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WP2: Methodological Framework Definition

Activity 2.4: Ontology Schema Development

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Executive Summary

The aim of the EthAI Tour project is to provide a VET offering to the VET students and trainers adapted to labor market needs for the digital transformation of the sector and the ethical and trustworthy use of AI while contributing to evolving EC mandates such as the Ethics Guidelines for Trustworthy AI, Europe's Digital Decade, the EU Pact for Skills and the Transition Pathways for Tourism. To fulfill these goals the consortium targets the horizontal priority: Addressing digital transformation through development of digital readiness, resilience and capacity and the sectoral priorities: VET: Adapting vocational education and training to labour market needs and VET: Increasing the flexibility of opportunities in vocational education and training.

This report is part of the work conducted in Work Package 2 'Methodological Framework Definition' and specifically of Activity 4 'Ontology schema development' led by Travel2Fit. The Activity aims for the development of a lightweight ontology schema with targeted skills and competences that will allow the demonstration of connections and hierarchical structure, so as to better formulate the proposed training content and offer small portions of knowledge, containing entities designed to facilitate the VET trainees into their own tailored learning route.

Positioning of the deliverable in the context of the EthAI Tour project:

In the context of the EthAI Tour project, the current deliverable is positioned as follows:

- It is based on the Lean Methodological Framework of WP2/Activity 3 led by ATLANTIS.
- It draws valuable information from existing practices and identified skills gaps with regard to assessment methodologies deriving from the formation of WP2/A2 'Analysis of key Methodologies' led by TRAVEL2FIT.
- It constitutes part of the project outcomes that will be presented in the first Multiplier event (M8).

1. Introduction

The present deliverable delves into the Lean Methodological Framework, the outcome of WP2/A3, where after the meticulous examination and analysis of existing practices, methods and tools used in each partner's country and the identification of skills gaps concerning assessment methodologies (SWOT analysis), a guideine, linking aspects of the use of AI together with the analyzed methodologies and the responsible use of digital technologies was examined.

The principal goal is to define in the finest way the proposed EthAI Tour training content and assist the progress of the VET trainees enabling them to design and follow their individualized learning path more efficiently.

The deliverable is structured as follows:

Section 1 constitutes the introduction, including general insights and the deliverable's overall positioning in the project's lifecycle.

Section 2 briefly analyses the general concept of ontologies, their fundamental characteristics and the related literature review.

Section 3 highlights the potential advantages and benefits for VET trainers and trainees exploring the proposed ontology schema.

Section 4 refers to the ontology schemas that will be of valuable use by the EthAI Tour tourism professional taken into consideration the proposed aspects of the use of AI along with the analyzed methodologies and the expected competences and skills gained.

Section 5 concludes the deliverable.

2. Ontology general concept, key features and literature review

Ontologies are considered the core of the Semantic Web and could be defined as 'a formal, explicit specification of a shared conceptualization, composed of concepts and relations between them'.(i) They constitute the multi-dimensional representation of the expected, gained skills, displaying the progress and adjusting the VET trainee's personal choices of learning paths he/she advances towards competency acquirement.

Ontologies are regarded as a commonly known method for promoting the desired knowledge and are continuously proceeded forward in innovative and interactive e-learning learning methods mostly due to the fact that the desired skills and competences are presented in a consolidated way. The use of ontologies in education is not an accomplishment of the latest times. (ii)In fact many ontologies have been designed within the last years and are exploited successfully in the educational sector as a result of the concrete learning domain defining all existing concepts.(iii)

Taking into consideration the Digital Educational Plan of the European Union, that targets the skills' development through online learning platforms (iv) and the general tendency towards the digital transformation of education, ontologies could prove to be a valuable tool for the inclusion of AI tools and the application of Smart Education methods.(v)

A recent research conducted categorises the methods of ontology schema development into five prospects: (vi)

Gold-standard based,

Corpus-based or data-driven,

Task-based or Application-based,

Criteria-based and

Evaluation by humans.

As, in general, ontology schemas could be applied for domain-centered specification of knowledge can be used to represent domain-specific knowledge, in terms of tourism education and skills training, they could assist the complex knowledge basis that is required for effective training.

