Smart qualifications for smart employees in air transport

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KAAT
Knowledge Alliance In Air Transport

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PART 1
Context and future occupations

Future trends
Vision for future transportation system in 2030

The following **long-term societal changes** are important for the future transportation system including the aviation sector:

URBANISATION:
Growing and extending cities lead to the emergence of city-regions, requiring development of different, well interconnected transportation solutions.

DIGITALISATION:
Technological change is occurring faster, creating a gap between technological innovation and societal progress. Creation of smart cities will further push the digitization and deployment of new technologies in transport.

DEMOGRAPHIC CHANGES:
Demographic composition of the workforce is changing. These demographic changes together with technological innovations will require more flexibility in labour conditions.

CLIMATE CHANGE:
Climate change, air pollution, noise and the shortage of resources have strong impacts on policy making and result in societal demand for sustainable transport solutions.

SAFETY AND SECURITY:
The growing concern of governments in relation to terrorism, migration and cyber threats. New technologies can assist in developing high-security systems for the future.

GLOBALISATION
Increasingly integrated global labour markets will lead to higher mobility across countries requiring transversal, international skills.

Today, airspace is occupied mainly by traditional manned aviation

- Traditional piloted fixed-wing and rotorcraft with limited connectivity
- Internet of things on airports
- Airport digitalisation – ACDM and TAM



Thousands of aircrafts in the sky

Tomorrow, Digital Aviation infrastructure to enable all air operations

- **Connected airplanes and rotorcrafts, drones**, urban air mobility and taxi services
- **Smart airports**, advanced airport digitalisation



