

# Customised VilniusTech PICASP Smart Systems

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## 1. Customised PICASP Smart Systems developed at VilniusTech

VilniusTech developed and used (1) Customized Google Tourism Text Analytics, (2) Tourism Computer Learning Systems, (3) PICASP Intelligent Tutoring System, and (4) access to open e-sources (games, digital twins, blockchain, AI, IoT, augmented, virtual and immersive realities, etc.) during the PICASP project. VilniusTech used these resources in VilniusTech 2 modules (Smart City and Analytics, Web and Biometric Support for Business Management) of our 2 MSc programs.

The project contributed to the development of the HE sector within society at large (Priority D) through the modernisation of higher education with student-centred approaches, the promotion of lifelong learning, and collaboration with labour market representatives to develop new innovative competences. A crucial step was to introduce online MOOC modules and the above four Customised VilniusTech PICASP Smart Systems in Kazakhstan's and Azerbaijan's education areas, as such modules and tools had not been trendy before that. The conversion of this learning aspect was even more beneficial during the COVID-19 pandemic as the universities eventually had to switch to online teaching systems.

The above four Customised VilniusTech PICASP Smart Systems were developed based on the common capacity-building framework and Bologna principles. Awareness about smart tourism, which fosters changes in consumer behaviour across countries of different regions, was thus enhanced. In addition, institutions in partner countries had an opportunity to learn from European good practices and enhance their capacities in curriculum development.

The Tourism Computer Learning Systems' ability to simulate various tourism and related alternatives make them a potentially useful tool in lifelong learning. The Customized Google Tourism Text Analytics and the PICASP Intelligent Tutoring System allow course tailoring to match the needs of a specific labour market. The open Customized Google Tourism Text Analytics and the PICASP Intelligent Tutoring System can help learners find a practical solution by searching through different textbooks, papers and other knowledge sources, which include all available courses and topics concerning tourism and related subjects. These technological innovations are tied to raising the overall effectiveness of the knowledge triangle in PCs.

ChatGPT, text classification, ontology building, automatic language processing, text clustering, concept/entity extraction, finding patterns in the structured data, information mining, relationship extraction, systematic content analysis, language engineering, language technology, emotion and sentiment analytics, granular taxonomies, text summarization, computational linguistics, output interpretation and entity relation modelling comprise the majority of innovative text mining and analytics functions. The current state of ChatGPT, text mining and analytics is unable to create document variants by developing various options, conducting multi-criteria examinations, and routinely identifying the most rational options based on multiple factors (journals IF, supporting expressions, paper title, density of keywords, manuscripts and authors citation index, etc.), compute usefulness grade and market value. We know the PICASP Intelligent Tutoring System can carry out the abovementioned tasks. To the best of the information provided, these tasks have never been used before (Figure 1).

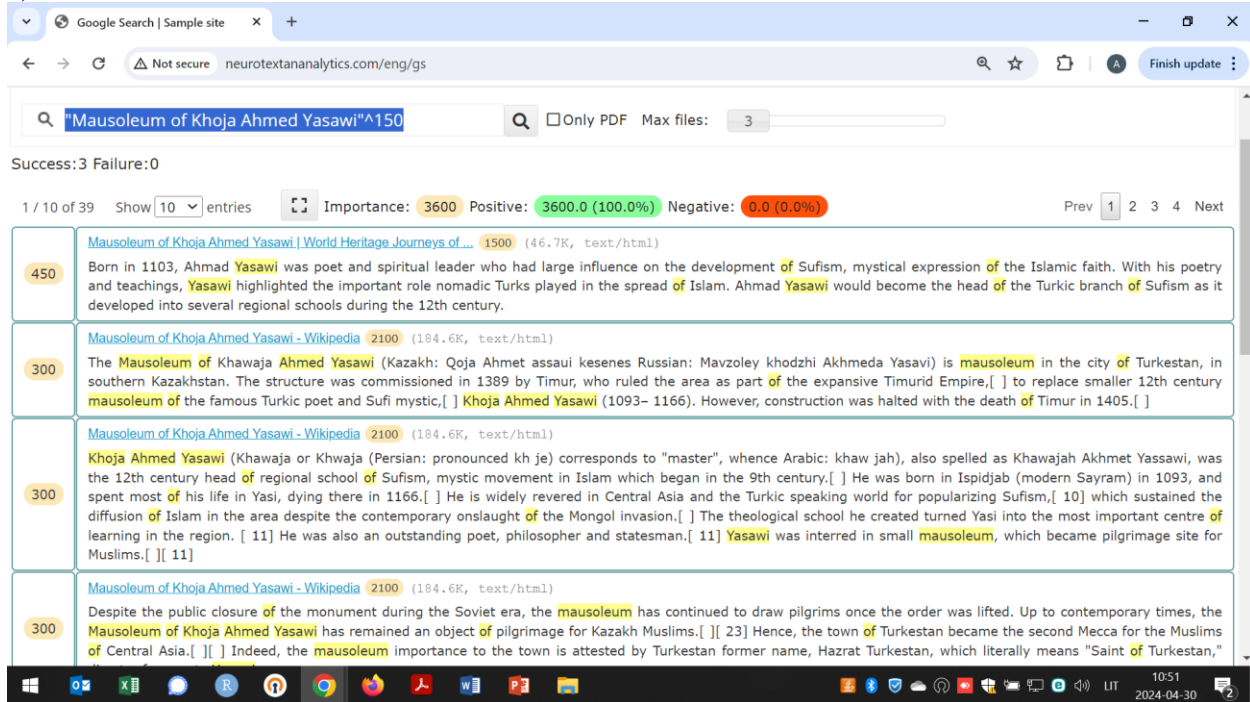
The screenshot displays the PICASP Intelligent Tutoring System interface. At the top, there are navigation links for "OPEN SOURCE MATERIAL" and "DATA FILES", along with a language selector set to "EN" and a "Log in" button. The main search area includes a "Search keywords:" input field, "Add a keyword" and "Quick search" buttons, and a list of keywords including "tourism". Below this, there are controls for "Delete", "Delete all", and "Add new" keywords, along with a "New keyword:" input and a "Weight for keywords adding:" dropdown set to "1". A "Significance" dropdown is also present. A "Search" button is located at the bottom of the keyword list. To the right, a list of suggested keywords includes "tourism", "disaster", "hurricaneapps", "hurricanecalculators", "education", "artificial intelligence", "HurricaneVideo", "drones", and "blockchain". Below the search area, there is a checkbox for "Advanced search options" and a "Search result document(PDF)" link. At the bottom, a table provides analysis data for three publications.

The following factors determine a rational text:	Publication 1	Publication 2	Publication 3
<b>Citation of papers:</b>			
Citation of papers (Web of Science)	11	-	-
<b>Top 25 papers</b>	-	1	-
<b>Impact factor of journals</b>	0.171	-	0.4
<b>Density of keywords (% of a text):</b>			
tourism	0.467873645055361	0.370653644760843	0.379796198646976

**Figure 1.** PICASP Intelligent Tutoring System

Customized Google Tourism Text Analytics was used to perform various Google text analytics. For example, Figure 2 shows a Google search for information about (a) the Mausoleum of Khoja Ahmed Yasawi, (b) Petroglyphs within the Archaeological Landscape of Tamgaly and (c) Silk Roads: the Routes Network of Chang'an-Tianshan Corridor.

a)



Google Search | Sample site x +

Not secure neurotextanalytics.com/eng/gs

Search: "Mausoleum of Khoja Ahmed Yasawi" ^150

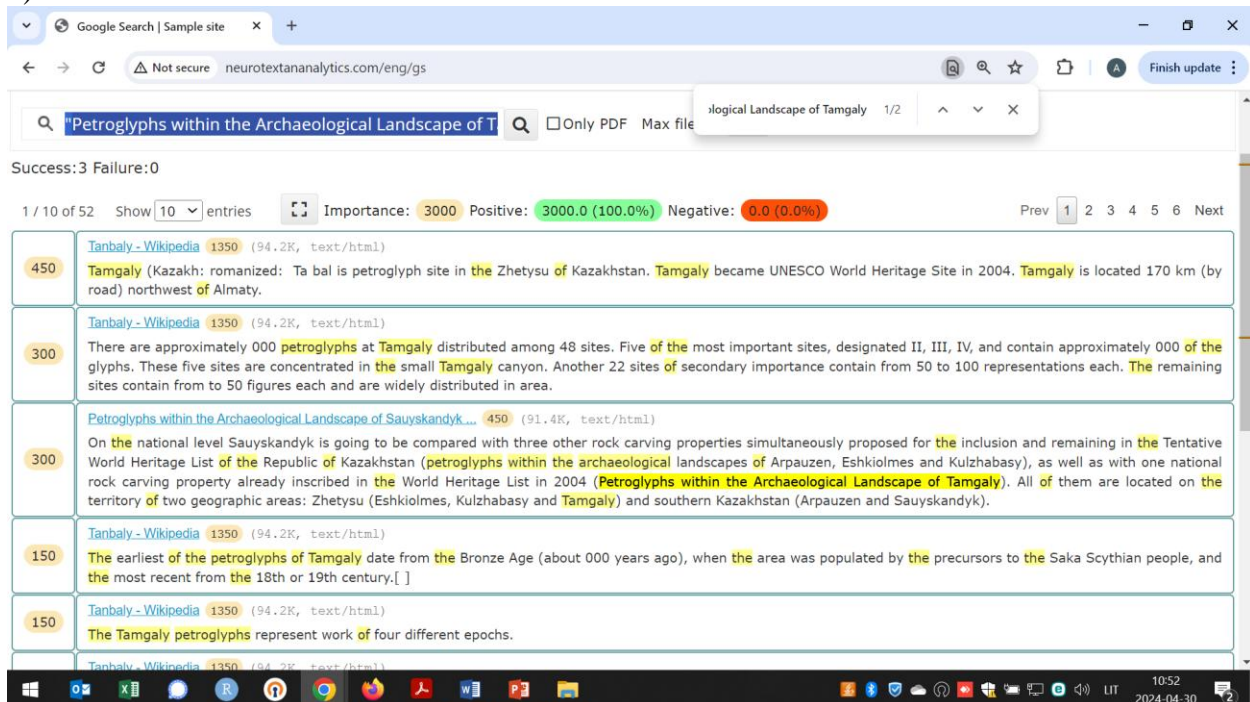
Only PDF Max files: 3

Success: 3 Failure: 0

1 / 10 of 39 Show 10 entries Importance: 3600 Positive: 3600.0 (100.0%) Negative: 0.0 (0.0%) Prev 1 2 3 4 Next

