: a dedicated holistic course combining all engineering areas, containing mobility behaviour issues also. There is also a need for development of an “ITS engineering” degree consisting of issues/ courses from transport and telecommunication areas.

- Urgent need for differentiation and distinction between educational and training courses and schemes: Education (Labs, AR/VR & remote education, practical and iterative education) and training (gamification, social media, distance learning web proctoring).

- The skills that require new or additional training are related to ITS technologies, behavioural sciences (i.e. psychology, ergonomics, etc), law, sciences and business related to information technologies.

Findings:

- Automation and AI will play a key role in generating new jobs across the sectors.
- Big data will be of major importance across modes in the future and there is need for more data analysis skills in employees.
- Cybersecurity skills will grow in importance in companies in the future.
- Green technology is an area of growth for transport employers and they need employees who understand sustainable development and alternative energy development.
- Softer skills training also needed
- There needs to be more and closer cooperation between universities and industry in training and educating future employees and in ensuring up-skilling of current employees. .

Results: A 2.5

- Gaps: Technology, Automation, Softer Skills, Cybersecurity etc.
- Best practices:
- Closer links between the educators/trainers and industry. This will enable better education/training of current students and better CPD/on-the-job training for those already working. There are a number of formats identified in the literature and interviews that could help promote this:
  - Internships, Lectures from those in practice, Work-based learning,

Results A 2.5

- Upskilling and continuous retraining of workers is important, in particular as new skills in cybersecurity and other highly technical areas become more essential. There are many resources that allow this to happen more easily today than in the past:
  - Virtual Learning Environments
  - Distance/Mobile Learning
  - Smart learning technologies

Results A 2.5

- While technology and changes in teaching practice allow for more innovative forms of teaching and training, there is still a place for traditional forms of teaching (lecturing, tutorials etc.) A blended approach is seen as being the most likely to have a significant impact on student learning.

- A student-centric approach, where the student takes ownership of their learning, is recommended as best practice both at early stages and while working. This type of approach ensures engagement from the student and promotes life-long learning.

- There is a need to assess the impacts of the resources identified in the project on skills and learning.

Matching gaps to teaching resources

Gap	Modes that identified this gap	Training tools/methodologies
IT Skills	All modes	Smart Learning Technologies, Virtual Learning Environments
Autonomous vehicles	Rail, Roads, Intermodal	VLE, Virtual/Augmented Reality, Simulations
Augmented reality in the work place	air, intermodal	V/A Reality tools
Cyber security	air, Intermodal	Smart Learning Technology Robotics VLE V/R learning tools

(Continued)

Gap	Modes	Tools
Green jobs	Maritime, Road	Portfolio approach, Smart Learning Technology, Collaborative Learning
Industry/Educator Links	Maritime	Portfolio approach, Smart Learning Technology, Collaborative Learning Work based learning Heutagogy
Logistics skills	Maritime	Game Based Learning, Collaborative Learning Work based Learning
Behavioural skills, psychology	Road	Portfolio approach Game based learning Collaborative learning