A literature review has been conducted regarding the use of ontology schemas in tourism education and skills training and their potential benefits.

The study by Karampiperis et al. in 2019 proposed an ontology-based framework for tourism skills training,(vii) in order to present knowledge related to different tourism skills, such as customer service, marketing, and hospitality.

Riveiro et al. in 2018 formed an ontology schema for tourism skills management and training (viii) highlighting various skills and competencies needed for a tourism professional, such as communication skills, language skills or leadership skills.

Additionally, Chen et al. in 2016 designed an ontology to identify different skills and competencies required in the tourism industry and it was applied to develop a competency-based assessment system (ix).

The essential terms related to the concept and use of ontologies are presented in the following summary:

Ontology: A definite and precise design and conceptualization of the competencies, skills and knowledge essential for a professional in the tourism domain.

Domain: A precise field of interest or knowledge, such as tourism.

Concept: An indefinite idea or general category of subjects that can be expressed in an ontology schema.

Relationship: A linkage between two or more concepts.

Competency: A set of knowledge, skills and abilities that enable a tourism professional to advance the job function.

Learning objective: A specific outcome that a training program is set to fulfill.

Learning outcome: The specialized competencies and skills that the trainee gains after the participation in a training program.

Learning pathway: The series of learning activities designed to better achieve specific learning objectives set.

Personalization: The case of training programs designed and tailored to cover the specific needs and learning goals of each trainee.

As a consequence, the application of ontology schemas in education and skills training in the tourism field could reinforce the trainees' skills, competencies and general knowledge and prove to be an asset due to its personalized and adaptive learning paths, accurate assessments and effective knowledge representation and sharing.

3. Benefits for VET trainers and trainees exploring ontology schemas

The formation of skills and competences related ontology schemas gained through specialized tourism training courses could upgrade the quality, consistency and relevance of the VET programs and facilitate sharing and reuse of the training resources even across various, different countries.

Benefits for VET trainees:

The preparation of an ontology schema leading to a personalised learning path is regarded as one of the most promising personalization methods for e-learning and could enable VET trainees to achieve a comprehensive knowledge of courses based on their relevance and the foreseen competences and skills.

The dynamic ontology mapping could be easily adjusted and adapted in different domains including the tourism sector.

The VET tourism trainees will be assisted with a better structured and more precise training courses' planning, with clear view of each course's expectations according to the desired skills and competences.

Benefits for VET trainers:

The VET trainers utilising the appropriately designed tools and applications would be able to choose better structured and well-defined learning outcomes.

Their educational material could be better disseminated through designated services and in a more personalized way.

Conceptual Framework of an Ontology Schema

An ontology schema outlines the connection between different concepts and entities in a specific domain. Practically, VET trainees familiarising themselves with the ontology schemas could design and form their own individualized educational path and gain the deriving skills and competences, or oppositely, primarily aiming for the acquisition of specific skills, choose accordingly the professional aspect that better suits their goals.

1. Organizing Knowledge:

VET trainees are given the opportunity to organize their knowledge basis in a systematical way, creating their own knowledge maps and identifying the main concepts of tourism, while developing a comprehensive understanding of the chosen subject.

2. Identifying Learning Objectives:

The ontology schema will aid the VET trainees to determine the essential concepts, skills, and competencies they aspire to gain, determine their learning goals and better focus their efforts.

3. Exploring Interconnections:

The interconnections among various concepts and entities of the tourism educational sector are depicted in an ontology schema, where trainees can benefit, expand their knowledge and better navigate related topics.

4. Accessing Relevant Resources:

The ontology schema could encourage VET trainees to identify and access relevant learning resources and thus, understand the broader scope of their chosen subject.

5. Tracking Progress and Self-Assessment:

Trainees via the ontology schema are able to keep track of their performance and progress and identify the concepts that require further attention. This self-assessment process benefits trainees and allows them to identify their knowledge gaps or allocate their efforts accordingly.

6. Collaborative Learning:

Collaborative learning is facilitated through the exploitation of the same ontology schema by multiple students, promotes knowledge sharing within the studying group.