450	<a href="#">Mausoleum of Khoja Ahmed Yasawi   World Heritage Journeys of...</a> 1500 (46.7K, text/html)
450	Born in 1103, Ahmad Yasawi was poet and spiritual leader who had large influence on the development of Sufism, mystical expression of the Islamic faith. With his poetry and teachings, Yasawi highlighted the important role nomadic Turks played in the spread of Islam. Ahmad Yasawi would become the head of the Turkic branch of Sufism as it developed into several regional schools during the 12th century.
300	<a href="#">Mausoleum of Khoja Ahmed Yasawi - Wikipedia</a> 2100 (184.6K, text/html)
300	The Mausoleum of Khawaja Ahmed Yasawi (Kazakh: Qoja Ahmet assauï kesenes Russian: Mavzoley khodzhi Akhmeda Yasavi) is mausoleum in the city of Turkestan, in southern Kazakhstan. The structure was commissioned in 1389 by Timur, who ruled the area as part of the expansive Timurid Empire, [ ] to replace smaller 12th century mausoleum of the famous Turkic poet and Sufi mystic, [ ] Khoja Ahmed Yasawi (1093– 1166). However, construction was halted with the death of Timur in 1405. [ ]
300	<a href="#">Mausoleum of Khoja Ahmed Yasawi - Wikipedia</a> 2100 (184.6K, text/html)
300	Khoja Ahmed Yasawi (Khawaja or Khwaja (Persian: pronounced kh je) corresponds to "master", whence Arabic: khaw jah), also spelled as Khawajah Akhmet Yassawi, was the 12th century head of regional school of Sufism, mystic movement in Islam which began in the 9th century, [ ] He was born in Ispidjab (modern Sayram) in 1093, and spent most of his life in Yasi, dying there in 1166. [ ] He is widely revered in Central Asia and the Turkic speaking world for popularizing Sufism, [ 10] which sustained the diffusion of Islam in the area despite the contemporary onslaught of the Mongol invasion. [ ] The theological school he created turned Yasi into the most important centre of learning in the region. [ 11] He was also an outstanding poet, philosopher and statesman. [ 11] Yasawi was interred in small mausoleum, which became pilgrimage site for Muslims. [ ] [ 11]
300	<a href="#">Mausoleum of Khoja Ahmed Yasawi - Wikipedia</a> 2100 (184.6K, text/html)
300	Despite the public closure of the monument during the Soviet era, the mausoleum has continued to draw pilgrims once the order was lifted. Up to contemporary times, the Mausoleum of Khoja Ahmed Yasawi has remained an object of pilgrimage for Kazakh Muslims. [ ] [ 23] Hence, the town of Turkestan became the second Mecca for the Muslims of Central Asia. [ ] [ ] Indeed, the mausoleum importance to the town is attested by Turkestan former name, Hazrat Turkestan, which literally means "Saint of Turkestan,"

b)



Google Search | Sample site x +

Not secure neurotextanalytics.com/eng/gs

Search: "Petroglyphs within the Archaeological Landscape of T...ological Landscape of Tamgaly" 1/2

Only PDF Max file

Success: 3 Failure: 0

1 / 10 of 52 Show 10 entries Importance: 3000 Positive: 3000.0 (100.0%) Negative: 0.0 (0.0%) Prev 1 2 3 4 5 6 Next

450	<a href="#">Tamgaly - Wikipedia</a> 1350 (94.2K, text/html)
450	Tamgaly (Kazakh: romanized: Ta bal is petroglyph site in the Zhetysu of Kazakhstan. Tamgaly became UNESCO World Heritage Site in 2004. Tamgaly is located 170 km (by road) northwest of Almaty.
300	<a href="#">Tamgaly - Wikipedia</a> 1350 (94.2K, text/html)
300	There are approximately 000 petroglyphs at Tamgaly distributed among 48 sites. Five of the most important sites, designated II, III, IV, and contain approximately 000 of the glyphs. These five sites are concentrated in the small Tamgaly canyon. Another 22 sites of secondary importance contain from 50 to 100 representations each. The remaining sites contain from to 50 figures each and are widely distributed in area.
300	<a href="#">Petroglyphs within the Archaeological Landscape of Sauyskandyk...</a> 450 (91.4K, text/html)
300	On the national level Sauyskandyk is going to be compared with three other rock carving properties simultaneously proposed for the inclusion and remaining in the Tentative World Heritage List of the Republic of Kazakhstan (petroglyphs within the archaeological landscapes of Arpauzen, Eshkiolmes and Kulzhabasy), as well as with one national rock carving property already inscribed in the World Heritage List in 2004 (Petroglyphs within the Archaeological Landscape of Tamgaly). All of them are located on the territory of two geographic areas: Zhetysu (Eshkiolmes, Kulzhabasy and Tamgaly) and southern Kazakhstan (Arpauzen and Sauyskandyk).
150	<a href="#">Tamgaly - Wikipedia</a> 1350 (94.2K, text/html)
150	The earliest of the petroglyphs of Tamgaly date from the Bronze Age (about 000 years ago), when the area was populated by the precursors to the Saka Scythian people, and the most recent from the 18th or 19th century. [ ]
150	<a href="#">Tamgaly - Wikipedia</a> 1350 (94.2K, text/html)
150	The Tamgaly petroglyphs represent work of four different epochs.
150	<a href="#">Tamgaly - Wikipedia</a> 1350 (94.2K, text/html)

c)

The screenshot shows a Google search interface with the following details:

- Browser: Google Search | Sample site
- URL: neurotextanalytics.com/eng/ga
- Page 1 of 10 of 24 entries
- Importance: 2550
- Positive: 2550.0 (100.0%)
- Negative: 0.0 (0.0%)

The search results are as follows:

Rank	Score	Text Snippet
600	1200 (48.3K, text/html)	Kyrgyzstan Settlements - Silk Roads: The Routes Network of Chang'an-Tianshan Corridor... Imagine you are walking down path, and everyone around you has something new and exciting to offer, all coming from distant lands with different clothes and different languages. This is the equivalent of what the Silk Road was back between the 2nd century BC and 1st century AD. The Chang an Tianshan Corridor is an excellent example of physical space that has morphed into cultural icon. There are 33 recognized sites in the corridor: 22 in China, in Kazakhstan, and in Kyrgyzstan. Through changing landscapes, religious buildings, and remnants of cities once at the center of the world, this corridor preserves the legacy of the ancient Silk Road. Moving along this corridor allows visitors the opportunity to walk through the most transformative crossroads in history. Pavel Svoboda Photography Shutterstock
450	1350 (100.2K, text/html)	Silk Roads: the Routes Network of Chang'an-Tianshan Corridor... At the end of 2011, UNESCO proposed that due to the vast scale of the Silk Road project that the application be divided into corridors.[ ] In December 2011, China, Kazakhstan and Kyrgyzstan agreed to jointly pursue application for one corridor from Central China across the Tianshan Range, and each country nominated one government official, one archaeologist and national application committee. Tajikistan, Uzbekistan and Turkmenistan prepared to apply for another corridor.[ ] In 2013, the application for the Chang an Tianshan Corridor was finalized and officially submitted by Kyrgyzstan.[ ] It contained 22 sites in China, sites in Kazakhstan and sites in Kyrgyzstan. Each UNESCO member country may submit one application per year, and China had submitted an application for the Grand Canal.[ ] The original sites proposed by China was substantially revised for this application.[ ] Sites in the Ningxia Hui Autonomous Region and relating to the Maritime Silk Road were removed.[ ] Chinese organizers have said that several of the sites left out of the application may be submitted in the future.[ ]
300	1350 (100.2K, text/html)	Silk Roads: the Routes Network of Chang'an-Tianshan Corridor... Silk Roads: The Routes Network of Chang an Tian Shan Corridor is UNESCO World Heritage Site which covers the Chang an Tianshan portion of the ancient Silk Road and historical sites along the route. On June 22, 2014, UNESCO designated 000 km stretch of the Silk Road network from Central China to the Zhetysu region of Central Asia as World Heritage site. The corridor spans China, Kazakhstan and Kyrgyzstan and includes 33 new sites and several previously designated heritage sites.[ ]
300	1200 (48.3K, text/html)	Kyrgyzstan Settlements - Silk Roads: The Routes Network of Chang... The views vary from breathtaking green landscapes, to desert oases. Expect to pass many beautiful villages and old religious sites along the way, with each one just as fascinating as the last. Massive sculptures can also be seen along the way, particularly relating to Buddhism. Religion is key when exploring the Silk Road, as it has led heavily to the influences we see today in Asia. The corridor shows the transition of Buddhism in the east and the Chinese imperial government as well. Now, the Chang an Tianshan Corridor is accredited with being one of the largest spreaders of culture, economics, and philosophy in the Asia region at that time.

**Figure 2.** Customized Google Tourism Text Analytics with particular emphasis on Kazakhstan's cultural heritage.

We also applied Customized Google Tourism Text Analytics to perform numerous Azerbaijan intangible cultural heritage elements in Google text analytics. For example, Figure 3 shows a Google search for information about: (a) Azerbaijani Mugham, (b) Art of Azerbaijani Ashiq (c) Traditional art of Azerbaijani carpet weaving in the Republic of Azerbaijan.

a)



617540-EPP-1-2020-1-IT-EPPKA2-CBHE-JP

Google Search | Sample site x +

Not secure neurotextanalytics.com/eng/gs

1 / 10 of 36 Show 10 entries Importance: 9150 Positive: 9150.0 (100.0%) Negative: 0.0 (0.0%) Prev 1 2 3 4 Next

900	<p><a href="#">Azerbaijani mugham — Google Arts &amp; Culture</a> 6600 (775.9K, text/html)</p> <p>Mugham, or mughamat, is musical genre that expresses complex ideas, emotional meaning, deep and comprehensive thinking, artistic excitement and the development of various musical characters. Since ancient times, mugham has grown, taken shape and been perfected as result of gradual development and evolution over centuries. In Azerbaijan, mugham is usually performed by khananda mugham singer), accompanied by mugham trio. This vocal instrumental performance by such trio is called whole mugham dastgah.</p>
900	<p><a href="#">Azerbaijani mugham — Google Arts &amp; Culture</a> 6600 (775.9K, text/html)</p> <p>The creative heritage of mugham performers in Azerbaijan is now preserved and promoted around the world. The International Mugham Centre has been established, the Mugham World International Mugham Festival presents, the magazine World of Mugham is published, and archived records are being restored and transferred to electronic media. On November 2003, Azerbaijani mugham was proclaimed by UNESCO as masterpiece of the intangible heritage of humanity. In 2008, Azerbaijani mughams were included in UNESCO' Representative List of Intangible Cultural Heritage.</p>
750	<p><a href="#">Azerbaijani mugham — Google Arts &amp; Culture</a> 6600 (775.9K, text/html)</p> <p>The history of mugham is very ancient one. Scientists attribute the creation of mugham, this magnificent artistic monument of Eastern music, to the past millennium, the pre Islamic era. They associate its roots with Zoroastrianism. But mugham has been enriched through the centuries, and was widely used by the Sufi in the Middle Ages. The idea is also expressed that mugham clears and purifies the human soul by the power of God. It is no coincidence that scholars of antiquity used mugham as treatment.</p>
600	<p><a href="#">Azerbaijani mugham — Google Arts &amp; Culture</a> 6600 (775.9K, text/html)</p> <p>The movements included in mugham composition consist of improvised recitative style vocal melodies that define the musical poetic content of the work. These are replaced by song and dance episodes with precise rhythm. Song episodes are called tasnif and those of dance are called rang. Mugham is music of the soul and therefore deeply affects people and transports them far away. The monumental, sequential form of mugham, including the slightest polishing of minor details, differs in terms of its counterpoints by reflecting the melody' expressive capabilities. The mugham performance requires perfect technique with the instruments and an understanding of the uniformity of the structure of the whole composition, the logic of the transitions from one movement to the next.</p>
600	<p><a href="#">Azerbaijani mugham — Google Arts &amp; Culture</a> 6600 (775.9K, text/html)</p> <p>The great masters such as Khan Shushinski, Zulfi Adigozalov, Seyid Shushinski, Abulfat Aliyev, Mutallim Mutallimov, Islam Rzayev and Arif Babayev are shining figures of the Shusha Mugham School. The calling card of Garabagh mugham performers is the Garabagh Shikestesi mugham which is modal musical system in zarbi mugham music.</p>

b)