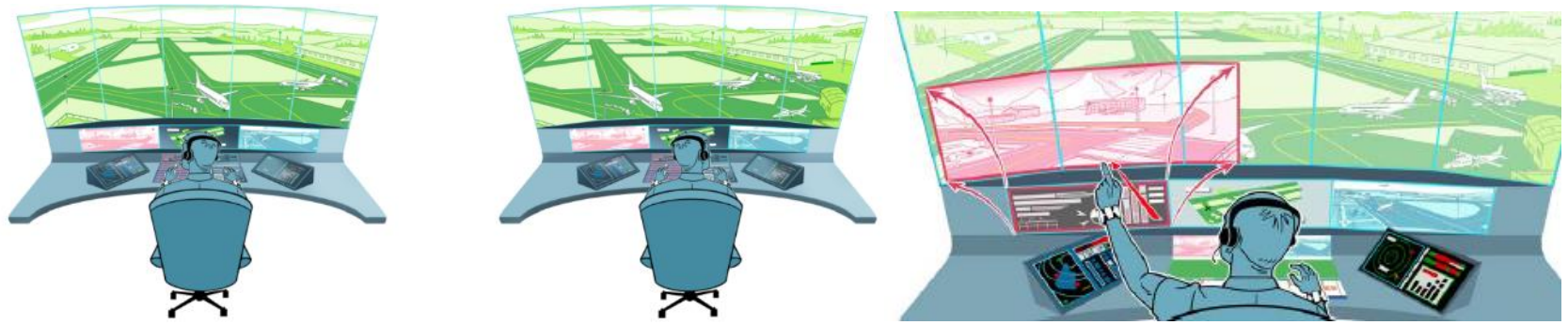

Hundreds of thousands of connected flying vehicles in the sky

MULTI AIR OPERATIONS BASED ON DIGITAL AVIATION INFRASTRUCTURE

Highly qualified workforce

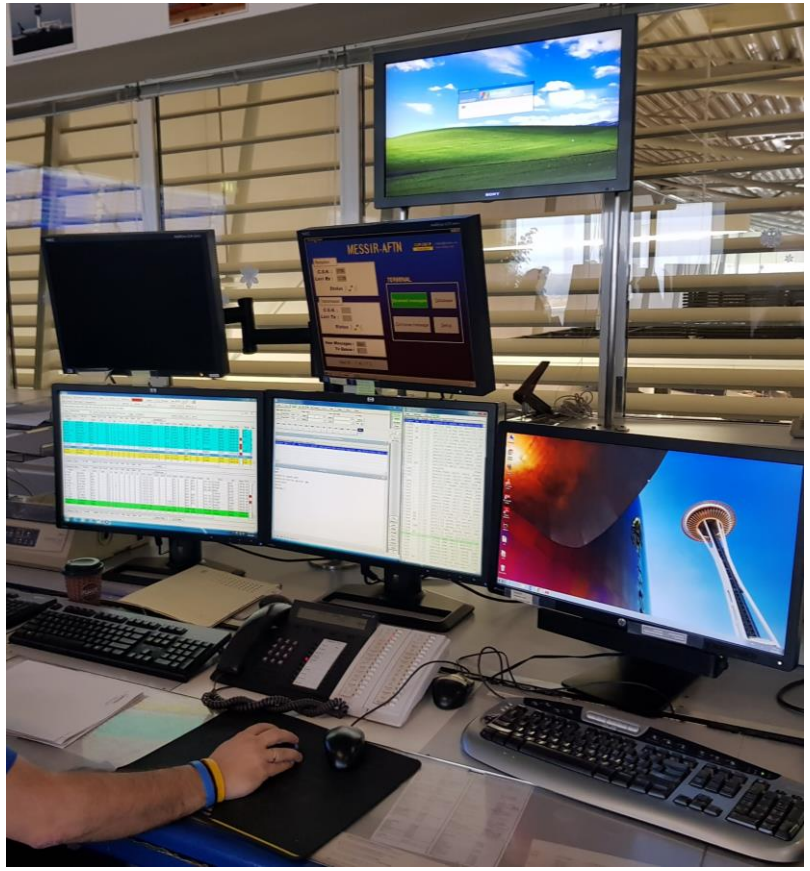
The changing nature of work

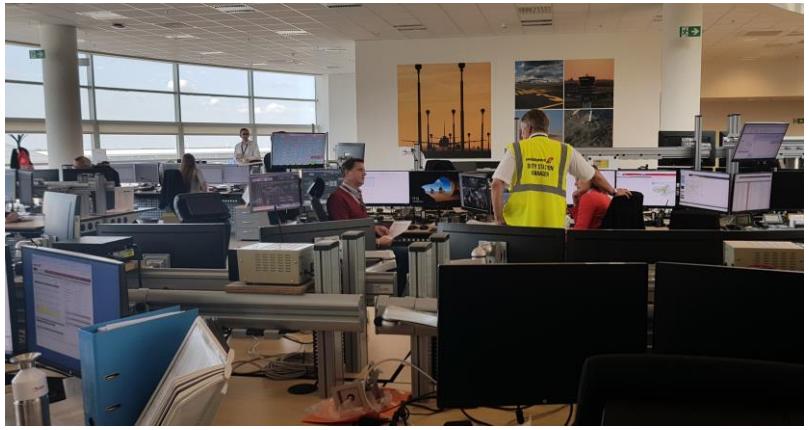
BIG DATA & CONNECTED SYSTEMS

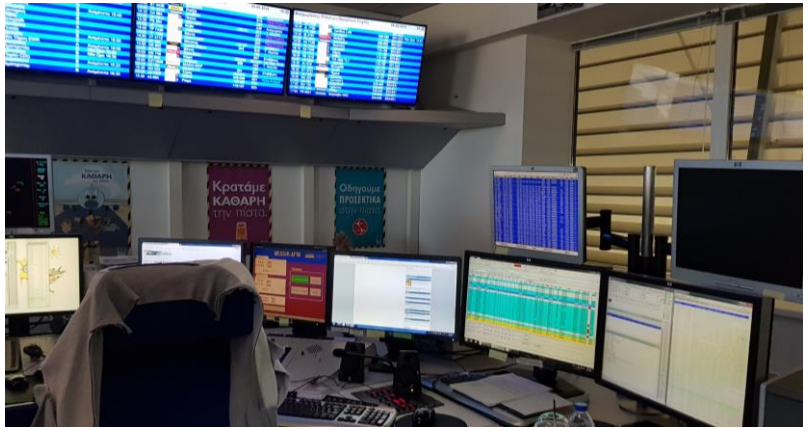


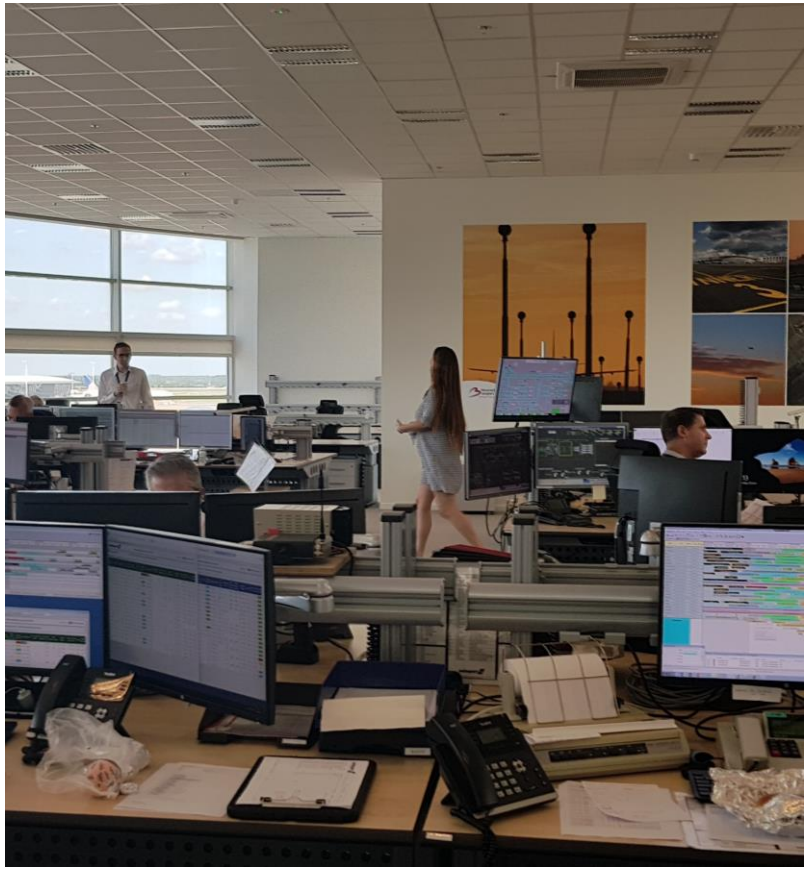
MULTI SENSORY INTERACTION

AUGMENTED REALITY









APOC – Athena and Brussels

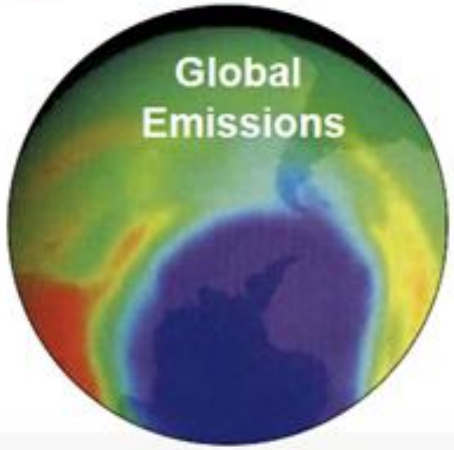
The changing nature of work
Emerging occupations (Examples)

ATC/ATM VIRTUALIZATION AND AUTOMATION	AUTONOMOUS SYSTEMS	SECURITY AND CYBER-SECURITY	ELECTRIC AND SUSTAINABLE AIRCRAFT
			
• Remote tower controllers • AI engineers/VR experts • Big data analysts • Robotics engineering	• Drone operators • Automated vehicle operators • Designers of autonomous vehicles • Safety officers for unmanned systems	• Software and AI engineers • Big Data and analytics experts • Security (& cyber security) experts • Legal services personnel and ethics and privacy protection specialists	• Energy and maintenance engineer • Electrical engineer/ Alternative Vehicle Developers • Climate Change Reversal Specialist • Consumer Energy Analysts • Battery Technician • Solar Flight Specialists

Sustainable development

* Aviation is a valuable driver of the world economy, but it is also leading the way with efforts to improve its environmental performance.
* It is the first industry to have ambitious global goals for reducing the climate impact of its operations which currently contribute 2% of man-made CO2 emissions.

Aviation's Environmental Impact



Measuring airports' vulnerability to assess their climate change resilience capacity

* Qualifying **the risks that climate changes pose to airports** in order to raise operators awareness on their resilience capacity
  * Identifying a list of climate change hazards and their consequences on airports;
  * Developing a methodology to qualify/ quantify the risks associated with the climate change effects;
  * Designing an automatic tool for airport to spot strengths and weaknesses.

Identifying climate change effects and impacts

- List of relevant climate changes
  - Six general categories of climate evolutions were identified
    - Temperatures evolution
    - Precipitation evolution
    - Sea level evolution
    - Biodiversity evolution
    - Wind evolution
    - Extreme events evolution

  - Nine hazards are finally considered

Evolution	Wind	Biodiversity	Sea-level rise	Temperatures		Extreme events			
Hazard	Direction change	Location, migration	1 metre rise	Heat wave	Drought	Sea swell or waves	Strong rains	Extreme winds	Snowfalls
Impacts	Binding Xwind	Wildlife hazard rise	Submersion	Fires, long take-offs	Clay expansion	Ponctual submersion	Floodings	Destruction	Contamination, destruction

Example

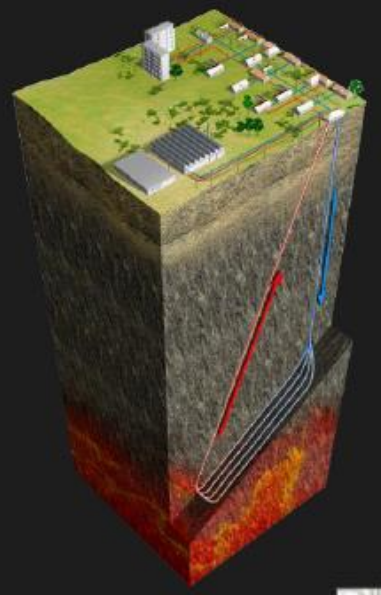
TRANSPORTATION

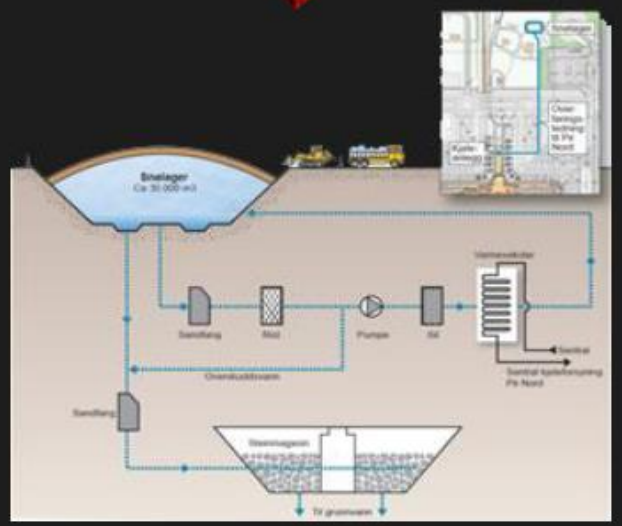
- **Public transportation**
  - 65 % of all pax
  - 310 trains/day
- **Electric vehicles**
  - 3 % of all cars sold in Norway are electric
  - 150-200 EV-chargings every day
  - Building high capacity EV charging stations at the airport
- **Supporting carbon neutral transportation**
  - Electric
  - Hydrogen Fuel-cell
  - Biogas and Biofuels

Energy management of terminals

ENERGY MANAGEMENT

- Assisting birth of new technology
- Implementing known green technology
- The airport buildings of the future will use less energy
  - Can they even produce renewable energy?



