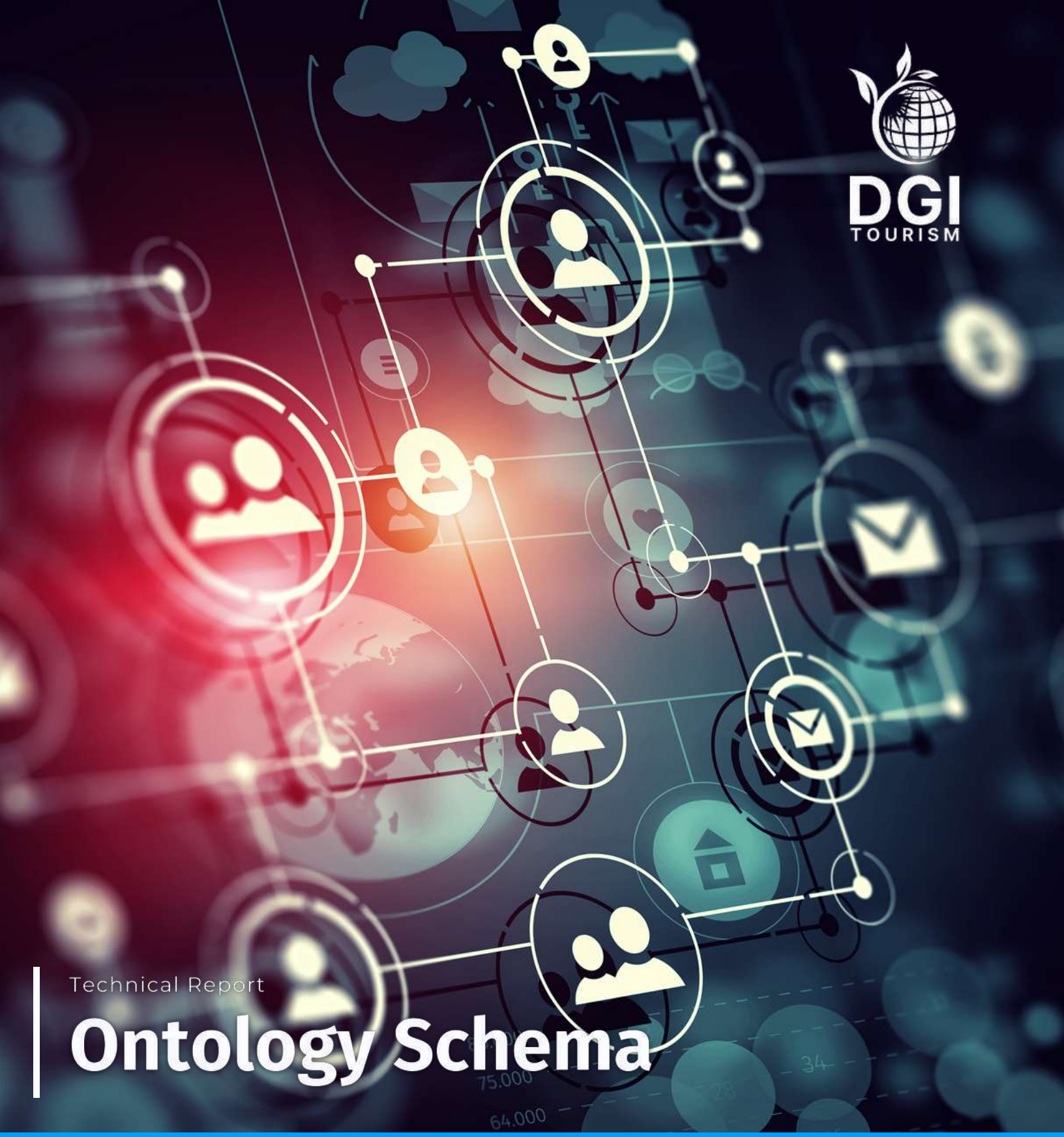

DGI TOURISM

Technical Report

Ontology Schema

Project Result 3 Task 1

Co-funded by the European Union

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Technical Report

Ontology Schema

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About the DGI Tourism Project

The **DGI Tourism Project** seeks to adapt the vocational education and training (VET) offering to the challenges of the digital age and climate change, innovatively accommodating post-Covid travel sector needs that enable a smooth transition towards more sustainable strategies and futureproofing the tourism sector.