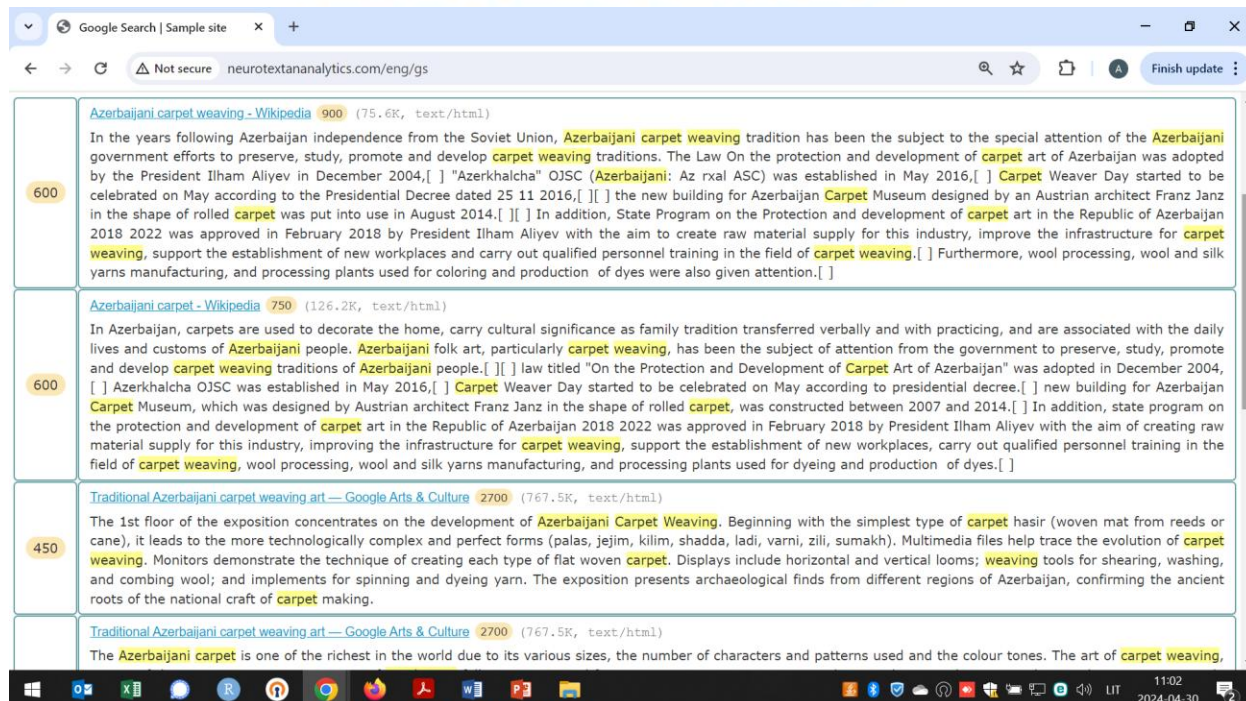
Google Search | Sample site x +

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1 / 10 of 47 Show 10 entries Importance: 8100 Positive: 8100.0 (100.0%) Negative: 0.0 (0.0%) Prev 1 2 3 4 5 Next

900	<p><a href="#">Ashiqs of Azerbaijan - Wikipedia</a> 3450 (133.7K, text/html)</p> <p>Ashiq poets, on the contrary, along with storytelling activities, engaged also in poetry. In Azerbaijan, such Ashiqs were called Ustad, which translates from Persian as "master". Ashiq poets have their own schools, where they teach their students the basics of ashig creativity. Famous Ashiq poets include such gifted poets as Gurbani, ashig Abbas from Tufargan, st Qas (Hasta Gasym), ashig Valeh, Ashig Alasgar and many others. They had tremendous impact not only on ashig poetry but also greatly influenced the written literature of Azerbaijan. [ ]</p>
900	<p><a href="#">Ashiqs of Azerbaijan - Wikipedia</a> 3450 (133.7K, text/html)</p> <p>The popular ashigs of modern Azerbaijan include ashig Zulfiyya, ashig Nemet Qasimli, ashig Ahliman, ashig Adalat, ashig Kamandar, Ali Tovuzly and ashig Khanlar.[ ] The late Zalimkhan Yagub, member of Parliament of Azerbaijan and Chairman of the Union of Ashiqs through 2015, was also very popular.</p>
750	<p><a href="#">The Art of Azerbaijani Ashiq :: Azərbaycan-UNESCO əlaqələri</a> 3000 (10.5K, text/html)</p> <p>There are over 80 geographical types of ashig melodies Karami Afshari Kurdu Dilgami Yanig Karami The alignment between the poetic text and ashig music has an important impact on their forms and rhythmic features. The main verse in ashig melodies is syllable. The structure of the melodies is closely linked to the poetic form and the content of the syllable. Ashig Gurbani (XVI century), Ashig Abbas Tufarganlı, Ashig Sarah (XVII century), Hasta Gasim, Ashig Valeh, Ashig Dilgam (XVIII century), Ashig Ali, Ashig Alasgar, Ashig Hussein Shamkiri (XIX century) and others, are considered classics of the ashig art. Among modern ashig masters Ashig Hussein Bozalganlı, Ashig Assad, Ashig Mirza, Ashig Islam, Ashig Shamshir, Huseyn Saradzhy, Gulmammadov Amrah, Hussein Javan, Ashig Kyamandar, Imran Hasanov, Azafly Mikail, Akbar Jafarov enjoy popularity. Ashig music is widely spread in the regions of Azerbaijan Gazakh, Tovuz, Shamakha, as well as in the historic regions Goycha and Borchali.</p>
600	<p><a href="#">Azerbaijani Ashig Art — Google Arts &amp; Culture</a> 1650 (778.6K, text/html)</p> <p>Distinguished modern day ashigs include Ashiq Hussein Bozanganli, Ashiq Asad, Ashig Mirza, Ashiq Islam, Ashig Shamshir, Huseyn Sarajli, Amrah Gulmammadov, Huseyn Javan, Ashiq Kamandar, Imran Hasanov, Mikayil Azafli, Akbar Jafarov and others.</p>
600	<p><a href="#">The Art of Azerbaijani Ashiq :: Azərbaycan-UNESCO əlaqələri</a> 3000 (10.5K, text/html)</p> <p>The most common verse in ashig poems is syllable and the structure of poem used in ashig songs is quatrain verses. Each verse starts with an instrumental into and verses are separated by instrumental solos. Kitabi Dede Gorgud folk epic which dates back to VII century, is the oldest among epic works dedicated to life, love and heroism of ancient ozans. Folk music had great influence on the work of national composers. For the first time some elements of the ashig music were used by Uzeyir Hajibeyli in his Koroghlu opera, as well as by Gara Garayev who combined technical means of contemporary music with ashig music in the second part of the Third Symphony.</p>

c)



**Figure 3.** Customized Google Tourism Text Analytics, particularly emphasizing Azerbaijan’s intangible cultural heritage elements.

## 2. VilniusTech Modules

During the PICASP project, new training methodologies were developed and disseminated, including company practices, (1) Customized Google Tourism Text Analytics, (2) Tourism Computer Learning Systems, (3) PICASP Intelligent Tutoring System, and (4) access to open resources (games, digital twins, blockchain, AI, IoT, augmented, virtual and immersive realities, etc.). VilniusTech used these resources in VilniusTech 2 modules (Smart City and Analytics, Web and Biometric Support for Business Management) of our 2 MSc programs. A series of lectures to discuss the topics of Groundbreaking Technologies in Tourism (Fig. 4) and Tourism Trends (The Latest Opportunities for The Tourism Industry, Fig. 5) were also delivered during the project.

As part of Deliverable 1.3 “Training tours of PC University staff” (Work Package 1 “Preparation for the implementation of Pilot Courses Programmes”), MOOC teacher training took place in Baku, Azerbaijan, on 23–25 November 2022. During the training, the development of MOOCs was discussed in detail. VilniusTech introduced teachers to online education experiences at VilniusTech.

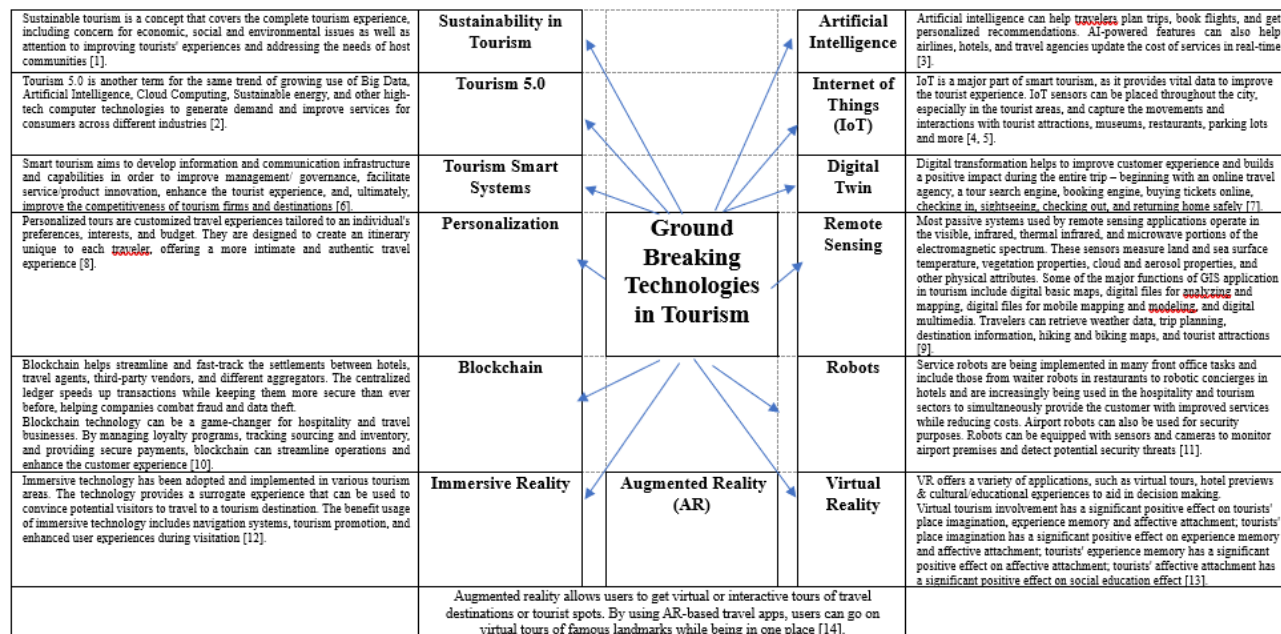
As part of Work Package 2 “Implementation of Pilot Courses and new Didactics in SMEs Entrepreneurship and Management”, VilniusTech participated in the implementation of new teaching methods through MOOCs. VilniusTech contributed with its expert knowledge to technical support preparation and hardware and software integration. VilniusTech also contributed to the implementation of interuniversity network for new didactics on SME entrepreneurship and management.

As part of Work Package 3 “Quality Plan and Accreditation”, the Report on Internal and External Control of Quality and the Report on Quality Procedures Implementation were prepared.

VilniusTech provided the module “Smart City and Analytics (with Course Project)” described in Table 1.