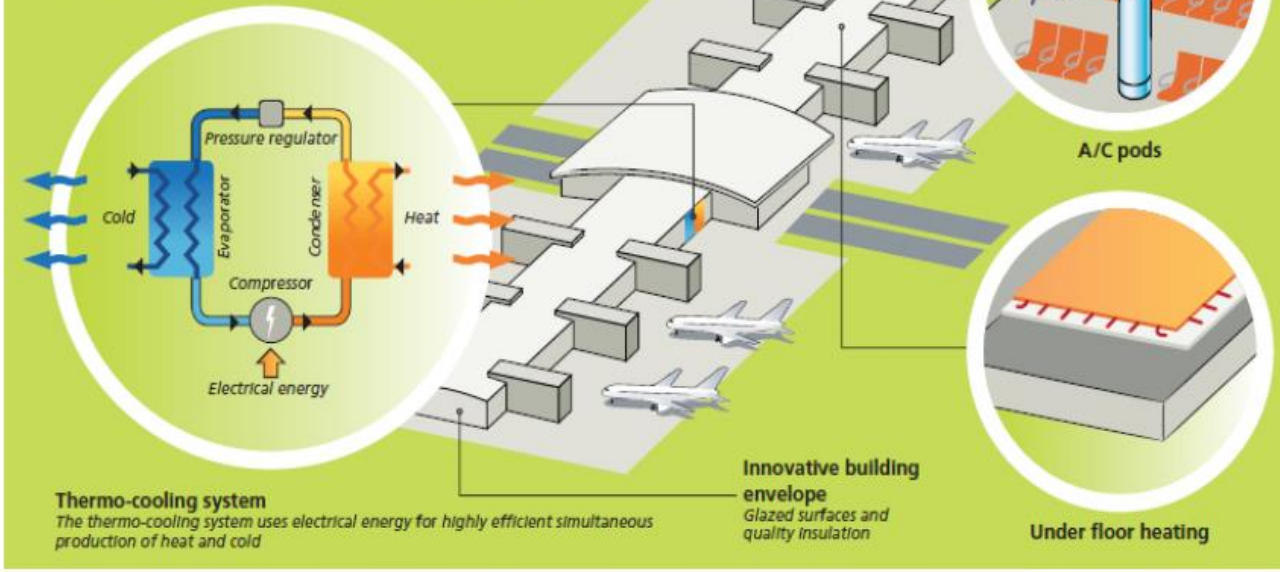


CDG – energy management

CDG- Terminal 2E - Satellite S4

Key figures
- 770 m long – 4 levels
- 100,000 m² floor area
- 2400 m² of retail space
- 580 million euro investment

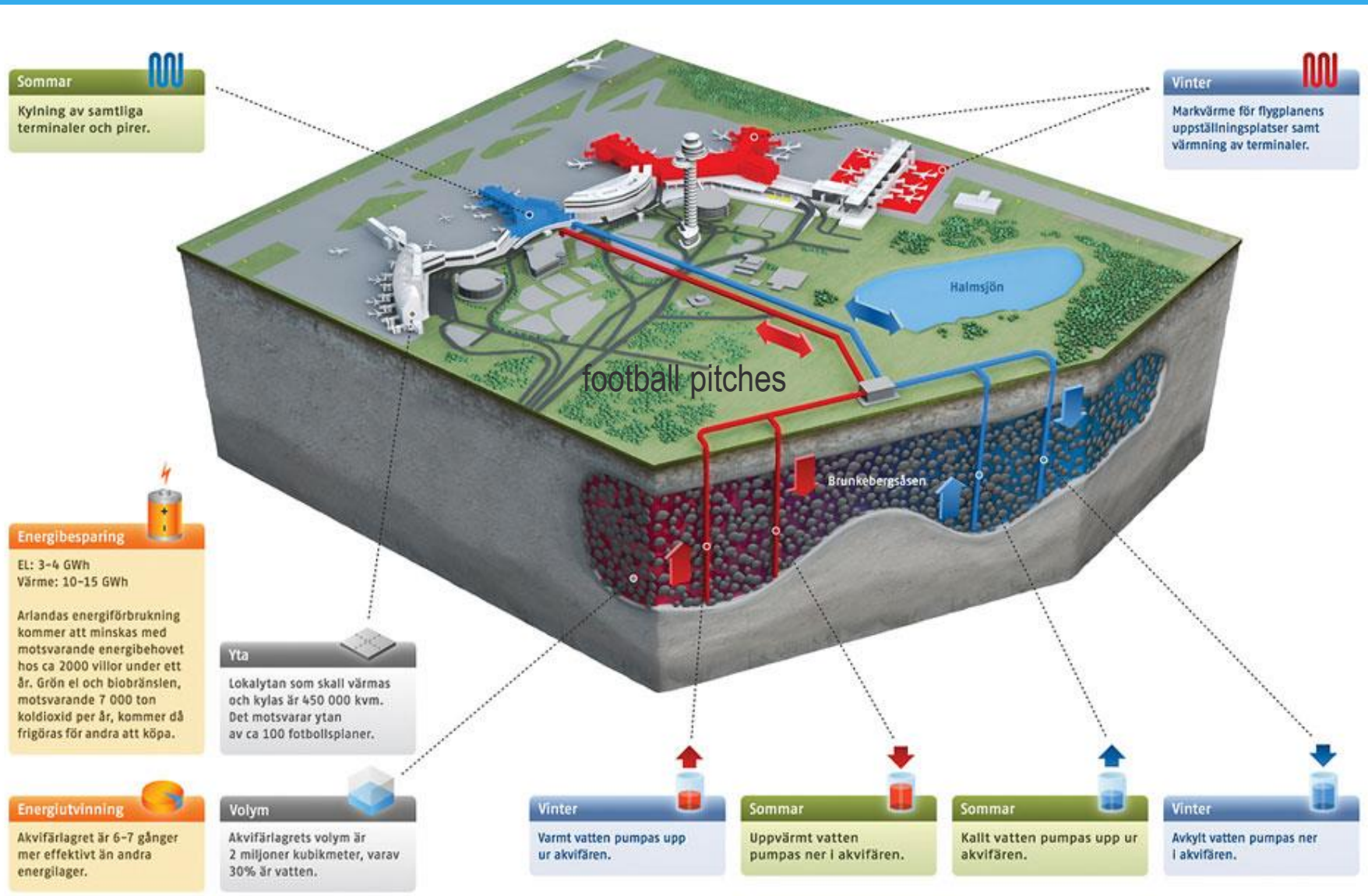
Satellite 4: a high performance building



Thermo-cooling system
The thermo-cooling system uses electrical energy for highly efficient simultaneous production of heat and cold

Innovative building envelope
Glazed surfaces and quality insulation

The aquifer


Sommar
Kylning av samtliga terminaler och pirer.
Vinter
Markvärme för flygplanens uppställningsplatser samt värmning av terminaler.
Halmsjön
football pitches
Brunkebergsåsen
Energibesparing
EL: 3-4 GWh
Värme: 10-15 GWh
Arlandas energiförbrukning kommer att minskas med motsvarande energibehovet hos ca 2000 villor under ett år. Grön el och biobränslen, motsvarande 7 000 ton koldioxid per år, kommer då frigöras för andra att köpa.
Yta
Lokalytan som skall värmas och kylas är 450 000 kvm. Det motsvarar ytan av ca 100 fotbollsplaner.
Energiutvinning
Akvifärlagret är 6-7 gånger mer effektivt än andra energilager.
Volym
Akvifärlagrets volym är 2 miljoner kubikmeter, varav 30% är vatten.
Vinter
Varmt vatten pumpas upp ur akvifären.
Sommar
Uppvärmt vatten pumpas ner i akvifären.
Sommar
Kallt vatten pumpas upp ur akvifären.
Vinter
Avkylt vatten pumpas ner i akvifären.