'EthAI Tour' ontology schema presentation

The World Economic Forum in its Future of Jobs 2023 report (x) states that 'Technology adoption will remain a key driver of business transformation in the next five years. Over 85% of organizations surveyed identify increased adoption of new and frontier technologies and broadening digital access as the trends most likely to drive transformation in their organization'.

However, technological advancements have generated the need to examine the possible negative impact of the use of these technologies on individuals, society or the environment and carefully evaluate them from an ethical point of view.

The goal of WP2/Activity 4 is to better formulate the proposed training content through the formation of a lightweight ontology schema and the examination of the distinct aspects of the project, taking into consideration the ongoing digital transformation of the tourism sector that demands a trustworthy and compliant adoption of the AI tools extensively used.

Ontology construction should follow the principles of clarity, coherence, extendibility, minimal encoding bias, and minimal ontological commitment.^{xi}

The EthAI Tour lightweight ontology schema is designed to offer learning path recommendations, which correspond to the VET trainees' learning goals and preferences, as well as labour-market skills and is inspired by the European Skills, Competences, Qualifications and Occupations ontology (ESCO) and Schema.(xii) It aims to offer an innovative, personalized recommendation system for VET centers, bridging the gap between data and skills acquired with the labor market needs and targeting for its future applicability even after the end of the project.

Specifically, in accordance with the critical outputs of the WP2/A3 of the project the proposed EthAI Tour Methodology integrates several key components to create a robust framework for VET programs in the tourism sector:

1. AI Integration in Curriculum
2. Ethical AI Use
3. DigiComp Framework
4. Lean Integration
5. Design Thinking
6. Competency-Based learning
7. Total Quality Management

When designing the expected learning outcomes and based on the identified best suited for the project's goals, methodological frameworks, it is a good practice to classify them into different skill levels according to a learning outcome taxonomy. Illustrative examples of such taxonomies are Bloom's and the Revised Bloom's Taxonomy as well as SOLO, Gagne's and the Finik's Taxonomy.

The EthAI Tour lightweight ontology schema outlining targeted skills and competences for the ethical use of AI in the tourism industry is suggested as follows:

Training Unit 1: Digitisation in tourism

Specific proposed Framework: DigiComp Framework

General proposed Frameworks:

- Lean Integration
- Design Thinking
- Total Quality Management

Digitization in tourism requires tourism professionals to obtain a blend of technical, analytical and soft skills to effectively leverage digital technologies and drive innovation in the industry.

Skills/Competences: Brief description of the specific skills and competences required in order to benefit from the use of digitisation in the tourism industry.

Technical Skills

- Digital Marketing
 - ✓ Knowledge of SEO and social media marketing
 - ✓ Knowledge of email marketing, content marketing, and influencer marketing
- Information and data literacy
 - ✓ Ability to locate and retrieve digital data, information, and content, judge the relevance of the source and its content. To store, manage, and organize digital data, information, and content
- Website and App Development
 - ✓ Basic understanding of web design and development
 - ✓ Familiarity with CMS platforms like WordPress and app development basics

Skills in using Customer Relationship Management (CRM) software.

- Experience with marketing automation tools, like HubSpot or Salesforce
- Cybersecurity Awareness
 - ✓ Understanding of basic cybersecurity principles to protect customer data
- Knowledge of GDPR and other data protection regulations

Analytical Skills

- Market Research and Trends Analysis
 - ✓ Ability to conduct market research to identify emerging trends and consumer preferences
- Proficiency in using market research tools and methods.
- Revenue Management
 - ✓ Understanding of dynamic pricing strategies
 - ✓ Skills in using revenue management software

Soft Skills

- Customer Service and Communication
 - ✓ Strong communication skills to interact with customers through various digital channels
 - ✓ Ability to provide excellent customer service online

- Problem-Solving and Critical Thinking
 - ✓ Ability to solve complex problems using a digital approach
 - ✓ Critical thinking to assess the impact of digital initiatives
- Adaptability and Continuous Learning:
 - ✓ Willingness to continuously learn and adapt to new digital tools and trends and stay updated with the latest technological advancements in the tourism industry.