**Table 1.** VilniusTech module “Smart City and Analytics (with Course Project)”

<b>For new courses</b>	
<b>What Practice Enterprise new courses will the PICASP project implement in your HEI?</b>	<b>Smart City and Analytics (with Course Project), 6 credits</b>
Title	Smart City and Analytics (with Course Project)
Level of study	Hybrid studies, full time, 2 semesters, 16 weeks, first-year students
List of subjects and credits for each of them	Course topics (MOOC): Tourism 5.0, smart tourism, robots, chatbots and automation, personalisation and customisation, tech-empowered travel, sustainable tourism, active ecotourism, transformative travel, experience tourism, wellness travel, staycation, virtual reality, voice search & voice control, artificial intelligence, the Internet of Things, Recognition Technology, big data analytics, blockchain, digital twins. Total 6 credits.
Date of implementation (up and running)	Started in February 2023



**Figure 4.** Ground-breaking Technologies in Tourism.



Whether it is airlines, cruises, hotels, restaurants, or bars since the outbreak of COVID, safety and hygiene standards have been paramount. Several tourism trends are related to this, such as increased cleaning, socially distanced seating, providing hand gel, and enforcing masks in some settings [1].	<b>Safety and Hygiene</b>	<b>Tourism Trends</b>	<b>Artificial Intelligence</b>	Machine learning technology is now firmly entrenched in the marketing of the tourism sector, with AI helping to personalize the experience of finding and booking tours and trips. AI is also increasingly valuable in contexts such as smart hotel rooms, identifying the likely needs of guests and fine-tuning the environment and services to fit the guest's needs and preferences [2].
Allowing contactless payments has enabled tourism companies to reduce friction and improve the speed of check-ins and check-outs. With the coronavirus, contactless payments are in greater demand than ever, as staff and customers often prefer to avoid handling cash [2].	<b>Contactless Payments</b>		<b>Recognition Technology</b>	One of the most familiar recognition technology applications for a frequent traveler is the bank of automatic gates at some borders [2].
With home smart speakers growing in popularity and mobile assistants like Siri, Google Assistant, and Bingy, more tourism customers are turning to voice search. For those in the tourism industry, it is important to capture these guests by structuring website content properly so it appears in voice search and allows for voice bookings [2].	<b>Voice Search and Voice Control</b>		<b>Internet of Things (IoT)</b>	IoT devices are gadgets equipped with a microprocessor and digital connectivity, allowing them to connect to, and be controlled from, the internet. IoT devices include heating and cooling systems, entertainment systems, and other items often found in a hotel room, giving rise to "smart" hotel rooms [2].
Customers can experience hotel interiors, restaurant interiors, outdoor tourist attractions, and more from their homes through online VR tours. VR is especially useful after COVID, where customers may need extra encouragement to press ahead with their plans. Most modern VR tours are web-based and can be viewed through any mainstream web browser [2].	<b>Virtual Reality and Metaverse Travel</b>		<b>Augmented Reality (AR)</b>	Augmented reality travel is an inevitable part of the tourism industry's future. It will alter how tourists, business people, and families plan their trips, get to their destinations, and engage with hotels, restaurants, and other points of interest [3].
The needs of solo travelers are diverse. Some want to travel without the distraction of a companion. Others are young singles looking for social activities or to find a partner. Some widowed seniors even use long-term hotel stays or cruises as a luxurious alternative to conventional elder care. These tourism trends are set to grow and grow [2].	<b>Solo Travel</b>		<b>Healthy and Organic Food</b>	Healthy food and the kind of fare consumed by tourists used to be antonyms in the minds of many travelers, with holidays traditionally representing a chance to break one's diet and indulge in forbidden treats. Demand for excellent cuisine with a view to better nutrition drives new tourism trends [4].
Eco-travel is just one example of these tourism trends, reflecting a growing concern among today's travelers for ethical and sustainable tourism options. Eco travel includes simple changes, such as the availability of carbon credits when booking a flight or the option to rent an electric instead of a conventional vehicle [2].	<b>Eco-Travel</b>		<b>Customer Experience 2.0</b>	With new technologies and an ever-broadening array of tourist options, enhancing the customer experience has never been more vital. Fine-tuning the experience can make the difference between creating a loyal repeat customer who boosts the business via word of mouth and one who drops out at the booking stage [5].
Today's tourists don't want to be insulated from the places they visit inside a cultural bubble. They want to engage with and participate in the local culture. From enjoying local cuisine to celebrating regional festivals and holidays, local experiences are set to become some of the top tourist trends to watch [2].	<b>Local Experience</b>		<b>Nostalgic Travel Options</b>	Nostalgia can inform travel decisions in several ways, such as a longing for simpler times and encouraging travelers to book trips to remote locations. Alternatively, nostalgia could see travelers focus on domestic trips, particularly on places they visited when they were younger [4].
Some of the key industry trends impacting the personalization theme are the rise in usage of mobile travel apps, the increase in digital partnerships between travel and tourism companies and leading technology providers, and the rising use of technologies such as artificial intelligence and machine learning (AI and ML), Big data among others [2].	<b>Personalization</b>		<b>Wellness And Self-Care Travel</b>	Travelers are looking to relax, unwind, and unplug on wellness and self-care vacations. These types of trips often have an emphasis on spa treatments, wellness activities, and healthy eating. It's all about using your time off to focus on your mental, physical, and spiritual well-being [6].
Chatbots are used in the tourism industry by collect data, obtain feedback and manage complaints. Chatbots record each of their communication with the users, thus allowing companies to do market research as they go and gather rich qualitative data from their customers. Hotel robots can be categorized into four major categories: chatbots, robotic service bots, housekeeping robots, and voice assistant robots [2].	<b>Robots, Chatbots, and Automation</b>		<b>Megatrends</b>	Four megatrends are likely to have significant impacts and relevance for tourism: i) evolving visitor demand; ii) sustainable tourism growth; iii) enabling technologies; and iv) travel mobility [7].

**Figure 5.** Tourism Trends: The Latest Opportunities for The Tourism Industry.

### 3. The Tourism Computer Learning Systems: Case Studies

The VilniusTech team developed the Tourism Computer Learning Systems. These systems are able to provide, in real-time, multivariate design and multi-criteria analysis and select the most rational tourism alternatives. Furthermore, the systems provide different and complex scenarios in real-time, which enables effective and informed tourism decision-making based on adequate, available and trustworthy data.

#### Case Study 1: Calculations of the hotel location utility degree

Aksoy and Ozbuk (2017) applied Multiple criteria decision making for hotel location evaluation. They analyzed customers' location selection criteria (10 criteria) for Istanbul urban hotels (15 hotels) and alternative hotels. The objective of the study was to rank the hotels from the best to worst in terms of location for the given criteria. The authors took into consideration the following criteria: distance to airport; distance to tram station; distance to bus stop; distance to ferry terminal; distance to metro station; distance to ferry dock; distance to the closest downtown; socio-economic rating of the district; number of tourist attractions in walking distance; distance to old town. By random choice 15 hotels were selected for analysis. At the end of the study preference selection index for alternative hotels and ranking of the alternatives were presented.

VilniusTECH team created Tourism Computer Learning Systems which allows to provide the priority of the alternatives by application of multiple criteria analysis methods and recommendations. The Tourism Computer Learning Systems was applied for this case study. The initial matrix presented in **Table 2**.

**Table 2.** Initial matrix for calculations of the hotel location utility degree



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Quantitative and qualitative information pertinent to alternatives																		
Criteria describing the alternatives	*	Measuring units	Weight	Compared alternatives														
				A (A1)	B (A2)	C (A3)	D (A4)	E (A5)	F (A6)	G (A7)	H (A8)	I (A9)	J (A10)	K (A11)	L (A12)	M (A13)	N (A14)	O (A15)
Distance to airport (C1)	+	km	1	30.2	30.4	6.4	18.4	20.6	21.4	23.9	19.7	49.5	23.4	21.6	19.4	21.1	21.4	5.6
Distance to tram station (C2)	+	km	1	2.8	3.7	4.7	0.45	0.4	0.11	1.4	0.6	6.8	0.5	0.17	0.5	0.2	0.14	4.8
Distance to bus stop (C3)	+	km	1	0.2	0.75	0.14	0.06	0.11	0.65	0.18	0.4	0.24	0.24	0.18	0.14	0.3	0.65	0.65
Distance to ferry terminal (C4)	+	km	1	2.8	3.7	18.5	2.6	1.5	0.8	1.5	1.7	3.9	1.5	0.5	2.2	1.2	0.75	15.2
Distance to metro station (C5)	+	km	1	0.24	1	0.65	0.7	2.3	2.8	0.22	2.4	3.4	0.4	2.8	1	2.4	2.9	4.1
Distance to ferry dock (C6)	+	km	1	7.8	8.7	11.4	1.1	1.8	2.9	5.8	1.6	16.3	6	2.8	1.6	2.2	2.9	13.5
Distance to the closest downtown (C7)	+	km	1	2.2	2.6	2.6	0.45	0.6	0.5	0.35	0.8	2.6	0.6	0.28	0.5	0.35	0.55	1.4
Socio-economic rating of the district (C8)	+	km	1	2.06	2.06	0.14	0.81	0.81	0.81	0.89	0.58	0.38	0.76	0.58	0.58	0.58	0.58	0.15
Number of tourist attractions in walking distance (C9)	+	km	1	1	1	1	34	34	34	16	34	1	16	34	34	34	34	1
Distance to old town (C10)	+	km	1	6.3	7.1	13	2	0.6	0.55	4.4	0.8	14.4	4.6	0.8	2.1	0.35	0.55	14.6

\*- The sign "+/-" indicates that a greater (less) criterion value corresponds to a greater significance for a user (stakeholders)  
The magnitude of weight (qi) indicates how many times one keyword is more/less significant than the other one in the rational text selection. For example, the keyword "cost" (qc=1) is 2,5 times more significant for user than the keyword "microclimate" (qm=0,4). Weights of keywords may be obtained as follows: the most important keyword is set equal to the magnitude of one point (qmi=1); the ratio (pi) amongst all the rest keywords and the best keyword magnitude is determined; the keywords are given relative values (qmi= pi); relative values of all keywords weights are recalculated so that their sum makes one.

Calculation results presented in Table 3.