It aims to develop interactive, participatory and lean teaching approaches that are grounded on responsible tourism principles.

Introduction

This report presents the design of a lightweight ontology schema for developing DGI Tourism training content. The framework showcased in this report allows VET students and practitioners to easily navigate individualised learning paths when customising and adapting the **DGI Tourism Training Plan**.

The current report explores the Lean Methodological Framework conducted within PR1/T2 where a lean and easily readaptable delivery of VET training was formed, based on analysis of existing practices along with the identification of skills gaps with regards to assessment methodologies (SWOT analysis). Moreover, the outcomes of this Task depended on the ECVET profile development that derived from PR2/T1, where the profile of the 'Digital and Green Tourism Expert' was designed describing the learning outcomes and the associated ECVET credit points.

PR3/Task 1 aimed towards the following:

- To draw valuable inputs from the Lean Methodological Framework (PR1/T2) and the ECVET profile (PR2/T1) and
- To develop a lightweight ontology schema where targeted skills and competences would be considered.

The main ambition was to better formulate the proposed DGI Tourism training content and facilitate the VET trainees in order to be able to follow their individualized learning path more conveniently. For this, lightweight career-oriented ontology schemas were created to facilitate the Task's reporting.

Ontology Schema

General concepts, key features, and literature review

An ontology can be defined as a formal, explicit specification of a shared conceptualisation composed of concepts and relations between them.[1] It is the core of the Semantic Web. It serves as a multi-dimensional representation of how expected skills acquirement is defined and developed, mapping progress and coordinating the individual choice of learning paths as a trainee progresses towards competency.

Educational ontology development is used in various learning methods because of its capacity to adapt and extend the target knowledge for learners.[2] They are constantly gaining ground in dynamic and multi-source e-learning experiences because of the consolidated presentation of the targeted skills and competences. Ontologies have been applied successfully in education since they allow a certain learning domain to specify all existing concepts.[3]

Moreover, with a growing interest in the digital transformation of education, such as the Digital Educational Plan of the European Union that aims to combine work with relevant skills and to enrich skill development through online learning platforms[4], educational ontology development could be useful in incorporating artificial intelligence (AI) tools and adopting smart education methods with the digital transformation of education.[5]

[1] https://slejournal.springeropen.com/articles/10.1186/s40561-021-00160-z
[2] Tarus, J.K., Niu, Z., Mustafa, G.: Knowledge-based recommendation: a review of ontology-based recommender systems for e-learning. Artif. Intell. Rev. 50(1), 21–48 (2017). https://doi.org/10.1007/s10462-017-9539-5
[3] https://link.springer.com/article/10.1007/s10639-020-10226-z
[4] Davies, H., Lehdonvirta, V., Margaryan, A., Albert, J., Larke, L.: Developing and matching skills in the online platform economy: findings on new forms of digital work and learning from Cedefop's CrowdLearn study (2020)
[5] Salem, A.M., Nikitaeva, A.Y.: Knowledge engineering paradigms for smart education and learning systems. In: 42nd International Convention on Information and Communication Technology, Electronics and Microelectronics, MIPRO 2019, Opatija, Croatia, 20–24 May 2019, pp. 1571–1574. IEEE (2019)

Evaluation methods of ontology schema development for refinement and improvement include gold-standard-based, corpus-based or data-driven, task-based or application-based, criteria-based and human evaluation. [6]

Ontology schemas can be utilised to represent domain-specific knowledge and facilitate knowledge sharing, reuse, and integration. In the context of tourism education and skills training, ontology schemas can capture the diverse and complex knowledge required for effective training. The following literature review examines the use of ontology schemas in tourism education and skills training and their potential benefits.

One study by Karampiperis et al. (2019) proposed an ontology-based framework for tourism skills training.[7] The ontology was designed to capture knowledge related to tourism skills, such as customer service, marketing, and hospitality. The framework was evaluated through a case study and found effective in enhancing learners' skills and competencies in tourism.