Creative Skills

- Content Creation and Management
 - ✓ Skills in creating engaging content for websites, blogs, and social media
 - ✓ Experience with content management systems and content strategy
- User Experience (UX) Design
 - ✓ Understanding of UX principles to enhance customer interaction with digital platforms
- Ability to work with designers to improve website and app usability

Interdisciplinary Skills

- Project Management
 - ✓ Ability to manage digital projects from conception to implementation
 - ✓ Proficiency in using project management tools like Trello, Asana, or Jira
- E-commerce and Online Booking Systems
 - ✓ Knowledge of e-commerce platforms and online booking systems
 - ✓ Understanding of payment gateways and transaction security
 - ✓

By developing these skills, tourism professionals can effectively contribute to the digital transformation of the tourism industry, enhancing customer experiences, optimizing operations, and driving sustainable growth.

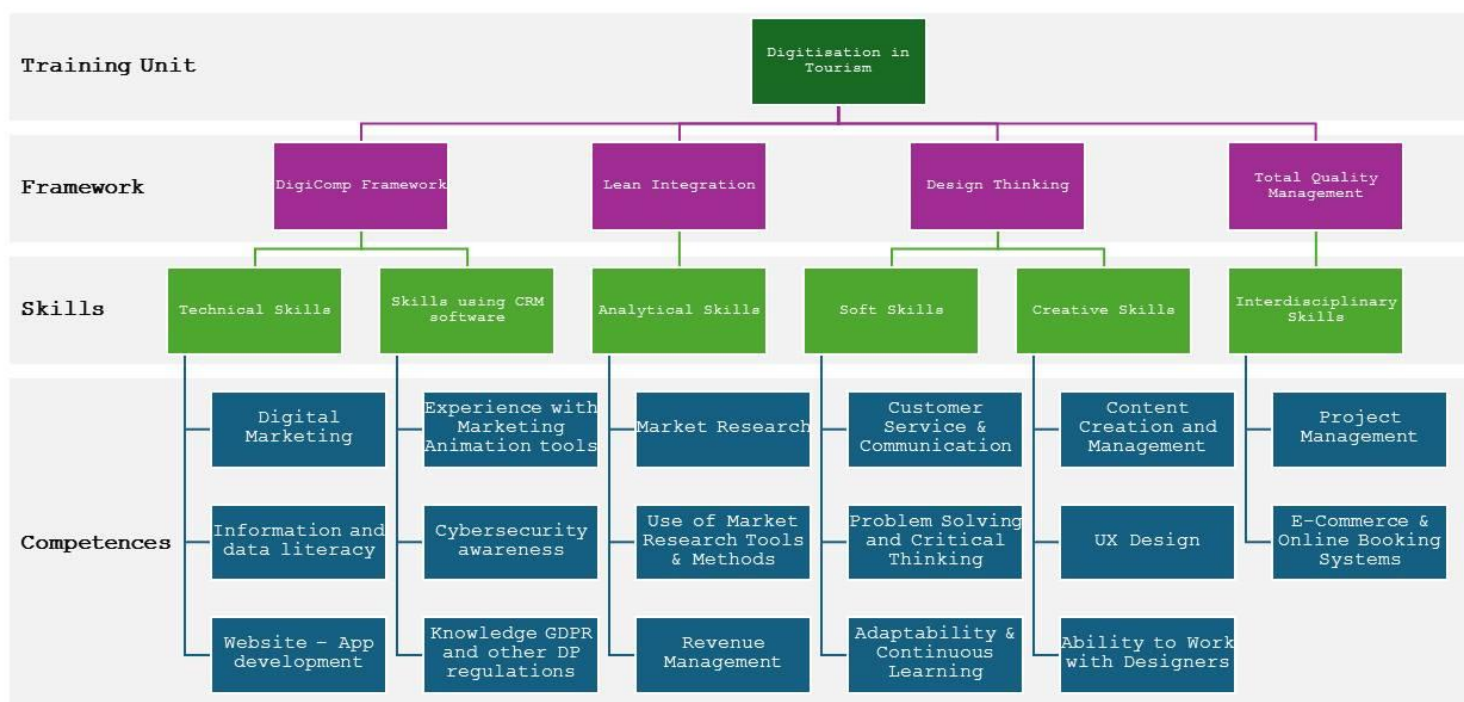


Figure 1: Training Unit 1-Digitisation in Tourism

Training Unit 2: AI in tourism

Specific proposed Frameworks:

- AI integration in Curriculum
- Competency-Based Learning

General proposed Frameworks:

- Lean Integration
- Design Thinking
- Total Quality Management

The integration of AI in the tourism industry demands a unique set of skills from tourism professionals. These skills include technical, analytical and interpersonal domains to ensure that AI technologies are effectively utilized to enhance customer experiences, optimize operations, and drive innovation.

Skills/Competences

Brief description of the specific skills and competences needed to take advantage of the use of AI in the tourism sector.

Technical Skills

- Basic Understanding of AI and Machine Learning

- ✓ Fundamental knowledge of AI concepts, machine learning algorithms, and their applications in tourism
- ✓ Awareness of AI tools and platforms commonly used in the industry
- Data Analysis and Management
 - ✓ Skills in using data analytics tools like Python, R, SQL, and Excel\
 - ✓ Understanding of data processing techniques
- AI Integration and Implementation
 - ✓ Ability to work with AI development teams to integrate AI solutions into existing systems
 - ✓ Knowledge of APIs and how they are used to connect AI tools with other software.
- Customer Relationship Management (CRM) Systems
 - ✓ Experience with CRM systems that utilize AI for personalized customer interactions
 - ✓ Understanding of how AI can enhance customer segmentation and targeting

Analytical Skills

- Predictive Analytics
 - ✓ Skills in using AI for forecasting trends, demand prediction, and improving decision-making processes
 - ✓ Ability to interpret AI-generated insights and apply them to strategic planning
- Natural Language Processing (NLP)
 - ✓ Understanding of how NLP can be used in chatbots, virtual assistants, and sentiment analysis
 - ✓ Ability to work with AI tools that process and analyze text and speech

Soft Skills

- Problem-Solving and Critical Thinking
 - ✓ Ability to identify challenges that can be addressed by AI and to develop innovative solutions
 - ✓ Critical thinking to evaluate the effectiveness and ethical implications of AI applications
- Communication Skills
 - ✓ Proficiency in explaining AI concepts and insights to non-technical stakeholders
 - ✓ Ability to communicate the benefits and limitations of AI solutions to clients and team members

Creative Skills

- Content Personalization
 - ✓ Skills in using AI to create personalized travel recommendations, itineraries, and marketing content
 - ✓ Understanding of customer preferences and behaviors to tailor AI-driven content
- User Experience (UX) Design

- ✓ Knowledge of UX principles to ensure AI applications are user-friendly and enhance the customer experience
- ✓ Ability to collaborate with UX designers to integrate AI features seamlessly

Interdisciplinary Skills

- Project Management
 - ✓ Ability to manage AI projects from conception to implementation, including setting goals, timelines, and budgets
 - ✓ Proficiency in using project management tools and methodologies
- Compliance:
 - ✓ Knowledge of legal regulations and compliance requirements for AI use in tourism

Industry-Specific Skills

- Tourism Market Knowledge
 - ✓ Deep understanding of the tourism industry, including market trends, customer behavior, and key challenges
 - ✓ Ability to apply AI solutions to specific tourism contexts, such as hospitality, travel planning, and destination management
- Customer Service Enhancement
 - ✓ Skills in leveraging AI to improve customer service, such as through AI-powered chatbots and virtual assistants
 - ✓ Understanding of how AI can enhance the overall customer journey and satisfaction

Continuous Learning

- Adaptability and Lifelong Learning
 - ✓ Commitment to staying updated with the latest AI developments and continuously improving relevant skills
 - ✓ Ability to adapt to new AI technologies and incorporate them into daily operations

By developing these skills, tourism professionals can harness the power of AI to drive innovation, enhance customer experiences, and improve operational efficiency in the tourism industry.