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**Table 3.** Calculation results of the hotel location utility degree

Quantitative and qualitative information pertinent to alternatives																	
Criteria describing the alternatives	Measuring units	Weight	Compared alternatives														
			A (A1)	B (A2)	C (A3)	D (A4)	E (A5)	F (A6)	G (A7)	H (A8)	I (A9)	J (A10)	K (A11)	L (A12)	M (A13)	N (A14)	O (A15)
Distance to airport (C1)	+km	1	0.0907 AVG MIN	0.0913 AVG MIN	0.0192 AVG MIN	0.0553 AVG MIN	0.0619 AVG MIN	0.0643 AVG MIN	0.0718 AVG MIN	0.0592 AVG MIN	0.1486 AVG MIN	0.0703 AVG MIN	0.0649 AVG MIN	0.0583 AVG MIN	0.0634 AVG MIN	0.0643 AVG MIN	0.0168 AVG MIN
Distance to tram station (C2)	+km	1	0.1027 AVG MIN	0.1357 AVG MIN	0.1724 AVG MIN	0.0165 AVG MIN	0.0147 AVG MIN	0.004 AVG MIN	0.0513 AVG MIN	0.022 AVG MIN	0.2494 AVG MIN	0.0183 AVG MIN	0.0062 AVG MIN	0.0183 AVG MIN	0.0073 AVG MIN	0.0051 AVG MIN	0.176 AVG MIN
Distance to bus stop (C3)	+km	1	0.0409 AVG MIN	0.1534 AVG MIN	0.0286 AVG MIN	0.0123 AVG MIN	0.0225 AVG MIN	0.1329 AVG MIN	0.0368 AVG MIN	0.0818 AVG MIN	0.0491 AVG MIN	0.0491 AVG MIN	0.0368 AVG MIN	0.0286 AVG MIN	0.0613 AVG MIN	0.1329 AVG MIN	0.1329 AVG MIN
Distance to ferry terminal (C4)	+km	1	0.048 AVG MIN	0.0634 AVG MIN	0.3171 AVG MIN	0.0446 AVG MIN	0.0257 AVG MIN	0.0137 AVG MIN	0.0257 AVG MIN	0.0291 AVG MIN	0.0668 AVG MIN	0.0257 AVG MIN	0.0086 AVG MIN	0.0377 AVG MIN	0.0206 AVG MIN	0.0129 AVG MIN	0.2605 AVG MIN
Distance to metro station (C5)	+km	1	0.0088 AVG MIN	0.0366 AVG MIN	0.0238 AVG MIN	0.0256 AVG MIN	0.0842 AVG MIN	0.1025 AVG MIN	0.0081 AVG MIN	0.0879 AVG MIN	0.1245 AVG MIN	0.0146 AVG MIN	0.1025 AVG MIN	0.0366 AVG MIN	0.0879 AVG MIN	0.1062 AVG MIN	0.1501 AVG MIN
Distance to ferry dock (C6)	+km	1	0.0903 AVG MIN	0.1007 AVG MIN	0.1319 AVG MIN	0.0127 AVG MIN	0.0208 AVG MIN	0.0336 AVG MIN	0.0671 AVG MIN	0.0185 AVG MIN	0.1887 AVG MIN	0.0694 AVG MIN	0.0324 AVG MIN	0.0185 AVG MIN	0.0255 AVG MIN	0.0336 AVG MIN	0.1562 AVG MIN
Distance to the closest downtown (C7)	+km	1	0.1343 AVG MIN	0.1587 AVG MIN	0.1587 AVG MIN	0.0275 AVG MIN	0.0366 AVG MIN	0.0305 AVG MIN	0.0214 AVG MIN	0.0488 AVG MIN	0.1587 AVG MIN	0.0366 AVG MIN	0.0171 AVG MIN	0.0305 AVG MIN	0.0214 AVG MIN	0.0336 AVG MIN	0.0855 AVG MIN
Socio-economic rating of the district (C8)	+km	1	0.175 AVG MIN	0.175 AVG MIN	0.0119 AVG MIN	0.0688 AVG MIN	0.0688 AVG MIN	0.0688 AVG MIN	0.0756 AVG MIN	0.0493 AVG MIN	0.0323 AVG MIN	0.0646 AVG MIN	0.0493 AVG MIN	0.0493 AVG MIN	0.0493 AVG MIN	0.0493 AVG MIN	0.0127 AVG MIN
Number of tourist attractions in walking distance (C9)	+km	1	0.0032 AVG MIN	0.0032 AVG MIN	0.0032 AVG MIN	0.11 AVG MIN	0.11 AVG MIN	0.11 AVG MIN	0.0518 AVG MIN	0.11 AVG MIN	0.0032 AVG MIN	0.0518 AVG MIN	0.11 AVG MIN	0.11 AVG MIN	0.11 AVG MIN	0.11 AVG MIN	0.0032 AVG MIN
Distance to old town (C10)	+km	1	0.0873 AVG MIN	0.0984 AVG MIN	0.1802 AVG MIN	0.0277 AVG MIN	0.0083 AVG MIN	0.0076 AVG MIN	0.061 AVG MIN	0.0111 AVG MIN	0.1996 AVG MIN	0.0638 AVG MIN	0.0111 AVG MIN	0.0291 AVG MIN	0.0049 AVG MIN	0.0076 AVG MIN	0.2024 AVG MIN
The sums of weighted normalized maximizing (projects)			0.7812	1.0164	1.047	0.401	0.4535	0.5679	0.4706	0.5177	1.2209	0.4642	0.4389	0.4169	0.4516	0.5555	1.1963

'pluses') indices of the alternative																
The sums of weighted normalized minimizing (projects 'minuses') indices of the alternative	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05
Significance of the alternative	0.7812	1.0164	1.047	0.401	0.4535	0.5679	0.4706	0.5177	1.2209	0.4642	0.4389	0.4169	0.4516	0.5555	1.1963	
Priority of the alternative	5	4	3	15	11	6	9	8	1	10	13	14	12	7	2	
Utility degree of the alternative (%)	63.99%	83.25%	85.76%	32.84%	37.14%	46.51%	38.55%	42.4%	100%	38.02%	35.95%	34.15%	36.99%	45.5%	97.98%	

Table 3 shows that the ninth alternative (A9) is the best by utility degree equaling N<sub>9</sub>=100%. The fifteenth alternative A(15) was second according to priority, and its utility degree was equal to N<sub>15</sub>=97.98%.

### Provision of recommendations

VilniusTECH team created Tourism Computer Learning Systems provides the recommendations. The system provided recommendations for compared alternatives: possible improvement of the analysed criterion in %; Possible increase of the market value of the alternative in % through increased value of the aforementioned criterion.

The recommendations for Case study 1 are shown in **Table 4**.

**Table 4.** Recommendations for the hotel location

Quantitative and qualitative information pertinent to alternatives																	
Criteria describing the alternatives	Measuring units	Weight	Compared alternatives														
			Possible improvement of the analysed criterion in %														
			Possible increase of the market value of the alternative in % through increased value of the aforementioned criterion														
			A (A1)	B (A2)	C (A3)	D (A4)	E (A5)	F (A6)	G (A7)	H (A8)	I (A9)	J (A10)	K (A11)	L (A12)	M (A13)	N (A14)	O (A15)
<a href="#">C1</a>	km	1	30.2 (63.91%) (6.3907%)	30.4 (62.83%) (6.2829%)	6.4 (673.44%) (67.3438%)	18.4 (169.02%) (16.9022%)	20.6 (140.29%) (14.0291%)	21.4 (131.31%) (13.1308%)	23.9 (107.11%) (10.7113%)	19.7 (151.27%) (15.1269%)	49.5 (0%) (0%)	23.4 (111.54%) (11.1538%)	21.6 (129.17%) (12.9167%)	19.4 (155.15%) (15.5155%)	21.1 (134.67%) (13.4597%)	21.4 (131.31%) (13.1308%)	5.6 (783.93%) (78.3929%)
<a href="#">C2</a>	km	1	2.8 (142.86%) (14.2857%)	3.7 (83.78%) (8.3784%)	4.7 (44.68%) (4.4681%)	0.45 (1411.11%) (141.1111%)	0.4 (1600%) (160%)	0.11 (6081.82%) (608.1818%)	1.4 (385.71%) (38.5714%)	0.6 (1033.33%) (103.3333%)	6.8 (0%) (0%)	0.5 (1260%) (126%)	0.17 (3900%) (390%)	0.5 (1260%) (126%)	0.2 (3300%) (330%)	0.14 (4757.14%) (475.7143%)	4.8 (41.67%) (4.1667%)
<a href="#">C3</a>	km	1	0.2 (275%) (27.5%)	0.75 (0%) (0%)	0.14 (435.71%) (43.5714%)	0.06 (1150%) (115%)	0.11 (581.82%) (58.1818%)	0.65 (15.38%) (1.5385%)	0.18 (316.67%) (31.6667%)	0.4 (87.5%) (8.75%)	0.24 (212.5%) (21.25%)	0.24 (212.5%) (21.25%)	0.18 (316.67%) (31.6667%)	0.14 (435.71%) (43.5714%)	0.3 (150%) (15%)	0.65 (15.38%) (1.5385%)	0.65 (15.38%) (1.5385%)
<a href="#">C4</a>	km	1	2.8 (560.71%) (56.0714%)	3.7 (400%) (40%)	18.5 (0%) (0%)	2.6 (611.54%) (61.1538%)	1.5 (1133.33%) (113.3333%)	0.8 (221.25%) (22.125%)	1.5 (1133.33%) (113.3333%)	1.7 (988.24%) (98.8235%)	3.9 (374.36%) (37.436%)	1.5 (1133.33%) (113.3333%)	0.5 (3600%) (360%)	2.2 (740.91%) (74.0909%)	1.2 (1441.67%) (144.1667%)	0.75 (2366.67%) (236.6667%)	15.2 (21.71%) (2.1711%)
<a href="#">C5</a>	km	1	0.24 (1608.33%) (160.833%)	1 (310%) (31%)	0.65 (530.77%) (53.077%)	0.7 (485.71%) (48.571%)	2.3 (78.26%) (7.826%)	2.8 (46.43%) (4.643%)	0.22 (1763.64%) (176.364%)	1.5 (70.83%) (7.083%)	3.4 (20.59%) (2.059%)	0.4 (925%) (92.5%)	2.8 (46.43%) (4.643%)	1 (310%) (31%)	2.4 (70.83%) (7.083%)	2.9 (41.38%) (4.138%)	4.1 (0%) (0%)



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			(160.83 33%)		(53.076 9%)	(48.571 4%)	(7.8261 %)	(4.6429 %)	(176.36 36%)	(7.0833 %)	(2.058 8%)		(4.642 9%)		(7.0833 %)	(4.1379 %)	
<b>C6</b>	km	1	7.8 (108.97 %) (10.897 4%)	8.7 (87.36 %) (8.735 6%)	11.4 (42.98 %) (4.2982 %)	1.1 (1381.8 2%) (138.18 18%)	1.8 (805.56 %) (80.555 6%)	2.9 (462.07 %) (46.206 9%)	5.8 (181.03 %) (18.103 4%)	1.6 (918.75 %) (91.875 %)	16.3 (0%) (0%)	6 (171.67 %) (17.166 7%)	2.8 (482.1 4%) (48.21 43%)	1.6 (918.7 5%) (91.87 5%)	2.2 (640.91 %) (64.090 9%)	2.9 (462.07 %) (46.206 9%)	13.5 (20.74 %) (2.0741 %)
<b>C7</b>	km	1	2.2 (18.18 %) (1.8182 %)	2.6 (0%) (0%)	2.6 (0%) (0%)	0.45 (477.78 %) (47.777 8%)	0.6 (333.33 %) (33.333 3%)	0.5 (420%) (42%)	0.35 (642.86 %) (64.285 7%)	0.8 (225%) (22.5%)	2.6 (0%) (0%)	0.6 (333.33 3%) (33.333 3%)	0.28 (828.5 7%) (82.85 71%)	0.5 (420%) (42%)	0.35 (642.86 %) (64.285 7%)	0.55 (372.73 %) (37.272 7%)	1.4 (85.71 %) (8.5714 %)
<b>C8</b>	km	1	2.06 (0%) (0%)	2.06 (0%) (0%)	0.14 (1371.4 3%) (137.14 29%)	0.81 (154.32 %) (15.432 1%)	0.81 (154.32 %) (15.432 1%)	0.81 (154.32 %) (15.432 1%)	0.89 (131.46 %) (13.146 1%)	0.58 (255.17 %) (25.517 2%)	0.38 (442.1 1%) (44.21 05%)	0.76 (171.05 %) (17.105 3%)	0.58 (255.1 7%) (25.51 72%)	0.58 (255.1 7%) (25.51 72%)	0.58 (255.17 %) (25.517 2%)	0.58 (255.17 %) (25.517 2%)	0.15 (1273.3 3%) (127.33 33%)
<b>C9</b>	km	1	1 (3300 %) (330%)	1 (3300 %) (330%)	1 (3300 %) (330%)	34 (0%) (0%)	34 (0%) (0%)	34 (0%) (0%)	16 (112.5 %) (11.25 %)	34 (0%) (0%)	1 (3300 %) (330%)	16 (112.5 %) (11.25 %)	34 (0%) (0%)	34 (0%) (0%)	34 (0%) (0%)	34 (0%) (0%)	1 (3300 %) (330%)
<b>C10</b>	km	1	6.3 (131.75 %) (13.174 6%)	7.1 (105.6 3%) (10.56 34%)	13 (12.31 %) (1.2308 %)	2 (630%) (63%)	0.6 (2333.3 3%) (233.33 33%)	0.55 (2554.5 5%) (255.45 45%)	4.4 (231.82 %) (23.181 8%)	0.8 (1725 %) (172.5 %)	14.4 (1.39 %) (0.138 9%)	4.6 (217.39 %) (21.739 1%)	0.8 (1725 %) (172.5 %)	2.1 (595.2 4%) (59.52 38%)	0.35 (4071.4 3%) (407.14 29%)	0.55 (2554.5 5%) (255.45 45%)	14.6 (0%) (0%)