PART 2:
Future occupations and qualifications

Competency framework for occupations in the aviation sector

INTERPERSONAL SKILLS AND TEAMWORK

- COLLABORATION AND CONSULTATION
- INTERPERSONAL AND CULTURAL AWARENESS

CUSTOMER FOCUS

- CLIENT MANAGEMENT
- SERVICE EXCELLENCE

COMMUNICATION AND REPORTING

- COMMUNICATION
- UNDERSTANDING TECHNICAL CONTENT
- REPORTING AND DISSEMINATION

LEADERSHIP, MANAGEMENT AND PLANNING

- ORGANISATION OF WORK
- MANAGEMENT OF PROCESSES
- MANAGEMENT OF HUMAN RESOURCES

SAFETY AND RESPONSIBILITY

- SCREENING, PREVENTION AND MONITORING
- SAFE AND ETHICAL PRACTICE
- COMPLIANCE WITH REGULATIONS

TECHNICAL EXPERTISE

- EQUIPMENT AND VEHICLE OPERATION
- DESIGN, MANUFACTURING AND INSTALLATION
- CLEANING, MAINTENANCE AND REPAIR
- MANUAL HANDLING
- PREPARATION AND SET-UP
- DATA-ANALYSIS AND RESEARCH

TRAINING AND DEVELOPMENT

- CONTINUOUS LEARNING
- TRAINING OF OTHERS
- ASSESSMENT AND REVIEW

PERSONAL RESILIENCE AND CRITICAL THINKING

- COPING WITH CRISIS AND PRESSURE
- ADAPTABILITY
- DECISION-MAKING

Q24: Out of the following competences, how important do you feel they are for your current occupation within the aviation sector?

	NOT IMPORTANT	FAIRLY IMPORTANT	VERY IMPORTANT	N/A	TOTAL	WEIGHTED AVERAGE
Teamwork and collaboration	1.05% 1	4.21% 4	94.74% 90	0.00% 0	95	2.94
Interpersonal skills and service excellence	1.05% 1	15.79% 15	82.11% 78	1.05% 1	95	2.82
Communication and reporting	1.05% 1	12.63% 12	86.32% 82	0.00% 0	95	2.85
Leadership, management and planning	1.05% 1	23.16% 22	74.74% 71	1.05% 1	95	2.74
Decision-making, safety and responsibility	2.11% 2	18.95% 18	76.84% 73	2.11% 2	95	2.76
Compliance with regulations	5.26% 5	17.89% 17	73.68% 70	3.16% 3	95	2.71
Technical expertise	3.16% 3	29.47% 28	65.26% 62	2.11% 2	95	2.63
Teaching, advising and coaching	6.32% 6	43.16% 41	48.42% 46	2.11% 2	95	2.43
Dealing with complexity and adaptability	0.00% 0	28.42% 27	71.58% 68	0.00% 0	95	2.72
Critical thinking and analysis	0.00% 0	24.21% 23	73.68% 70	2.11% 2	95	2.75

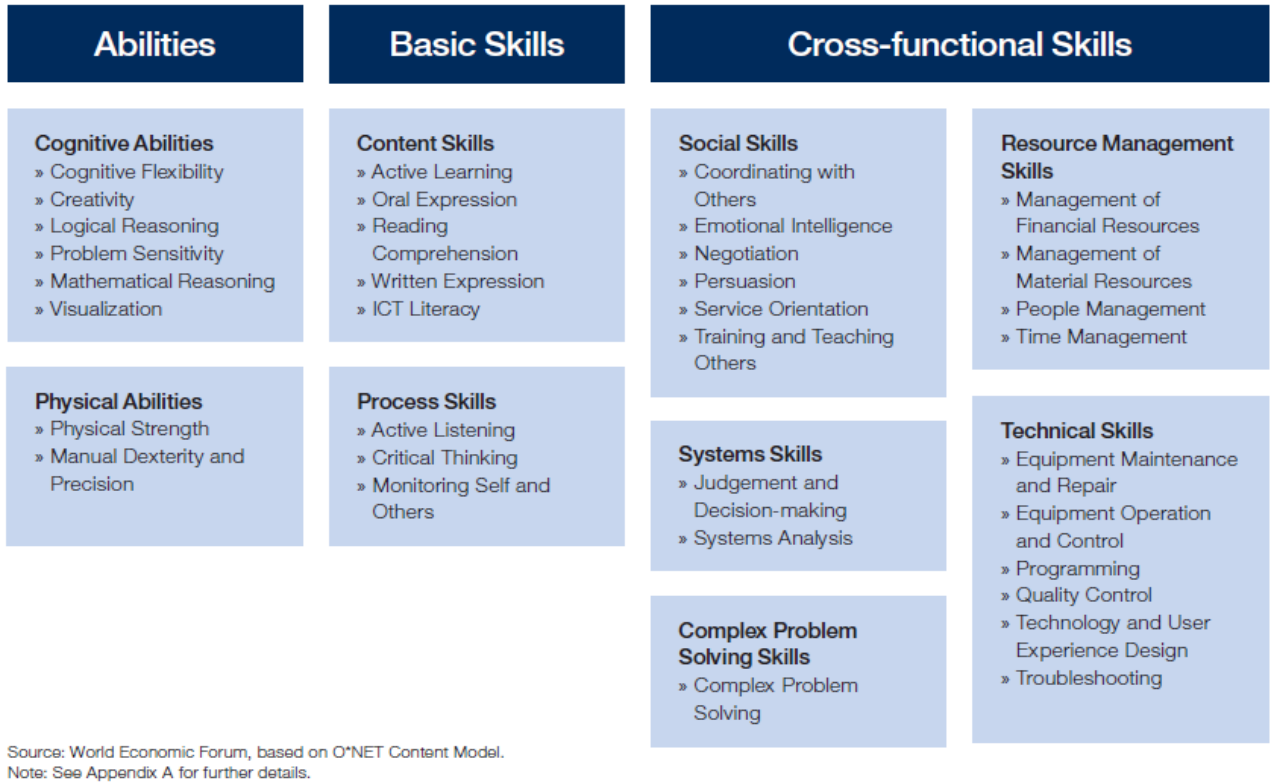
New skills
Re-skilling and up-skilling

Together, **technological, socio-economic, political and demographic changes** will generate **new categories of jobs and occupations** while changing and displacing others.

These macro changes are going to require **new sets of skills** in both current and emerging occupations within the transport system and to transform how and where people work.