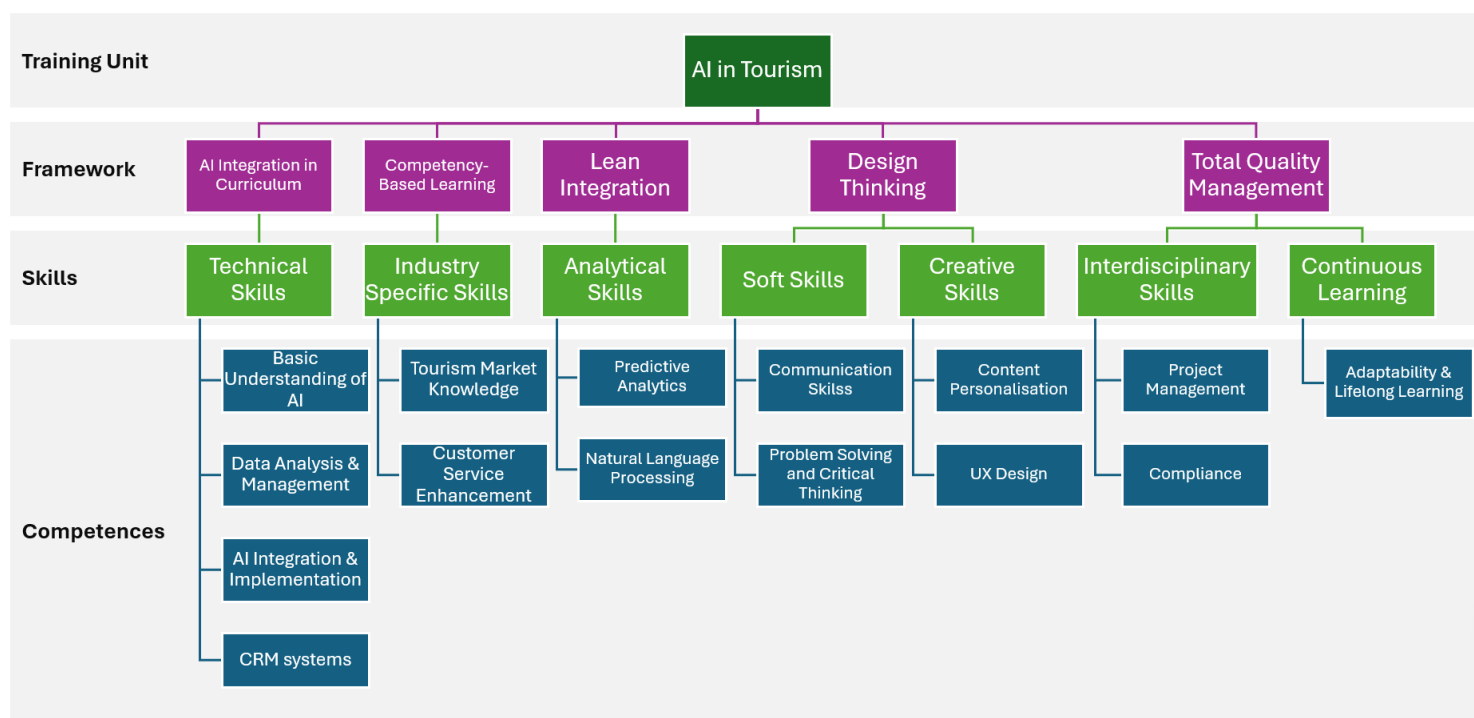


Figure 2: Training Unit 2 - AI in tourism

Training Unit 3: Ethical AI in tourism

Specific proposed Framework: Ethical AI Use

General proposed Frameworks:

- Lean Integration
- Design Thinking
- Total Quality Management

To ensure the ethical use of AI in tourism, professionals need a comprehensive set of skills that encompass technical know-how, ethical reasoning, data management, and interpersonal abilities. These skills are crucial to navigate the complexities of AI while upholding ethical standards and promoting responsible AI practices.

Skills/Competences: Brief description of the specific skills and competences required for the ethical use and implementation of AI tools in the tourism industry.