## Case Study 2: Sustainable travel and tourism competitiveness in Europe and Eurasia

Ozkaya and Demirhan (2022) performed the multi-criteria analysis of sustainable travel and tourism competitiveness in Europe and Eurasia. The Travel and Tourism Competition Index utilized in the research has four dimensions and fourteen indicators. In this research, the Entropy-based VIKOR approach, which is a Multi-Criteria Decision-Making method, Spearman Correlation analysis, and K-means clustering analysis were employed to propose a methodological novelty in this field. The study analyzed the competitiveness of significant European and Eurasian nations based on key indicators. According to country evaluations, Spain, France, Germany, the United Kingdom, Italy, and Switzerland differ from other countries in a positive sense and with a significant difference. Eastern European and Balkan nations are often at the bottom of the table. The following fourteen indicators were analysed: business environment (C1); safety and security (C2); health and hygiene (C3); human resources and labor market (C4); travel and tourism ICT readiness (C5); government prioritization of travel and tourism (C6); international openness and travel facilitation (C7); price competitiveness in the travel and tourism industry (C8); environmental sustainability (C9); air transport infrastructure (C10); ground and port infrastructure (C11); tourist service infrastructure (C12); natural resources (C13); cultural resources (C14). The Tourism Computer Learning Systems was applied for the sustainable travel and tourism competitiveness in Europe and Eurasia. The initial matrix presented in Table 5.

**Table 5.** Initial matrix for calculations of sustainable travel and tourism competitiveness in Europe and Eurasia

Quantitative and qualitative information pertinent to alternatives																
Compared alternatives																

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Criteria describing the alternatives	Measuring units	Weight	Armenia	Austria	Azerbaijan	Belgium	Bosnia and Herzegovina	Bulgaria	Croatia	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Kazakhstan	Kyrgyz Republic	Lithuania	Luxembourg	Malta	Moldova	Montenegro	Netherlands	Norway	Poland	Portugal	Romania	Russian Federation	Serbia	Slovak Republic	Slovenia	Spain	Sweden	Switzerland	Taiwan	Turkey	Ukraine	United Kingdom
C1	points	0.0491	4.98	4.84	5.04	4.83	3.36	4.43	3.78	4.52	5.07	3.36	5.69	4.76	5.18	5.43	4.39	5.31	5.21	4.40	4.73	4.35	4.68	5.78	4.95	4.03	4.6	5.5	5.29	4.42	4.66	4.38	4.26	4.39	4.08	4.48	5.28	6.4	4.28	4.41	4.41	5.75	
C2	points	0.0989	5.83	6.19	5.86	5.65	5.39	5.19	5.87	6.11	6.24	4.31	6.77	6.65	5.98	5.58	5.83	6.54	5.98	5.51	5.58	5.17	5.86	6.32	6.01	5.52	5.57	6	6.13	5.62	6.28	5.96	5.15	5.48	6.15	6.14	6.14	5.87	6.34	5.59	4.31	4.84	5.78
C3	points	0.0914	5.99	6.99	6.06	6.54	5.62	6.73	6.33	6.89	6.34	5.48	6.37	6.54	6.02	6.69	6.49	6.66	6.21	6.84	6.28	6.49	6.36	6.2	6.45	6.1	5.84	6.3	6.42	6.3	6.04	6.14	6.72	6.26	6.2	6.17	6.19	6.2	6.52	5.52	5.48	6.52	5.82
C4	points	0.067	4.77	5.29	5.26	5.29	4.1	4.59	4.12	4.89	5.67	4.1	5.47	5.12	4.75	5.64	4.7	4.6	5.61	5.34	4.7	4.78	4.29	5.45	4.81	4.42	4.78	5.56	5.51	4.76	5.09	4.54	5.01	4.75	4.95	5.53	5.76	4.66	4.18	4.48	5.53		
C5	points	0.049	4.7	6.07	4.96	5.83	4.54	5.19	5.17	5.69	6.11	3.37	6.12	5.92	4.96	5.22	5.27	6.32	6.74	4.88	4.97	5.72	5.64	6.19	5.88	4.58	5.21	6.25	6.35	5.51	5.55	5.16	5.27	5.09	4.77	5.65	5.78	6.38	3.37	4.64	4.52	6.18	
C6	points	0.0554	5.13	5.88	5.54	4.34	3.23	4.72	5.89	4.56	4.90	5.23	5.13	5.59	5.99	5.17	5.75	5.05	6.05	6.24	4.71	4.92	3.79	5.36	6.37	3.75	6.11	4.88	5.21	3.6	6.07	3.59	4.53	4.54	3.71	4.81	4.81	5.62	5.08	3.53	5.16		
C7	points	0.0667	3.21	4.01	3.08	4.15	2.41	3.89	4.16	4.17	4.36	2.36	4.12	4.24	3.42	4.24	4.11	4.4	4.51	4.13	2.43	3.99	4.01	4.27	3.96	3.11	2.44	4.27	4.05	4.4	4.23	3.93	2.23	3.25	3.92	3.95	4.09	4.12.5	3.83	3.73	4.24		
C8	points	0.0855	5.74	6.69	5.84	4.76	5.46	5.65	5.05	5.34	4.44	3.19	4.67	4.33	5.72	4.64	4.86	5.23	4.57	5.94	6.33	6.16	5.67	5.02	4.92	5.97	5.63	4.61	4.17	5.05	5.56	5.61	5.84	5.48	5.13	5.02	4.28	3.78	5.58	5.62	5.39	3.19	
C9	points	0.0589	4.04	5.68	4.08	4.81	4.28	4.85	5.11	5.09	5.18	3.77	5.16	5.27	4.53	4.54	4.84	4.81	4.88	4.29	3.81	3.71	4.57	5.63	4.79	4.2	4.72	5.41	5.8	4.21	4.18	4.41	4.21	4.67	4.6	5.36	4.74	5.24	3.9	3.67	3.88	5.21	
C10	points	0.0702	2.34	2.9	2.54	4.09	2.03	2.71	3.61	3.37	4.47	2.49	4.88	4.63	2.51	4.84	3.34	3.34	4.51	4.45	2.66	1.94	2.48	3.65	3.89	2.13	3.16	5.23	5.36	3.4	4.21	2.7	4.61	2.95	5.05	4.98	5.06	2.14	4.74	2.74	5.23		
C11	points	0.0628	2.83	3.22	3.9	5.46	2.35	3.21	3.86	4.93	4.47	4.07	4.53	5.54	3.24	3.57	3.85	4.14	4.48	4.67	2.94	2.07	4.31	5.5	4.88	2.54	3.34	6.14	3.86	4.26	4.18	3.13	3.3	4.06	4.76	4.66	6.07	2.81	3.56	3.14	5.36		
C12	points	0.0794	4.33	6.66	3.17	5.2	3.94	5.95	6.48	5.24	4.81	4.96	4.66	5.67	4.89	5.75	4.75	4.6	5.79	6.01	3.4	2.09	4.42	5.93	5.47	2.9	5.51	4.84	5.15	4.52	6.55	4.54	4.12	4.42	5.42	4.77	6.27	1.97	5.04	4.29	6.1		
C13	points	0.0468	2.51	4.14	2.15	2.54	1.94	3.69	4.44	2.33	2.4	1.66	2.92	4.2	2.35	4.03	2.73	2.3	2.58	2.89	2.55	2.54	2.28	2.78	1.66	2.73	2.72	3.32	3.3	4.01	3.19	3.84	2.06	3.43	4.18	3.21	3.7	2.86	2.77	2.23	4.38		
C14	points	0.1187	1.45	3.15	1.87	3.69	1.46	2.08	2.76	2.44	2.31	1.56	2.01	6.8	1.55	6.43	3.33	2.31	2.48	1.52	1.74	1.57	1.57	1.57	1.22	1.13	3.39	2.2	2.16	4.09	2.31	3.75	1.69	1.68	2.29	2.7	1.28	3.82	1.94	5.62			

Criteria describing the alternatives	Measuring units	Weight	Composed alternatives																																											
			Albania	Azerbaijan	Bahrain	Bosnia and Herzegovina	Bulgaria	Croatia	Czech Republic	Dominican Republic	Egypt	Estonia	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Kazakhstan	Kyrgyzstan	Latvia	Lithuania	Malta	Moldova	Montenegro	Netherlands	Norway	Poland	Portugal	Romania	Russian Federation	Serbia	Slovak Republic	Slovenia	Spain	Sweden	Switzerland	Tajikistan	Turkey	Ukraine	United Kingdom				
			c1	point	0.0491	4.98	4.84	5.09	4.83	3.26	4.43	3.78	4.5	5.52	5.07	3.3	5.69	4.76	5.18	5.45	3.9	4.31	5.3	5.2	4.01	4.73	4.37	4.5	4.68	5.7	4.95	4.03	4.6	5.5	5.29	4.2	4.66	4.30	4.26	4.3	4.08	4.31	4.48	5.28	6	4.28

From the calculation results can be seen, that the thirteenth alternative is the best by utility degree equaling  $N_{13}=99.97\%$ .

**Provision of recommendations**

VilniusTECH team created Tourism Computer Learning Systems provides the recommendations. The system provided recommendations for compared alternatives: possible improvement of the analysed criterion in %; Possible increase of the market value of the alternative in % through increased value of the aforementioned criterion.

**Case Study 3: Tourism destination**

Insap Santosa et al. (2012) developed a multi-criteria recommender system for tourism destination. The methods of weighted sum model (WSM) are implemented to develop recommender system for tourism destination. From analysis result of WSM algorithm obtained characteristic of algorithm to generate tourism object recommendations. In this study used eight criterion in the assessment process of tourism destination places (25 places in Indonesia). These criteria include distance (C1), facilities (C2), accessibility (C3), attractiveness (C4), management (C5), attractions (C6), safety (C7), and availability of store (C8). Each of eight criterions was assigned to different weight levels based on the results of a survey. The assessment process of tourism destination places using Likert scales of 1 (the worst) to 5 (the best). VilniusTECH team created Tourism Computer Learning Systems which allows to provide the priority of the alternatives by application of multiple criteria analysis methods and recommendations. The Tourism Computer Learning Systems was applied for this case study. The initial matrix presented in Table 6.





