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Tourism Management with AI Integration for Mining Heritage: a Literature Review Approach

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Abstract

Integrating Artificial Intelligence (AI) into heritage tourism has opened new avenues for transforming visitors' engagement with historical sites. This research paper delves into a novel paradigm, focusing on AI integration in inter- and intra-regional mining heritage site planning and design. Recognizing this context's unique challenges and opportunities, the study aims to uncover critical ideas and theories on how AI enhances visitor experience, promotes cultural preservation, sustainability, and stakeholder collaboration. Acknowledging the distinctive challenges and opportunities presented by inter- and intra-regional mining heritage contexts, this research work underscores the critical importance of striking a harmonious equilibrium between technological advancements and preserving historical and cultural legacies. Drawing from a cross-disciplinary approach, the study examines the profound implications of integrating AI into mining heritage sites' planning and design strategies. The study reviews 199 articles on AI-driven planning and design benefits, examining potential advantages. Ethical considerations, algorithmic biases, and the role of interdisciplinary research are also explored. The study highlights the intricate interplay between AI-enhanced engagement, responsible tourism practices, and the meaningful representation of local cultures. By shedding light on this uncharted territory, the research contributes to developing informed strategies that harness AI's potential to shape inter- and intra-regional mining heritage site planning and design, fostering responsible and impactful tourism experiences. By delving into this paradigm, it hopes to arm the researchers, policy-makers, practitioners, and other stakeholders with information and understanding that will help them forge a progressive and morally upright future, in which technology co-exists peacefully with practices for cultural preservation and sustainable tourism.

1. Introduction

Tourism management is crucial in preserving and promoting mining heritage, bridging the gap between historical significance and contemporary visitor experiences [1]. This convergence has led to sustainable development, cultural preservation, and economic growth [2; 3]. Effective tourism management strategies ensure the physical preservation of mining sites, creating immersive storytelling, educational engagement, and sustainable economic progression [4]. Mining heritage sites including abandoned mines, industrial relics, and mining towns offer visitors a tangible connection to history and insights into labour, innovation, and societal evolution [5]. Tourism management leverages this potential by curating experiences that evoke a sense of time travel, allowing visitors to interact with the past through guided tours, interpretive exhibitions, and immersive multimedia installations [6]. Effective tourism management creates a delicate balance between accessibility and preservation, enabling the influx of visitors while mitigating the impact on fragile historical structures and ecosystems [7; 8; 9; 10]. This dynamic interplay between preservation, promotion, and responsible tourism management promises to conserve mining heritage and foster a

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deeper understanding of the intertwined relationships between human industry, culture, and the environment [9; 10; 11; 12; 13; 14; 15].

AI integration has become increasingly important in the tourism industry, revolutionizing data analysis, decision-making, and automation [16; 17]. Technologies like natural language processing, machine learning, and computer vision have demonstrated remarkable capabilities in analysing massive data, predicting user preferences, and delivering personalized experiences [18; 19]. In tourism, these technologies converge to enhance various aspects of the industry such as customized marketing, virtual assistants, chatbots, predictive analytics, image recognition, sentiment analysis, and language translation [16; 19]. AI's predictive analytics enable demand forecasting, optimizing pricing strategies, and resource allocation [20]. Airlines and hotels use AI to adjust prices dynamically based on booking patterns, seasonal trends, and external events [21]. Computer vision technology aids in image recognition, security, and emotional responses, while natural language processing allows for sentiment analysis of online reviews [19; 20]. AI also supports language translation, making travel more accessible for global tourists [21]. AI's potential is particularly promising in the context of cultural heritage and tourism [22]. Through digitization, AI can assist in preserving and restoring historical sites and artifacts [23]. Augmented reality (AR) and virtual reality (VR) experiences powered by AI can transport visitors back in time, providing an engaging and educational tourist experience [20; 23]. AI integration in tourism promises to create more personalized, efficient, and immersive experiences for travellers, while helping businesses optimize operations, improve decision-making, and preserve and promote cultural heritage [24].