Technical Skills

- Data Privacy Management
 - ✓ Ability to manage and protect sensitive tourist data in compliance with data protection regulations (e.g., GDPR).
- Bias Detection and Mitigation
 - ✓ Capability to identify and mitigate biases in AI algorithms to ensure fair and inclusive outcomes for all tourists
- Transparency and Explainability

- ✓ Efficient use of AI systems tools with precise knowledge and conscious that they are transparent and could provide explanations for their decisions and recommendations to tourists
- Privacy and Data Protection
 - ✓ Knowledge of data protection regulations (e.g., GDPR) and best practices
- Skills in applying ethical frameworks and guidelines (e.g., IEEE Ethically Aligned Design, ACM Code of Ethics)

Communication Skills

- Ability to explain complex AI concepts and ethical considerations to non-technical stakeholders
- Proficiency in communicating the benefits and limitations of AI applications to clients and team members
- Stakeholder Engagement
 - ✓ Skills in engaging with diverse stakeholders, including customers, local communities, and regulatory bodies, to gather insights and perspectives on the ethical use of AI
- Ethical Frameworks Application
 - ✓ Capacity to apply ethical frameworks to guide the development and deployment of AI technologies in the tourism sector.
- Continuous Learning and Adaptation
 - ✓ Commitment to staying updated on the latest developments in AI ethics and adapting strategies and practices accordingly to ensure ongoing ethical use of AI in tourism

Creative and Design Skills

- Content Personalization:
 - ✓ Skills in using AI to create personalized and ethically sound travel recommendations and marketing content
- Tourism Market Understanding
 - ✓ Deep knowledge of the tourism industry, including market trends, customer behaviors, and key challenges
 - ✓ Ability to apply ethical AI solutions to specific tourism contexts, such as hospitality, travel planning, and destination management
- Adaptability and Lifelong Learning
 - ✓ Commitment to staying updated with the latest developments in AI ethics
 - ✓ Willingness to continuously improve skills and adapt to new ethical challenges and technological advancements.

Governance and Compliance

- Regulatory Compliance
 - ✓ Knowledge of legal regulations and compliance requirements for AI use in tourism
 - ✓ Ability to navigate and adhere to ethical standards and industry guidelines
- Ethical AI Governance
 - ✓ Understanding of governance mechanisms to ensure responsible AI use

- Ethics and Compliance:
 - ✓ Understanding of ethical considerations related to AI, including bias, privacy, and transparency

By cultivating these skills, tourism professionals can ensure that AI technologies are used responsibly and ethically, promoting trust and positive outcomes for all stakeholders in the tourism industry.