Similarly, Riveiro et al. (2018) developed an ontology schema for tourism skills management and training.[8] The ontology captured different skills and competencies required in the tourism industry, such as communication, language, and leadership skills. The ontology schema was used to develop a training platform that provided personalized learning paths based on learners' skills and competencies.

[6] Ivanova, T., Popov, M.: Ontology evaluation and multilingualism. In: Proceedings of the 21st International Conference on Computer Systems and Technologies 2020, CompSysTech 2020, pp. 215–222. Association for Computing Machinery, New York (2020)
[7] Karampiperis, P., Bikakis, A., & Tsampoulatidis, I. (2019). An ontology-based framework for tourism skills training. Journal of Hospitality, Leisure, Sport & Tourism Education, 24, 66-75.
[8] Riveiro, M., Gómez, D., Vázquez-Parrado, A., & Ramos, S. (2018). An ontology schema for tourism skills management and training. Journal of Hospitality, Leisure, Sport & Tourism Education, 22, 41-49.

In a different approach, Chen et al. (2016) proposed an ontology-based system for tourism skills assessment.[9] The ontology was designed to harbour different skills and competencies required in the tourism industry and was used to develop a competency-based assessment system. The system was evaluated through a case study and effectively provided accurate and objective assessments of learners' skills and competencies in tourism.

The list below summarizes the main terms and concepts around the use of ontologies:

- **Ontology**: A formal and explicit specification of a shared conceptualization of the tourism domain and the competencies, skills and knowledge required by tourism professionals.
- **Domain**: A specific area or field of interest or knowledge, such as tourism.
- **Concept**: An abstract idea or general category of things that can be represented in an ontology.
- **Relationship**: A connection or association between two or more concepts or instances.
- **Competency**: A set of knowledge, skills and abilities that enable a tourism professional to perform a specific task or job function.
- **Learning objective**: A specific goal or outcome a training program aims to achieve.
- **Learning outcome**: The knowledge, skills, and attitudes a trainee acquires from participating in a training program.
- **Learning pathway**: A sequence of learning resources and activities to help a trainee achieve specific learning objectives.
- **Personalization**: Tailoring training programs to individual trainees' specific needs and learning styles, usually through adaptive learning technologies.

Consequently, ontology schemas in tourism education and skills training show promising results in enhancing learners' knowledge, skills and competences. They can provide personalized and adaptive learning paths, accurate assessments and effective knowledge representation and sharing.

[9] Chen, N., Liu, Y., Huang, Y., & Song, W. (2016). Ontology-based system for tourism skills assessment. Tourism Management, 55, 42-52.

Ontology Schema

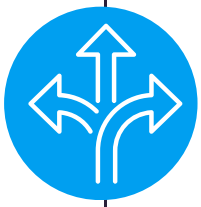
Benefits for vocational education and training

In general, the development of an ontology schema regarding the competences and skills acquired through specialized training courses in the tourism sector, contributes to the improvement of the quality, consistency and relevance of VET programs and furthermore to the facilitation of the sharing and reuse of the training resources even across various, different countries.

Benefits for VET Trainees and Trainers

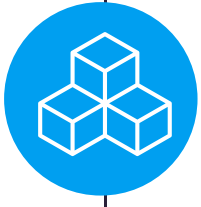
Personalised learning path

Trainees and trainers can use dynamic ontology mapping to link the proposed training course profiles with tourism job profiles



Flexible

Adaptable to different domains, including the tourism sector.



Structured learning

Well-constructed and defined learning outcomes help learners know the exact concepts to be absorbed and enable them to evaluate their progress themselves and organize their learning path according to the desired skills and competences based on a practical guide in learning.

Effective use of the DGI Tourism ontology schema

Understanding the Conceptual Framework

Trainers and trainees should start by familiarizing themselves with the ontology schema, studying the various concepts, and understanding how they are interconnected. This foundational knowledge will help them understand tourism-related information's structure and organisation.

In practice, individualized learning paths are developed by either (a) choosing the field they would like to specialise in (digital, green, innovative) or (b) by being guided at first by targeted skills that would lead them to the tourism professional aspect that best suits their goals.