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C6	points	0.09	0.002 AVG MIN	0.002 AVG MIN	0.002 AVG MIN	0.002 AVG MIN	0.002 AVG MIN	0.002 AVG MIN	0.010 AVG MIN	0.002 AVG MIN	0.002 AVG MIN	0.006 AVG MIN	0.002 AVG MIN	0.002 AVG MIN	0.010 AVG MIN	0.010 AVG MIN	0.002 AVG MIN	0.002 AVG MIN	0.002 AVG MIN	0.010 AVG MIN	0.002 AVG MIN	0.002 AVG MIN	0.006 AVG MIN	0.002 AVG MIN	0.002 AVG MIN	
C7	points	0.27	0.021 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	0.021 AVG MIN	0.021 AVG MIN	0.004 AVG MIN	0.021 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	0.021 AVG MIN	0.021 AVG MIN	0.004 AVG MIN	0.021 AVG MIN	0.004 AVG MIN	0.004 AVG MIN	
C8	points	0.08	0.003 AVG MIN	0.003 AVG MIN	0.005 AVG MIN	0.001 AVG MIN	0.003 AVG MIN	0.003 AVG MIN	0.005 AVG MIN	0.003 AVG MIN	0.003 AVG MIN	0.005 AVG MIN	0.003 AVG MIN	0.001 AVG MIN	0.005 AVG MIN	0.005 AVG MIN	0.001 AVG MIN	0.001 AVG MIN	0.005 AVG MIN	0.005 AVG MIN	0.003 AVG MIN	0.003 AVG MIN	0.001 AVG MIN	0.005 AVG MIN	0.001 AVG MIN	0.001 AVG MIN
The sums of weighted normalized maximizing (projects 'pluses') indices of the alternative			0.0469	0.0363	0.0372	0.0258	0.0338	0.0469	0.0696	0.0356	0.0533	0.0613	0.0333	0.0269	0.0497	0.0624	0.0258	0.03	0.0368	0.0582	0.0442	0.0442	0.0258	0.0576	0.0258	0.0317
The sums of weighted normalized minimizing (projects 'minuses') indices of the alternative			1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05
Significance of the alternative			0.0469	0.0363	0.0372	0.0258	0.0338	0.0469	0.0696	0.0356	0.0533	0.0613	0.0333	0.0269	0.0497	0.0624	0.0258	0.03	0.0368	0.0582	0.0442	0.0442	0.0258	0.0576	0.0258	0.0317
Priority of the alternative			9	14	12	24	16	9	1	15	6	3	17	20	7	2	24	19	13	4	11	11	24	5	24	18
Utility degree of the alternative (%)			67.38%	52.15%	53.44%	37.06%	48.56%	67.38%	99.99%	51.14%	76.57%	88.06%	47.41%	38.64%	71.4%	89.64%	37.06%	43.1%	52.87%	83.61%	63.5%	63.5%	37.06%	82.75%	37.06%	45.54%

Table 7 shows that the seventh alternative is the best by utility degree equaling N<sub>7</sub>=99.99% (Ambun Pagi tourism destination). The fourteenth alternative (Muko-Muko (PLTA Maninjau) tourism destination) was second according to priority, and its utility degree was equal to N<sub>14</sub>=89.64%

### Provision of recommendations

The recommendations for Case study 3 are shown in Table 8.

Table 8. Recommendations for the tourism destination

Criteria describing the alternatives	Measuring units	Weight	Quantitative and qualitative information pertinent to alternatives																						
			Compared alternatives																						
			Possible improvement of the analysed criterion in % Possible increase of the market value of the alternative in % through increased value of the aforementioned criterion																						
Air Angek	Air Terjun Badoral	Air Terjun Gadin Rantih	Air Terjun Mala lak	Air Terjun Saras ah	Air Tiga Rasa	Ambun Pagi	Ambun Tanai	Bunga Rafles ia	Ilkan Sakti Sunga i Janiah	Kelok 44	Lingga ai	Mani njau	Muko Muko (PLT A Mani njau)	Ngal au Kam ang	Ngala u Simar asok	Nga rai Sian ok Ana m Suka i	Pant ai Ban dar Muti ara	Pulau Tanga h	Pulau Ujung	Punc ak Gumu ng Mera pi	Punca k Lawa ng	Punca k Singg alang	Tarus an		
C1	points	0.18	2 (150%) (27%)	5 (0%) (0%)	3 (66.6%) (12%)	3 (66.6%) (12%)	4 (25%) (4.5%)	2 (150%) (27%)	4 (25%) (4.5%)	4 (25%) (4.5%)	4 (25%) (4.5%)	4 (25%) (4.5%)	2 (150%) (27%)	3 (66.6%) (12%)	2 (150%) (27%)	3 (66.6%) (12%)	4 (25%) (4.5%)	5 (0%) (0%)	1 (400%) (72%)	1 (400%) (72%)	1 (400%) (72%)	3 (66.6%) (12%)	3 (66.6%) (12%)	3 (66.6%) (12%)	4 (25%) (4.5%)
C2	points	0.065	2 (150%) (9.75%)	1 (400%) (26%)	2 (150%) (9.75%)	1 (400%) (26%)	1 (400%) (26%)	2 (150%) (9.75%)	3 (66.6%) (4.33%)	2 (150%) (9.75%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)	1 (400%) (26%)
C3	points	0.11	4 (0%) (0%)	3 (33.33%) (3.66%)	4 (0%) (0%)	1 (300%) (33%)	3 (33.33%) (3.66%)	4 (0%) (0%)	4 (0%) (0%)	4 (0%) (0%)	3 (33.33%) (3.66%)	2 (100%) (11%)	3 (33.33%) (3.66%)	4 (0%) (0%)	4 (0%) (0%)	1 (300%) (33%)	2 (100%) (11%)	2 (100%) (11%)	2 (100%) (11%)	1 (300%) (33%)	1 (300%) (33%)	1 (300%) (33%)	3 (33.33%) (3.66%)	1 (300%) (33%)	3 (33.33%) (3.66%)

C4	#points	0.145	3 (66.67%) (9.6667%)	5 (0%) (0%)	5 (0%) (0%)	5 (0%) (0%)	5 (0%) (0%)	3 (66.67%) (9.6667%)	4 (25%) (3.625%)	5 (0%) (0%)	5 (0%) (0%)	5 (0%) (0%)	3 (66.67%) (9.6667%)	5 (0%) (0%)	4 (25%) (3.625%)	5 (0%) (0%)	5 (0%) (0%)	5 (0%) (0%)	5 (0%) (0%)	4 (25%) (3.625%)	5 (0%) (0%)	5 (0%) (0%)			
C5	#points	0.06	1 (400%) (24%)	1 (400%) (24%)	1 (400%) (24%)	1 (400%) (24%)	1 (400%) (24%)	1 (400%) (24%)	5 (0%) (0%)	1 (400%) (24%)	5 (0%) (0%)	5 (0%) (0%)	1 (400%) (24%)	1 (400%) (24%)	1 (400%) (24%)	5 (0%) (0%)	1 (400%) (24%)	1 (400%) (24%)	1 (400%) (24%)	5 (0%) (0%)	5 (0%) (0%)	5 (0%) (0%)	1 (400%) (24%)	1 (400%) (24%)	
C6	#points	0.09	1 (400%) (36%)	1 (400%) (36%)	1 (400%) (36%)	1 (400%) (36%)	1 (400%) (36%)	1 (400%) (36%)	5 (0%) (0%)	1 (400%) (36%)	1 (400%) (36%)	3 (66.67%) (6%)	1 (400%) (36%)	1 (400%) (36%)	5 (0%) (0%)	1 (400%) (36%)	1 (400%) (36%)	1 (400%) (36%)	1 (400%) (36%)	5 (0%) (0%)	1 (400%) (36%)	1 (400%) (36%)	3 (66.67%) (6%)	1 (400%) (36%)	1 (400%) (36%)
C7	#points	0.27	5 (0%) (108%)	1 (400%) (108%)	1 (400%) (108%)	1 (400%) (108%)	1 (400%) (108%)	5 (0%) (0%)	5 (0%) (0%)	1 (400%) (108%)	5 (0%) (0%)	5 (0%) (0%)	1 (400%) (108%)	1 (400%) (108%)	1 (400%) (108%)	5 (0%) (0%)	1 (400%) (108%)	1 (400%) (108%)	1 (400%) (108%)	5 (0%) (0%)	5 (0%) (0%)	5 (0%) (0%)	1 (400%) (108%)	1 (400%) (108%)	
C8	#points	0.08	5 (66.67%) (5.3333%)	5 (66.67%) (5.3333%)	5 (66.67%) (5.3333%)	1 (400%) (32%)	5 (66.67%) (5.3333%)	5 (66.67%) (5.3333%)	5 (0%) (0%)	5 (66.67%) (5.3333%)	5 (66.67%) (5.3333%)	5 (0%) (0%)	5 (66.67%) (5.3333%)	1 (400%) (32%)	5 (0%) (0%)	5 (66.67%) (5.3333%)	5 (66.67%) (5.3333%)	1 (400%) (32%)	1 (400%) (32%)	5 (0%) (0%)	5 (66.67%) (5.3333%)	5 (66.67%) (5.3333%)	1 (400%) (32%)	1 (400%) (32%)	

The Tourism Computer Learning Systems allows to determine the strongest and weakest aspects of each alternative for a sustainable tourism and its constituent parts. Performance of the analyses is to learn by what degree one alternative is better than is another. Furthermore this discloses the details, why this is so. The practical case studies presented in this research validate this developed Tourism Computer Learning Systems. An analysis of the results reached by the Tourism Computer Learning Systems permits making the following claims:

- The System can determine the utility degree, investment, market, hedonic and customer-perceived values of the tourism projects under deliberation.
- The System can provide digital tips for improving projects
- The System can define, what the value of a selected criterion needs to be for the tourism project under deliberation to be equally competitive in the market, as compared with others under comparison after a set assessment of all their positive and negative features.
- The System can calculate, what the value of the project under deliberation should be for this tourism project to become the best among others under deliberation.

#### 4. Dissemination of the Results

During the Work Package 4 “Dissemination of results and its exploitation”, the results of VilniusTech were disseminated (see Table 9).