Internal mobility (within the aeronautic sector) and **external mobility** (between different transportation modes) **will increase, requiring more cross-function skills and a combination of soft skills together with technical skills.**

Figure 9: Core work-related skills



Source: World Economic Forum, based on O*NET Content Model.
Note: See Appendix A for further details.

New skills in the aviation sector
Re-skilling and up-skilling

The aviation engineer of the future[1] will require **a mixture of technical and soft skills**, including:

- Digital competencies (advanced analytics and big data, cloud and service platforms, mobility, etc.)
- Design thinking
- Entrepreneurial thinking
- Cyber security skills
- Skills related to virtual/augmented reality

Experts across Airbus[1] have highlighted the growing need for graduates trained in **cyber security** and **data science**. In the future, there will be a huge demand of specialists who will analyse and interpret big data collected in transport.

A recent study conducted by MGI[2] found that future workforce will spend:

- **more time** on activities of **control, supervision, managing of people and communication**
- **less time** on **physical activities**, where machines already exceed human performance

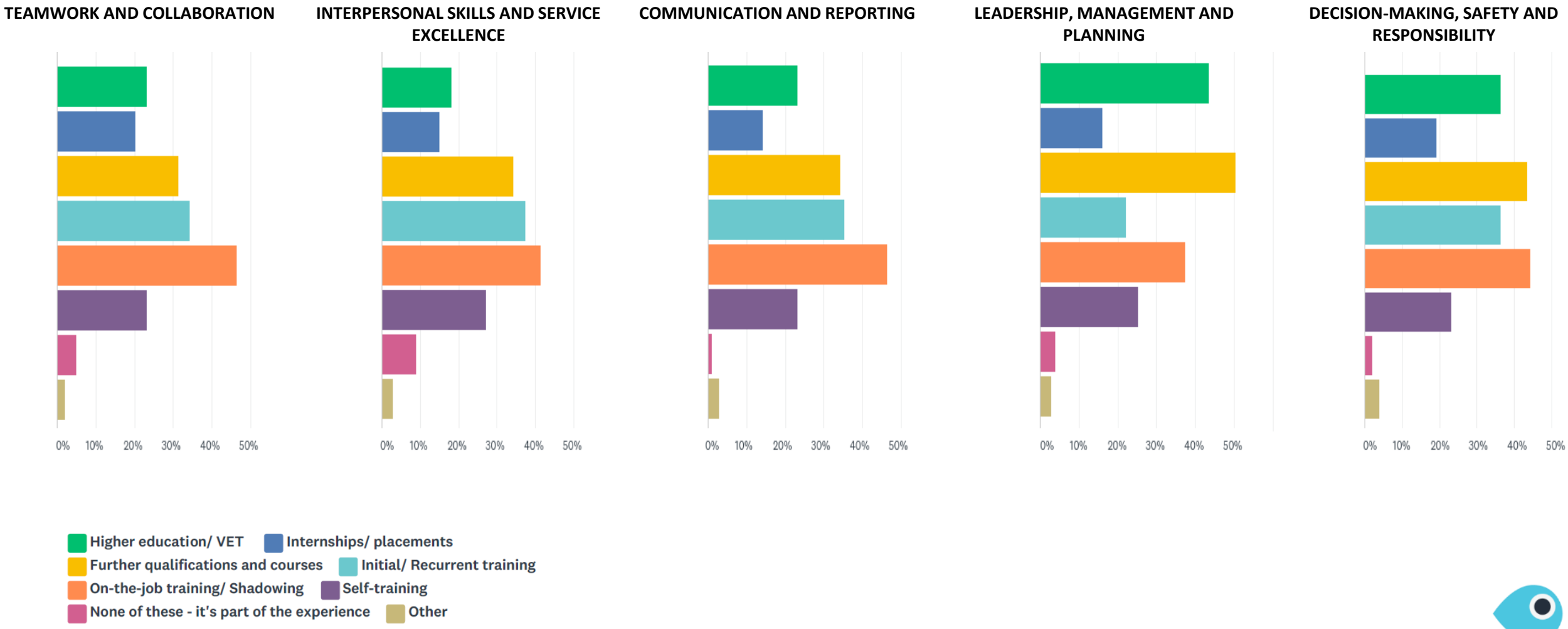
[1] Airbus Global University Partner Programme, *"The engineer of the of the future"*, White Paper 2018
[2] McKinsey Global Institute, *"Job lost, jobs gained: Workforce Transitions in a time of automation"*, December 2017

Q26: In the next 10 years, do you think the importance of these competences will stay the same, increase or decrease?

	WILL DECREASE	WILL STAY THE SAME	WILL INCREASE	TOTAL	WEIGHTED AVERAGE
Teamwork and collaboration	4.21% 4	38.95% 37	56.84% 54	95	2.53
Interpersonal skills and service excellence	5.26% 5	41.05% 39	53.68% 51	95	2.48
Communication and reporting	4.21% 4	40.00% 38	55.79% 53	95	2.52
Leadership, management and planning	5.26% 5	45.26% 43	49.47% 47	95	2.44
Decision-making, safety and responsibility	3.16% 3	41.05% 39	55.79% 53	95	2.53
Compliance with regulations	4.21% 4	44.21% 42	51.58% 49	95	2.47
Technical expertise	7.37% 7	42.11% 40	50.53% 48	95	2.43
Teaching, advising and coaching	10.53% 10	42.11% 40	47.37% 45	95	2.37
Dealing with complexity and adaptability	3.16% 3	32.63% 31	64.21% 61	95	2.61
Critical thinking and analysis	3.16% 3	40.00% 38	56.84% 54	95	2.54

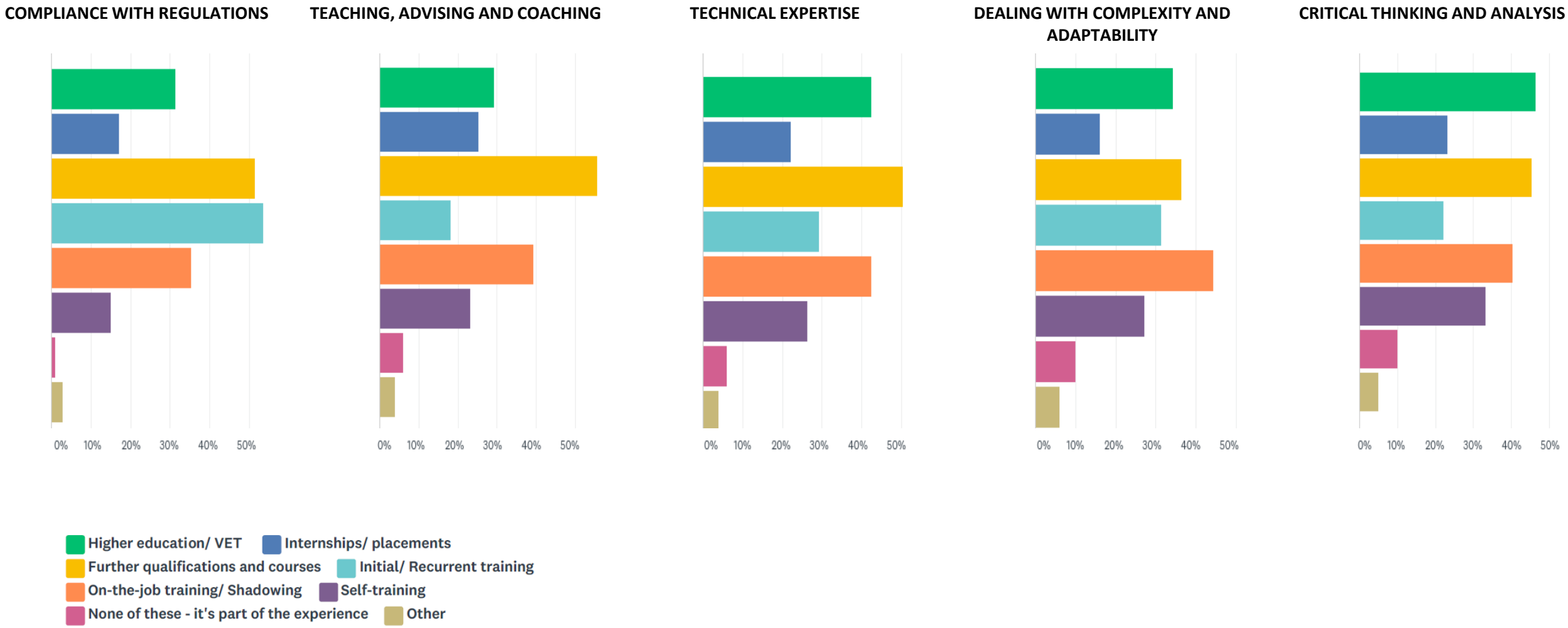
Q16: In your opinion, who should be responsible for providing training in the following competence areas?