This literature review explores the intersection of tourism management, mining heritage, and AI integration. By systematically examining existing scholarly works, we seek to uncover the potential benefits and challenges of incorporating AI technologies into mining heritage tourism management. This review shows how AI can improve visitor engagement, contribute to site preservation, and facilitate sustainable tourism practices in mining heritage destinations. The research paper follows a structured format that systematically explores the integration of AI in heritage mining tourism. It commences with an engaging introduction that outlines the topic's significance, highlighting the role of AI in tourism management for mining heritage sites. The subsequent literature review delves into existing scholarly works, offering insights into the current state of AI integration, challenges, benefits, and potential applications in this specialized context. The paper then transitions into a detailed discussion, examining the implications, opportunities, and obstacles associated with AI integration. It emphasizes collaboration, interdisciplinary research, and responsible implementation. The paper concludes by summarizing the main findings and implications, stressing the importance of AI's alignment with cultural preservation and sustainable tourism practices. This structured approach ensures a systematic exploration of AI integration in heritage mining tourism, encouraging further research and dialogue in this evolving field.

2. Background and Context

Mining heritage refers to the tangible and intangible remnants of mining activities' historical, industrial, and cultural significance within a region [24]. It encompasses a broad spectrum of artifacts, landscapes, structures, stories, and traditions that have evolved over centuries of human interaction with the earth's resources [25]. Mining heritage encapsulates the physical artifacts like mine shafts, machinery, and buildings and the oral histories, local knowledge, and social dynamics shaped by the mining industry [26]. It symbolizes the intersections of human labour, innovation, technology, and the environment, representing a unique and multifaceted narrative of human endeavor. Mining heritage is crucial in cultural and historical contexts, reflecting the layers of human achievement and societal transformation through mining activities [25]. It reflects the identities, traditions, and sense of belonging of communities surrounding mines and the historical context of technological advancements, economic shifts, and social struggles [26; 27]. Mining heritage sites offer insights into the evolution of societies and economies, with their architectural structures, machinery, and relics serving as living history lessons [28]. They are integral to global heritage, fostering cross-cultural understanding and appreciation for the diverse ways societies have engaged with natural resources [29]. Preserving mining heritage allows societies to honour past generations, acknowledge complex relationships between humans and the environment, and create educational opportunities for future generations [30]. This preservation also provides a platform for

sustainable development, as mining heritage sites can become pillars of tourism, education, and economic revitalization within local communities, revitalizing areas that may have faced post-industrial challenges [27; 31]. Tourism management for mining heritage has become a specialized field within the cultural tourism industry, recognizing the economic, social, and cultural value of mining heritage sites as tourist destinations [32]. Abandoned mines, mining towns, and industrial relics represent tangible evidence of a region's industrial past, reflecting labour, technology, and historical context [33]. The rise of mining heritage tourism can be attributed to the decline of mining activities, which created opportunities for repurposing and redeveloping these sites for tourism, contributing to regional economic diversification [31; 33]. Additionally, societal interest in preserving and promoting cultural heritage including industrial heritage has increased [34]. Mining heritage sites hold significant historical, technological, and social value, making them compelling attractions for tourist seeking authentic experiences [30]. Transforming former mining areas into tourist attractions attracts visitors, generates revenue, and creates employment opportunities, revitalizing local economies [5; 9; 14; 35]. Additionally, mining heritage tourism educates travellers about the historical significance of mining activities and their impact on developing societies and industries [12; 19; 30; 36].