**Table 9.** The dissemination of the PICASP results on VilniusTech website and in LinkedIn and their exploitation.

Date	VilniusTECH website	VilniusTECH LinkedIn
2021-10-28	<a href="https://vilniustech.lt/universitetas/nauijenos/vilnius-tech-prisides-prie-picasp-projekto-igyvendinimo/26671?nid=331096">https://vilniustech.lt/universitetas/nauijenos/vilnius-tech-prisides-prie-picasp-projekto-igyvendinimo/26671?nid=331096</a> (in Lithuanian) <a href="https://vilniustech.lt/about-university/news/vilnius-tech-will-contribute-to-the-implementation-of-the-picasp-project/73472?nid=331098">https://vilniustech.lt/about-university/news/vilnius-tech-will-contribute-to-the-implementation-of-the-picasp-project/73472?nid=331098</a> (in English)	<a href="https://www.linkedin.com/posts/vilniustech_industry50-enviroment-qualityassurance-activity-6859789038891646976-x-EG">https://www.linkedin.com/posts/vilniustech_industry50-enviroment-qualityassurance-activity-6859789038891646976-x-EG</a> (in English)
2023-04-21	In Lithuanian: <a href="https://vilniustech.lt/universitetas/nauijenos/varsuvoje-vyko-vilnius-tech-picasp-projekto-dalyviu-susitikimas/26671?nid=360018">https://vilniustech.lt/universitetas/nauijenos/varsuvoje-vyko-vilnius-tech-picasp-projekto-dalyviu-susitikimas/26671?nid=360018</a>  In English: <a href="https://vilniustech.lt/about-university/news/vilnius-tech-picasp-project-participants-meeting-in-warsaw/73472?nid=360051">https://vilniustech.lt/about-university/news/vilnius-tech-picasp-project-participants-meeting-in-warsaw/73472?nid=360051</a>	



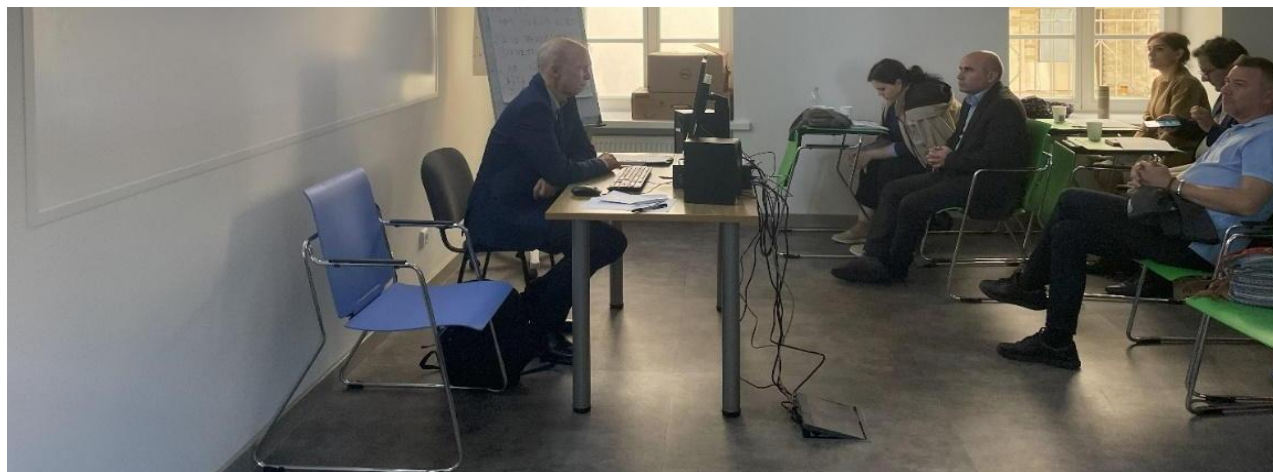
During the implementation of the Work Packages, one meeting of the project participants was hosted by VilniusTech. This international meeting was conducted as part of the capacity-building activity of the PICASP project. VilniusTech put together the meeting programme. The event took place on 25-27 September 2023 and included presentations, dissemination activities, and technical visits to a selection of tourism sites in Lithuania. During the visit to Lithuania, Italian, Polish, Kazakh, Azerbaijani, and Lithuanian scientists and educators (a total of 23 participants from abroad, some joined online) learned about state-of-the-art approaches in tourism to maintain good practices and opportunities for knowledge transfer. During the meeting, the achievements of all project participants and next project activities were presented. Thematic excursions and lectures were organised. During the meeting in Vilnius, the participants had a chance to listen to a set of lectures on the following topics:

1. “Tourism Trends: The Latest Opportunities for The Tourism Industry” and “Groundbreaking Technologies in Tourism”, by Prof Habil Dr Artūras Kaklauskas, Head of the Department of Construction Management and Real Estate;
2. “Overview of the Lithuanian heritage protection system”, by Lukas Rekevičius, Founding Partner at Aketuri Architektai;
3. “Historical cultural heritage and history of the Jews of Lithuania”, an educational lecture by Marius Galadauskas, a private guide;
4. “Application possibilities of virtual tourism in Lithuania”, by Dr Antanas Ūsas, Lithuanian Sports University.

Various excursions were organized for the participants during the meeting:

1. A guided tour at the Palace of the Grand Dukes of Lithuania (1.5 hours);
2. A guided tour at Gediminas Castle Tower;
3. A guided visit to the National Museum;
4. A guided walking tour in Vilnius Old Town and Užupis Republic (2.5 hours)

During the Round Table, the project participants presented their progress towards the project aims. Managerial issues were also discussed (needs, expectations, plans, budget, calendar, outcomes). Several moments from the meeting in Vilnius are presented below.



**Figure 6.** Prof Habil Dr Artūras Kaklauskas giving the lecture “Groundbreaking Technologies in Tourism”.

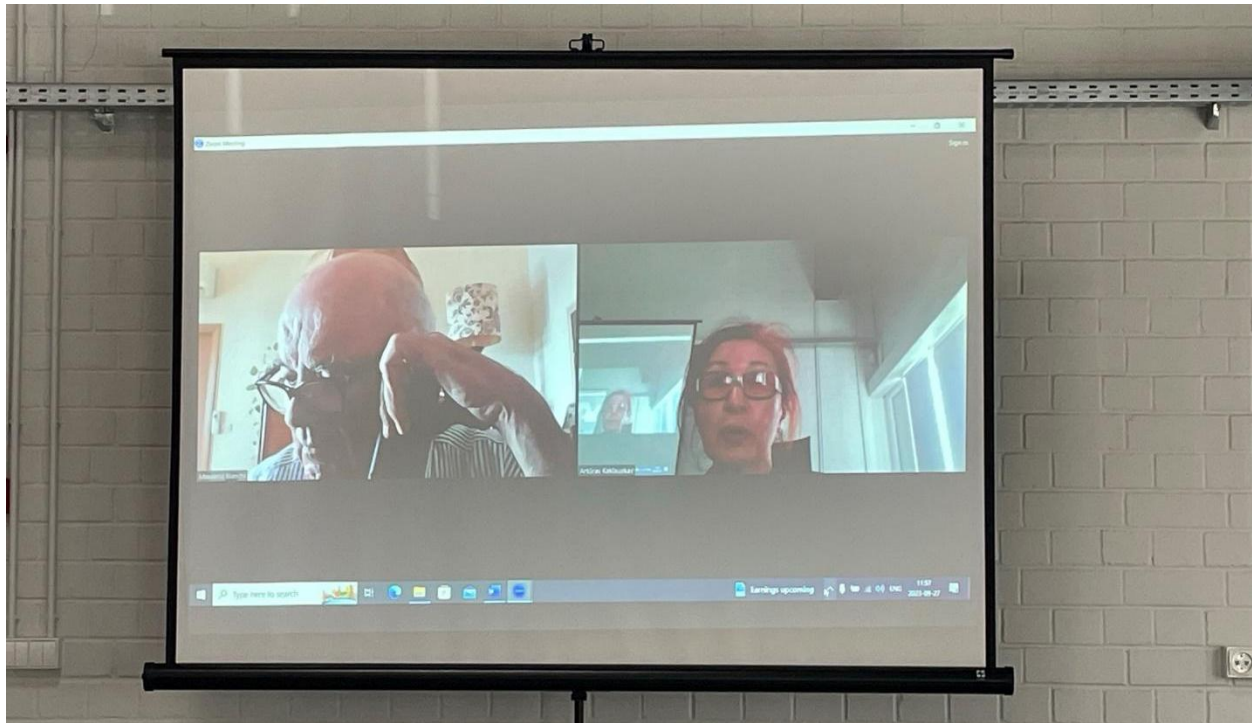


**Figure 7.** Lukas Rekevičius, Founding Partner at Aketuri Architektai, giving the lecture “Overview of the Lithuanian heritage protection system”

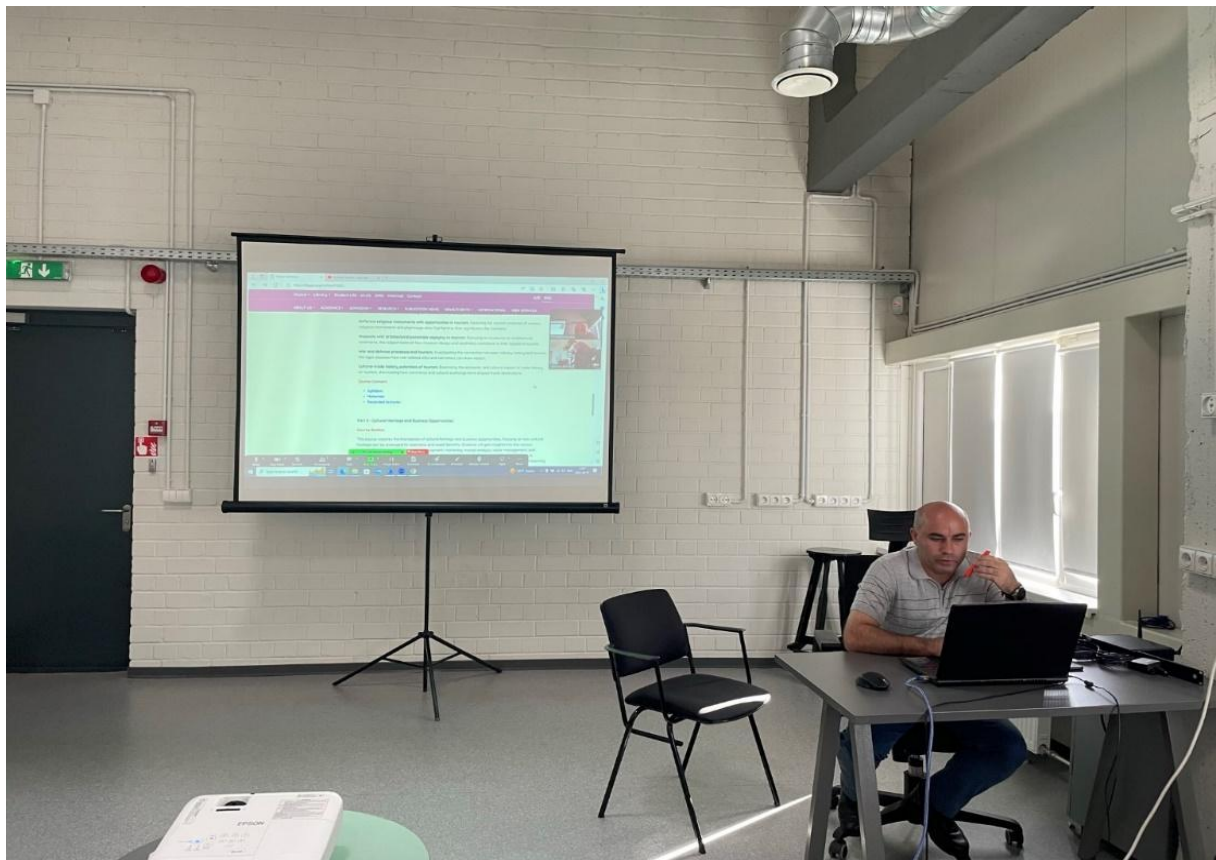


**Figure 8.** Group photo of the participants





**Figure 9.** A partner's presentation



**Figure 10.** A partner's presentation.





Figure 11. A partner's presentation.



Figure 12. An excursion at LinkMenü Fabrikas

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#### Figure 4

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## Figure 5

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