Organising Knowledge

The visual representation provided by the ontology schema allows trainers to organise knowledge acquisition in a structured manner when adapting to different learning pathways for trainees. VET practitioners can create knowledge and concept maps based on the ontology schema, linking relevant concepts together.

Identifying Learning Objectives

The DGI Tourism ontology schema can help identify specific learning objectives within the tourism domain. Essential concepts, skills, and competencies needed to be acquired can be easily identified.

Exploring Interconnections

An ontology schema reveals the interconnections between different concepts and entities within tourism. Following these interconnections allows trainers and trainees to delve deeper into more specific topics relevant to their pathway. With very complex and interconnected networks within tourism, various specialisations will require different target knowledge, skills and competences, yet need a common foundational framework for responsible and sustainable practices. For example, learning pathways for destination management and hospitality can differ in terms of competences, but can remain the same in terms of acquiring foundational knowledge of tourism and sustainability.

Accessing Relevant Resources

The ontology schema can guide trainers and trainees to identify, access, and discover relevant learning resources. It helps them understand the broader scope of the subject and develop the skill to delve deeper into finding relevant resources according to their learning pathway.

Tracking Progress and Self-Assessment

Trainers and trainees can use the ontology schema to track learning progress and assess their understanding of different concepts. An ontology schema's visual representation allows users to monitor their learning journey, identify gaps in their knowledge and skills, and allocate learning time effectively.

The DGI Tourism Ontology Schema

The DGI Tourism Professional Analysis and Schema Presentation

This section presents the lightweight ontology schema for each targeted learning outcome of the digital, green, and innovative components of the DGI Tourism Training. The DGI Tourism ontology schema follows the outcomes of the previous project results, summarised as follows:

- **Project result 1**: The DGI Tourism methodology espouses the principles of the Digital Competence Framework (DigiCompOrg), Total Quality Management (TQM), and GreenComp Framework.
- **Project Result 2:** Identifying target skills and competencies through developing the ECVET Profile and Training Plan.

The DGI 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.[10] Each component is derived from the educational, labour market and individual needs of learners' perspectives.[11]

Based on these considerations, the DGI Tourism ontology offers an adaptable recommendation system for VET centres based on the learning paths and the user profile. This enables bridging the gap between educational data and skills with the labour market needs and targeting its applicability beyond the project's scope. Each concept of course-competence-skill could stand alone or be added to offering a combination of the proposed aspects of the DGI Tourism professional. Moreover, the ontology schema was developed given the proposed open-source ontology and its potential to be applied as key performance indicators (KPIs).

[10] https://esco.ec.europa.eu/en
[11] https://link.springer.com/chapter/10.1007/978-3-030-88361-4_32

The DGI Tourism Ontology Schema

The following ontology schema is presented as following:

Every concept and sub-concept in the schema both is linked and connected with the others, based on the input and output of each one. The expected competences that were identified in the PR2/T1 played a central role in the ontology schema as competencies have to be aligned not only with the training curricula but also with the labor market needs.[12]

[12]https://www.researchgate.net/publication/228361979_Educational_Ontology_and_Knowledge_Testing

Innovative Dimension

Framework

Total Quality Management

Training Unit

Evolution and trends, development and promotion of a territory with a view to innovation and new technologies

Target Competences

Understand and analyse in an innovative way the trends and characteristics of a territory's tourism sector, including the processes necessary for its development and promotion

Design and implement innovative tourism services related to emerging trends and technologies in tourism

Target Skills

- Agile project development
- Technology and trend monitoring
- Creativity and ideation

- Design thinking
- Adaptability and decision making
- Entrepreneurship and intrapreneurship
- Creative problem solving
- Prototyping and experimentation

Agile project development

Basic agile project development skills are expected to be acquired through short development cycles and focusing on the continuous improvement and development of the trainees' provided services. The agile project development skill is becoming increasingly important in the tourism industry, as businesses seek to deliver high-quality products and services to customers in a fast-changing and competitive environment that meets their needs and expectations while maximizing efficiency, collaboration, and innovation.

Technology and trend monitoring

The technology and trend monitoring skills include the ability to track and measure the trainees' progress against goals, identify areas of improvement, effectively communicate their progress and results, and use data to make informed decisions. The trend monitoring skill will facilitate the tracking and analysis of the recent advancements in the tourism sector, allowing the innovative trainees their competitive position in the field.