(1/2)

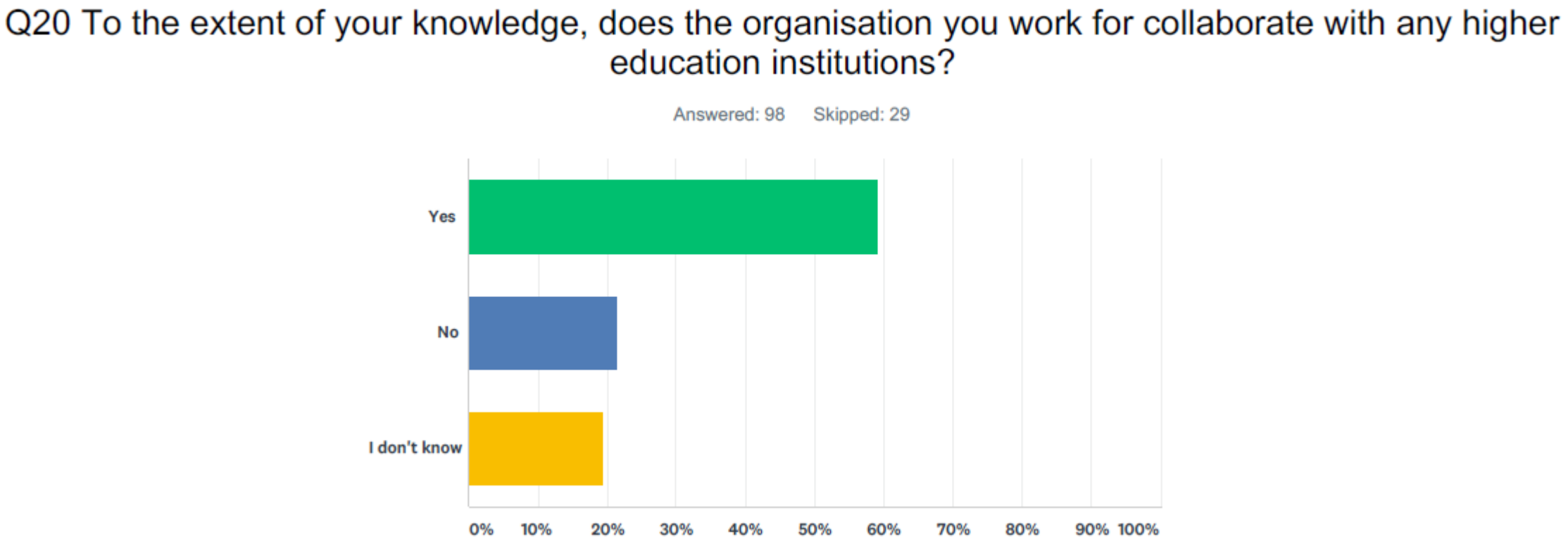


Q16: In your opinion, who should be responsible for providing training in the following competence areas?

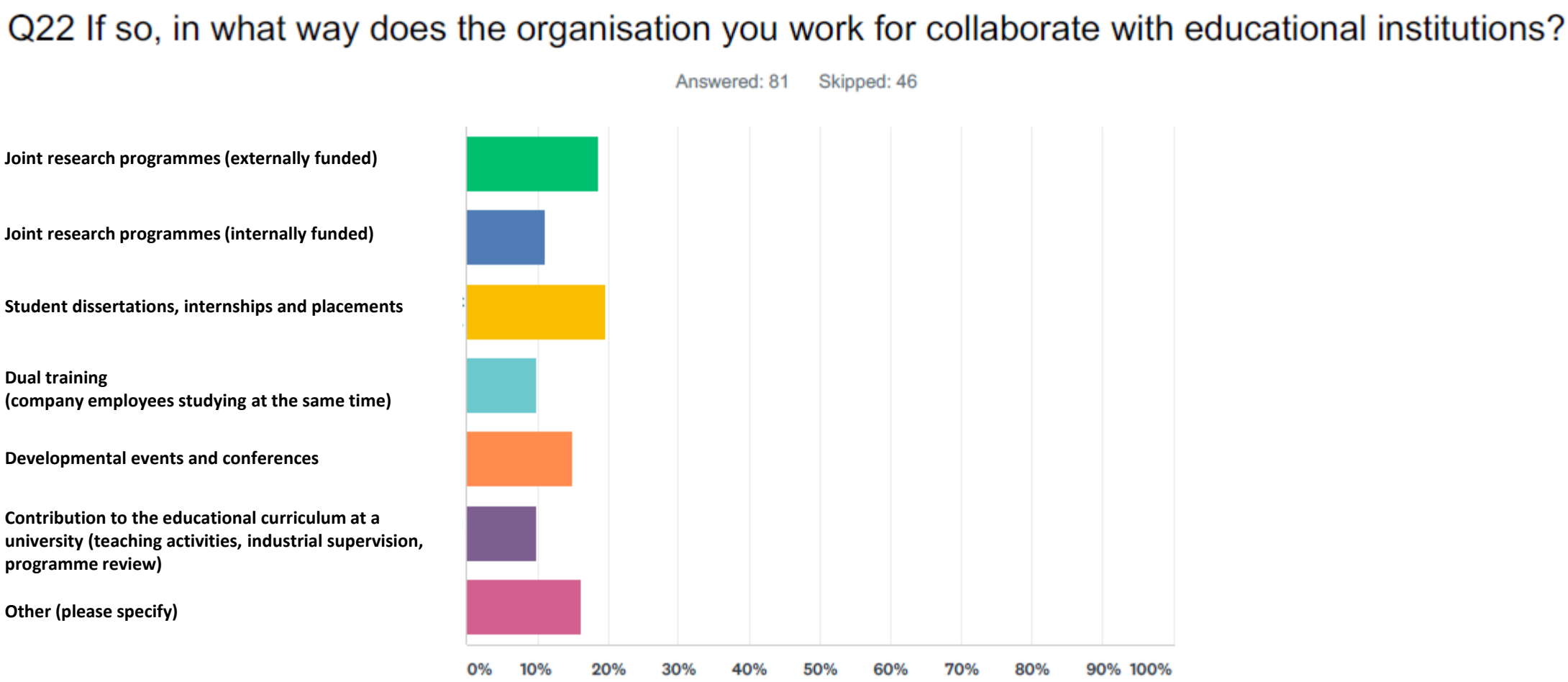
(2/2)



Q20: To the extent of your knowledge, does the organisation you work for collaborate with any higher education institutions?