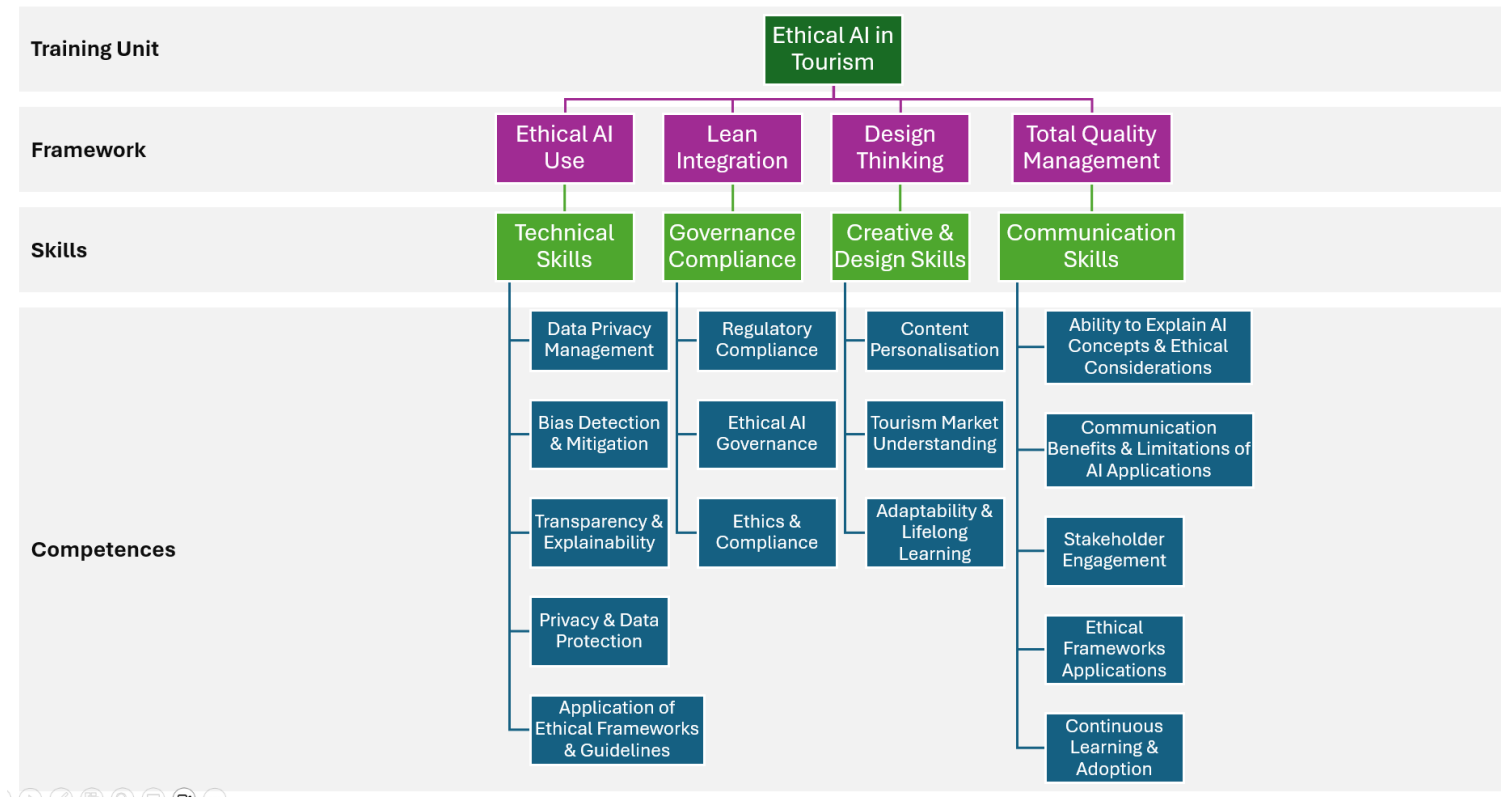


Figure 3: Training Unit 3 - Ethical AI in tourism

Conclusions

The tourism sector was already under fundamental transformations including digitization, automation and personalization of services, even before the Covid-19 pandemic hit and further accelerated the use of AI for the improvement of efficiency and customer experience. The growing exploitation of AI tools brought to light many ethical concerns and also the need for VET trainees to comprehend the new digital landscape, be equipped with new skills and competences and enlightened in aspects related to AI technology and its ethical implications in order better adapt to labour market needs. The related upskilling and reskilling of citizens has been also included in the EU's Digital Decade programme, dictating that 80% of all adults will be skilled to use tech for everyday tasks and 75% of businesses would use Cloud, AI and Big Data by 2030. The EthAI Tour project aims to address these needs, by proposing an innovative VET offering that is expected to aid VET trainees and travel professionals to adapt to labor market

needs for the digital transformation of the sector and the ethical and trustworthy use of AI.

Understanding the technological and societal benefits and challenges that impact employment demands in tourism and require upgraded skills and competences is crucial for the design of relevant and high-quality VET offering.()

Based on the outcomes of WP2/A3 and after the literature review conducted, in the present deliverable we presented the EthAI Tour lightweight ontology schema, through a carefully crafted set of targeted skills and competences, we evaluated the capabilities of the EthAI Tour project in the VET offering in tourism, with the expectation our ontology to be a beneficial tool for VET tourism trainees and trainers as they design and navigate through their personalized educational paths.

The presented ontology schema provides a structured framework for defining and categorizing the skills and competences necessary for the ethical implementations of the use of AI in the tourism industry. It could serve as a foundation for developing the project's training content and guiding research and development efforts aimed at promoting ethical AI practices in tourism.

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