Creativity and ideation

The creativity and ideation skill will equip the VET trainees with the beneficial process of coming up with and communicating new ideas or combine multiple existing ideas to create a new one that will make them stand out in the labor market competition.

Design thinking

Design thinking is a typical skill useful for VET tourism trainees refering to the ability to approach problem-solving and innovation in a creative and human-centered way, with a focus on empathy, collaboration, and iterative prototyping. Design thinking is a methodology that originated in the field of design but has been applied to various fields, including travel, education and social innovation.

Adaptability and decision making

The adaptability and decision-making skills will give to the trainees the opportunity to adjust to the tourism sector's continuous challenges by responding quickly to them with fresh, innovative ideas, responsibilities, expectations, trends, strategies and other processes.

Entrepreneurship and intrapreneurship

Entrepreneurship and intrapreneurship skills will form self-motivated, proactive, and action-oriented trainees with leadership skills that stand out and meet the needs of the demanding tourism market.

Creative problem solving

Creative problem-solving skill (CPS) refers to the ability to approach problems and challenges in a creative, innovative, and strategic way, using a range of techniques and tools to generate and evaluate potential solutions. Creative problem-solving involves using analytical and creative thinking to identify problems, analyze data, generate ideas, and implement solutions. Creative problem-solving skills can help VET trainees approach problems in an analytical, creative, and strategic way, generating effective, efficient, and adaptable solutions to changing needs and contexts.

Prototyping and experimentation

The skill of prototyping and experimentation involves effectively creating prototypes and conducting experiments to validate ideas, identify potential problems, and refine solutions. It requires creativity and problem-solving abilities to iterate and improve upon initial designs or concepts successfully. This skill could prove to be particularly important in the tourism field.

Green Dimension

Framework

GreenComp

Training Unit

Environmental, social, cultural, and economic sustainability in tourism

Target Competences

Define and apply the concept of environmental, social and economic sustainability in tourism

Develop and implement sustainable tourism services, aimed at enhancing and integrating the environmental, cultural and economic resources of a destination with a view to innovation and sustainability

Target Skills

- Environmental and socio-cultural awareness
- Sustainable tourism management
- Sustainable tourism marketing and promotion

- Sustainable tourism product development
- Waste & water management
- Energy conservation and efficiency
- Climate action

Environmental and socio-cultural awareness

Environmental awareness skill refers to the ability to understand and appreciate the natural environment, its ecosystems, and the impact of human activities on the environment. It involves a deep understanding of environmental issues and challenges and an appreciation of the importance of sustainable development and the need to protect and preserve the environment for future generations.

Sustainable tourism management

Sustainable tourism management refers to the approach and practices implemented to ensure that tourism activities and developments are carried out to minimise negative impacts on the environment, society, and culture while maximizing the benefits for local communities and the economy. Sustainable tourism management aims to maintain a destination's natural and cultural resources so that present and future generations can enjoy them.

Sustainable tourism marketing and promotion

The ability to promote products or services that are sustainable and eco-friendly throughout their life cycle will prove to be a valuable tool for the VET trainees and their green marketing strategies in their future businesses as environmental sustainability is increasingly drawing attention globally.

Sustainable tourism product development

The increasing demand for sustainable tourism products and services requires that trainees be educated on creating and promoting tourism offerings that prioritize environmental, social, and economic sustainability. The goal is to develop travel experiences that have a minimal negative impact on the environment, benefit local communities, and contribute to the overall well-being of the destination while providing enjoyable and authentic experiences for travellers.

Waste & water management

Developing skills and principles grounded on waste reduction and water-saving measures marks an essential basis for sustainable product development in view of global environmental issues.

Energy conservation and efficiency

Energy conservation and efficiency skill refers to actions followed in order to reduce the amount of energy end use in the tourism sector and the expression of creative ideas easily understood by non-expert VET trainees.

Climate action

Beyond understanding the impacts and reducing greenhouse gas emissions, developing skills toward climate action also tackle mitigation and adaptation measures.