Q22: If so, in what way does the organisation you work for collaborate with educational institutions? (1/2)



Challenges for educational institutions

COMPETENCY BASED TRAINING + KNOWLEDGE AND SKILLS

TEAMWORK AND SOFT SKILLS

AR AND VR FOR TRAINING

*"You need many **skilled people**, minimum level of **education** needed is going to get higher. Some kind of professional degree in computer science (…) We are forcing the threshold of education to move up. It is going to be tough if you do not get good **training**."*

*"Technical collages need to **collaborate** with industry… but there is a risk of low focus on people. People **understanding of behaviour** is still limited. People need to understand how we behave and interact. Technical education needs to become part of that. You need a combination of the two (**human behaviour and technology**). Very separated at the moment."*

ALIGN LEARNING OUTCOMES TO TIMELY RESPOND TO THE NEW NEEDS OF A FASTLY EVOLVING LABOUR MARKET

Improvement of aviation sectors

where the high and interdisciplinary qualifications of employers are essential

- **Economic Development Planning**
- **Air Transport Regulatory Framework**
- **Aviation Infrastructure**
- **Resource Mobilization**
- **Safety and Security**
- **Environmental Protection**

The **digitalisation** is a **cross sectorial action** which supposes advanced skills and competences in ICT and in aviation simultaneously.





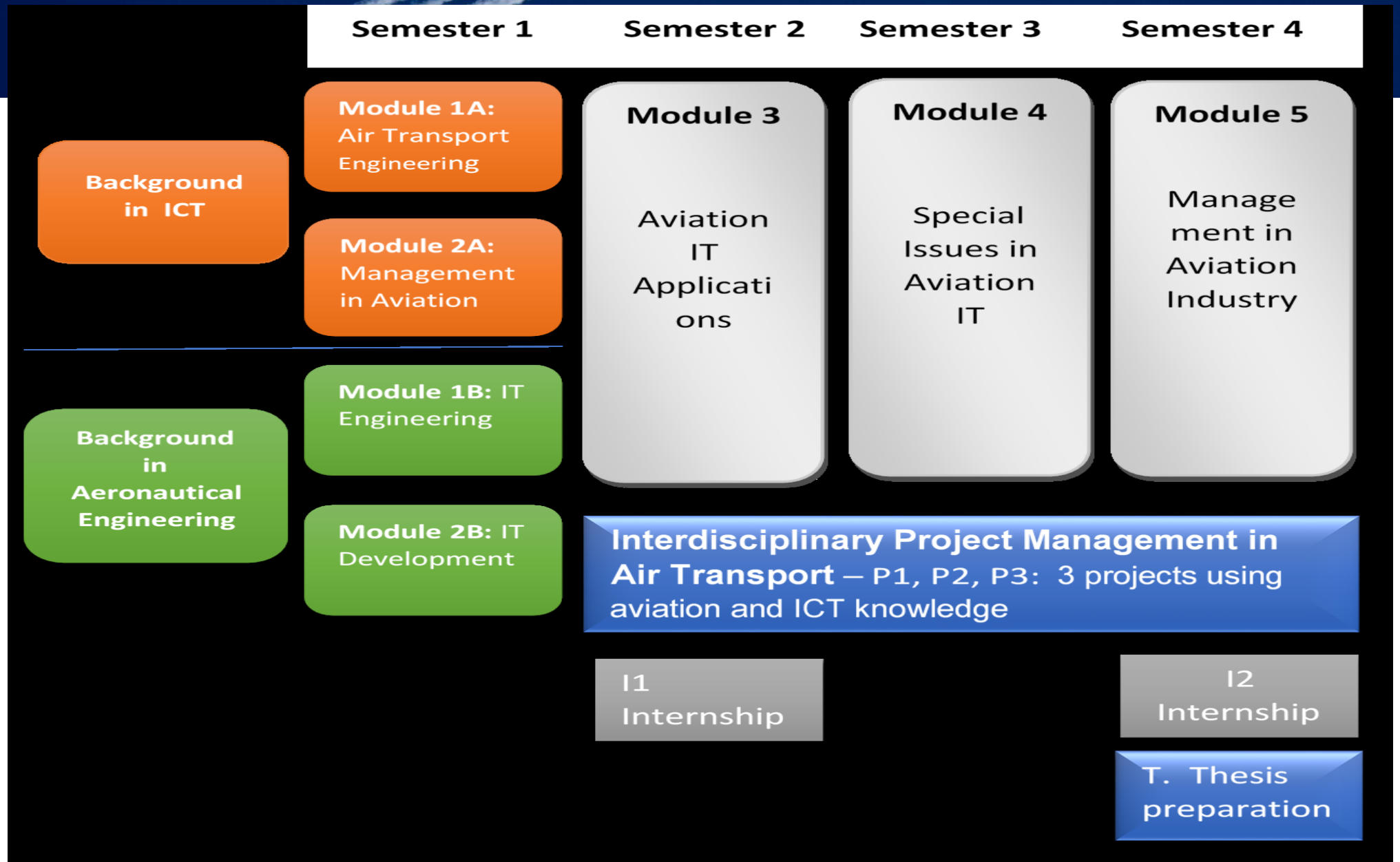
PART 3:
New study programmes (qualifications)

1. IT applied in air transport
2. Green, smart and integrated transport and logistics

Interdisciplinary master
“ICT applied in aviation”

- The purpose of this advanced Master’s programme is to provide students with a broad range and depth of interdisciplinary knowledge;
- Will be organized by **modules, function of background of graduates;**
- Will use **new modes of delivery**:
  - **distance,** through new forms of personalized learning,
  - strategic use of **open educational resources, virtual mobility,**
  - **European internships** in the main air transport employers.

STUDY PROGRAMME STRUCTURE



Programul de masterat

“ GREEN, SMART AND INTEGRATED TRANSPORT AND LOGISTICS”

United Nations Educational, Scientific and Cultural Organization

UNESCO Chair on Engineering for Society, University Politehnica of Bucharest, Romania

- Masterat predat în limba engleză
- 2 ani, 4 semestre, 120 ECTS
- **30 de locuri fără taxă**, 20 de locuri cu taxă

- organizat în cadrul departamentului UNESCO “**Engineering for Society**”

- În parteneriat cu universități și instituții de aviație din străinătate, în conformitate cu misiunea UNESCO de a oferi **educație pentru dezvoltare durabilă.**

- Grup internațional interdisciplinar de profesori și lectori, combinat cu specialiști din practica profesională: *Constantin Brătianu, Mihnea Costoiu, George Firican, Cătălin Radu, Mihaela Popa, Dorinela Costescu, Florin Rădulescu și alții.*

Rezultatele învățării

Cunoștințe și abilități pentru **transport și logistică internaționale și durabile;**

Cunoașterea extinsă a **soluțiilor de transport inteligente, verzi și integrate;**

Abilități în **tehnologia software**, știința datelor, metode de planificare, cercetare, evaluarea și managementul operațiunilor;

Abilități în domeniul cercetării, **managementului tehnologiilor și leadership** -premise pentru progresul carierei în industria internațională a transporturilor cu accent pesustenabilitate.