Digital Dimension

Framework

DigCompOrg

Training Unit

Digitalisation as a tool for the development of the tourism sector

Target Competences

Implement new technologies and approaches in tourism management

Define, design, and implement novel methods of customer relationship management within the digital realm

Develop a tourism communication plan with a focus on managing social media activities

Target Skills

- Fundamental computer skills
- Data analysis and management
- Word and data processing

- Online marketing and e-commerce
- Digital communication and collaboration
- Effective communications

- Internet and social media proficiency
- Database development and management

Fundamental computer skills

Essential computer skills include the main and typical usages of a computer, namely: the basic notions of computer manipulation, computer files management, word processing, information gathering and communication via computers; awareness of possible social and ethical implications of the use of the Internet, identification and assessment of the capabilities, as well as the limitations of emerging technologies.

Data analysis and management

The collection, organization, protection and storage method of an organization’s data so it can be analyzed for further business decisions, taking advantage of the vast quantity of data collected and shared in tourism. Overall, data analysis and management skill is a valuable asset in today's data-driven world and can help individuals and organizations make better-informed decisions, improve efficiency and effectiveness, and gain a competitive advantage in their respective fields.

Word and data processing

Word processing is the creation and editing of documents on a computer, the translation of gathered information and the publishing of them under effective formatting. It is a tool used to enhance learning and trainees' productivity while promoting collaboration and communication. Finally, this skill can be leveraged as a part of the problem-solving process to build technology-enhanced models and promote other creative works.

Online marketing and e-commerce

Online marketing is a skill that leverages web-based channels to spread a message to potential customers. At the same time, the ability to perform e-commerce is the method of buying and selling services online, including affiliate marketing.

Digital communication and collaboration

Digital communication and collaboration skills refer to effectively communicating and working with others using digital tools and platforms. In today's digital age, these skills are becoming increasingly important as more and more people work remotely or in distributed teams. Digital communication skills include using various tools, such as email, instant messaging, video conferencing, and social media, to communicate with others clearly and effectively. It also conveys information and ideas through various digital formats, such as presentations, documents, and multimedia content. On the other hand, collaboration skills involve the ability to work with others in a team or group setting to achieve a common goal. This requires active listening, effective communication, and working cooperatively with others. In a digital context, collaboration skills involve using digital tools and platforms to collaborate with others, such as online project management tools, shared document repositories, and virtual team spaces.

Effective communications

These skills refer to communicating messages to a targeted audience concisely and clearly. Exceptional communication skills are critical for tourism professionals for marketing, promotions, and education toward sustainable practices. These involve effectively delivering information, ideas, and data to an audience.

Internet and social media proficiency

Knowledge of the Internet and social media platforms will allow trainees to access information in real time and find niche tourism communities, as connectivity is among the most significant benefits of social media.

Database development and management

Databases are commonly used for storing, maintaining and accessing data in one place to be observed and analyzed. The skill to use and produce databases can be considered as an organized collection of information, using effective search strategies for retrieving electronic information from common databases of tourism or planning, creating and editing records in their database.

Conclusions

Tourism plays a critical role in the EU economy. The evolving demands toward digitalisation and sustainability in the sector underscore the need to reorient vocational education and training in tourism.

There has been growing interest in developing skills and competences ontology for the tourism industry in recent years. An ontology of skills and competences could help identify the specific knowledge and skills required for different roles within the industry and the competencies needed to succeed in those roles. Understanding the business and societal challenges and opportunities that affect employment levels, tasks in occupations and thus skill profiles in tourism and its sub-sectors is critical for designing and offering relevant and high-quality education and training.[13]

The tourism sector has been undergoing a paradigm shift even before the Covid-19 pandemic, and digital swifts require new skills from tourism professionals to better adapt to labour market needs. Sustainable tourism, for example, has been included in Sustainable Development Goals (SDGs) which underlines the sector's contribution to job creation and benefits for the economy, environment, and society.

The DGI Tourism ontology schema presented in the report showcases learning pathways that are needed in updating the competences and skills needed in today's labour market and because of the global issues that urgently need practical solutions.

[13] Cedefop (2020). Skills developments and trends in the tourism sector. Skills intelligence.

DGI TOURISM

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Project Consortium Partners

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