CURRICULA - anul I

Semestrul I

- Data analysis and statistics
- Economic and Financial Analysis
- Quality-security-environment in transport services
- Organizational Behaviour, HR and Intercultural management
- E-commerce and Transport Marketing
- Project management
- Scientific research

Semestrul II

- Sustainable Transport and Logistics Management
- Knowledge Management and Innovation in Transport Services
- Green technologies in transport systems
- Intermodal transportation
- Scientific research
- ***Optional 1***:
  - *Safety management systems/*
  - *Optimization in air transport*
- ***Optional 2***:
  - *Road and Rail safety*
  - *Sustainable Urban Transportation and mobility*

CURRICULA CURRICULA - anul II

Semestrul III

- Regulatory policies and Transport Law
- Strategic management in Transport
- Scientific research
- ***Optional 1***:
  - *Aviation and environment*
  - *Sustainable management and infrastructure of airports*
  - *Air transport operations*
  - *ICT in Air Transport*
- ***Optional 2***:
  - *Transportation and Land-Use Integration*
  - *Green vehicles*
  - *Advanced Operations in Terminals*
  - *Intelligent Transport Systems and ICT*

Semestrul IV

- Scientific research and dissertation development
- Ethics

ADMITEREA – sesiunea septembrie 2018

☑ Înscriere:

➲ **27.08-12.09.2018** ➲

🕒 Examinare:

13-14.09.2018

Înscrierile se fac la următoarea adresă:

Universitatea POLITEHNICA din București, Splaiul Indendenței 313, sector 6, București

Departmentul UNESCO *"Engineering for Society"*, Clădirea CAMPUS, etaj 7, camera 709

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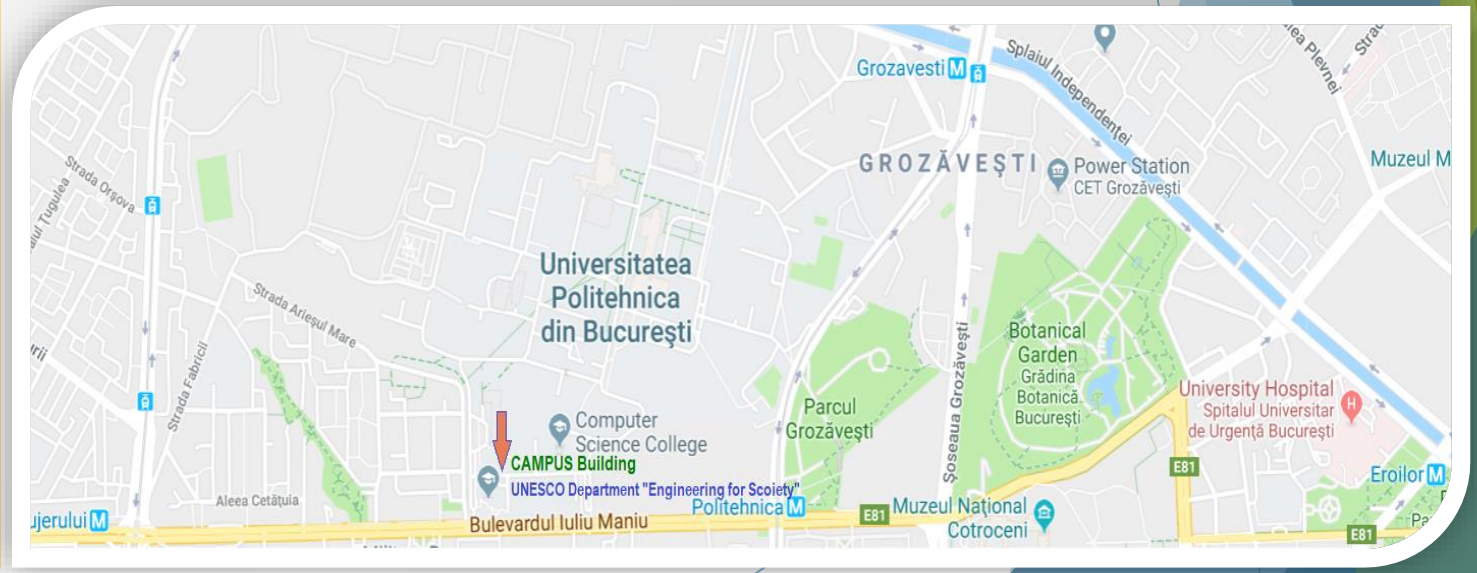
E-mail: unesco.office@upb.ro



Carbon management

* **Renewable fuels and lower energy use** are two key factors in climate work:
  * in the autumn of 2014, Swedavia introduced the world's **first biogas-fuelled snow removal equipment,** known as plough, sweep and blow or PSB machines, (Åre Östersund Airport);
  * The aim is for **biofuels to completely replace fossil fuels in Swedavia's vehicles by 2020**.

* **Terminal 2 is Heathrow's most sustainable terminal**

Example

* **Inventory of Manchester Airport in 2011:**

  * Passengers' own trips to and from the airport: 60% of total CO_2;
  * Energy used for terminal lighting and heating: 20%;
  * Ground aircraft movement: 20%.

Measures for sustainable water management

- **The principle of sustainable water management** involves a hierarchy of methods.
- The most economical and environmentally friendly method is to **minimize water consumption at source** by:
  - Raising awareness and promoting turn-off programs (economy);
  - Mounting of stop and collection systems;
  - Introduction of simple, low-water operating practices such as the use of sand instead of water with detergents to remove oil stains;
  - Using low-water equipment such as waterless platform cleaners.

- **Introducing dual drainage systems at the airports**
  - Collection, treatment and reuse of toilet water, washing and, in some cases, irrigation of land;
  - They can demand large investments but with good effects on long-term costs.
- **Collection and storage of rainwater.**
- At the moment, airports are a priority in providing the necessary water; the situation may change in the future and the solution is for airports to provide their own water resources by themselves by maximizing collection, recycling and consumption savings.

Atena airport – collection and treatment of water

Examples of results following the application of the stated methods

* Atlanta Airport: In 2009-2010 it used 86.7 million gallons of water than in 2007-2008 (www.atlanta-airport.com).
* In 2010-2011, on the Hong Kong International Airport, water treatment plants processed 1.37 million m3 of gray water from restaurants, airplane catering, airplane cleaning, bath sinks, and was reused for irrigation of the land (http://www.hkairport2030.com)
* Beijing International Capital Airport produces 10 million liters of reusable water each day; is used for toilet cleaning, irrigation and cooling of airport power stations.
* Singapore's Changi Island: Rainwater covers one-third of the airport's water needs, generating a $ 390,000 annual operating cost savings.
* Portland International Airport: 400 toilets with 80,000 toilets; the installation of the dual toilets system has reduced daily consumption from 280,000 gallons to 177,000 gallons. (www.portofportland)

Water

* Swedavia's objective is **to contribute to the good ecological and chemical status of the watercourses that the company affects**. Their work includes **decreasing the use of chemicals** and collecting chemicals that are used before they reach a watercourse.
* Most discharges to water from the airports take place during the winter when aircraft and runways are de-iced for aviation safety reasons.
* The use of more environmentally chemicals, **the collection of chemicals and treatment of water from the runways** are examples of measures that reduce the impact on watercourses in the vicinity of our airports.

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- Most discharges to water from the airports take place during the winter when aircraft and runways are de-iced for aviation safety reasons.
- The use of more environmentally chemicals, **the collection of chemicals and treatment of water from the runways** are examples of measures that reduce the impact on watercourses in the vicinity of our airports.

- The event will bring together **airlines, airports, air navigation service providers (ANSPs), manufacturers, suppliers, governments, non-governmental organizations** (NGOs) and stakeholders to discuss sustainable mobility under the SDGs, aviation and **climate change mitigation, sustainable alternative fuels, empowering employees to be sustainably responsible,** gender equality, and noise and communities, among other issues.

Thank you for you attention!