As interest in mining heritage tourism grew, various stakeholders including governments, local communities, heritage organizations, and tourism practitioners, recognized the need for effective management strategies [11; 25; 29]. Tourism management for mining heritage involves a multidisciplinary approach that balances tourism development with heritage preservation [18]. It requires collaboration between different actors to ensure that the sites are appropriately conserved, interpreted, and presented to visitors [23]. Furthermore, mining heritage tourism presents unique challenges compared to other forms of cultural tourism. Preservation efforts must carefully balance site access for tourists with the need to protect delicate structures and landscapes [35]. Additionally, ensuring the authenticity and accuracy of the interpretation of mining heritage requires historical research and expert input [35; 36]. Sustainable tourism practices have significantly impacted tourism management for mining heritage [28]. These practices emphasize responsible development that minimizes environmental, cultural, and community impacts while maximizing stakeholder benefits [33; 34]. As mining heritage sites attract tourists worldwide, effective management is crucial for long-term conservation and appreciation [30]. Technological advancements, particularly in artificial intelligence (AI), have shown promise in transforming industries, including tourism [17; 18; 29; 32; 36]. AI technologies like machine learning algorithms, natural language processing, and computer vision can analyse large datasets, identify patterns, and deliver personalized experiences [19; 22; 23]. As a result, the tourism industry has increasingly embraced AI to enhance customer engagement, optimize resource management, and improve visitor satisfaction. Managing and promoting mining heritage sites for tourism presents a complex challenge that requires strategic strategies to balance preservation, education, and visitor experience [37; 38]. The key is preserving the authenticity and integrity of these sites, while making them accessible to the visitors [39]. The influx of tourists can cause wear and tear on fragile elements, risking the site's historical value [37; 40]. Integrating modern infrastructure and amenities is crucial to maintain the visual and cultural coherence of the site [41]. Sustainability is also vital, as balancing tourist activities with environmental conservation is complex [32]. Proper waste disposal, energy-efficient facilities, and responsible tourism practices are essential to minimize carbon footprints and protect the environment [42]. Financial sustainability is another concern, as maintaining and managing these sites can be expensive [43]. They are generating revenue through tourism, while reinvesting proceeds in preservation efforts and community development is a continuous challenge. Crafting interpretive experiences that effectively communicate the significance of mining heritage sites without sacrificing authenticity is complex. Over-commercialization or dilution of historical context must be managed carefully to avoid turning the site into a theme park rather than a repository of genuine history. Mining heritage sites offer unique opportunities for holistic development beyond economic gains. These sites provide cultural education, allowing visitors to engage with the history, stories, and struggles of the past [19; 44]. By integrating informative exhibits, guided tours, and immersive multimedia, these sites enhance the educational aspect of tourism, fostering a deeper understanding of human history [19; 20; 45]. Economically, mining heritage sites can provide local revitalization, injecting revenue

into communities that may have faced economic challenges post-mining industry decline. Local businesses, such as cafes and accommodations, can flourish, creating employment opportunities for residents [46]. Community engagement can be fostered through active involvement in the management and promotion of these sites [40]. Collaborations between local governments, heritage organizations, and tourism boards can harness collective expertise and resources for sustainable development [44; 46]. Technological innovation opens doors for enhanced visitor experiences, with virtual and augmented reality applications transporting visitors back in time [39; 42; 43]. Interactive exhibits and interpretive centers cater to diverse age groups, enriching the visitor experience and attracting younger generations, fostering an enduring interest in history and heritage [46].

3. Literature Review

A systematic review of existing literature on the interplay between tourism management, mining heritage, and AI integration reveals a comprehensive landscape of research that delves into the complexities, opportunities, and challenges at the convergence of these domains. Scholars have recognized the significance of preserving mining heritage through effective tourism management strategies, and the integration of AI technologies has emerged as a promising avenue for enhancing visitor experiences, conservation efforts, and sustainable development. 'Cooper (1988) taxonomy of literature reviews' was used to describe the purpose, audience, scope, perspective, coverage, and organization of the literature review [47; 48; 49], as it can classify literature reviews by topic, purpose, perspective, coverage, structure, and target and facilitate more accurate and thorough selection [49]. This SLR aims to explore both the theoretical underpinning and use in the practice of AI integration in creating mining tourism in inter and intra-regional planning and design of mining heritage sites. Hence, the search included all types of research papers. The goal of incorporating AI was to combine and synthesize the many topics in the body of literature to establish the basis for contemporary mining heritage tourism [47]. The outcomes were theoretically and methodologically structured. The review's objective was to be as impartial and devoid of bias as possible. The assembly included representatives from all the groups involved with or affected by inter- and intra-regional planning and design of cultural assets. Numerous books have been written about the subject under discussion, mainly focusing on urban heritage or mining tourism. Due to the choice requirements in the next section, the analysis only contains one paradigmatic example from these studies: rural and urban mining historical sites [47]. The next step was to find a more specific search term linked to the introduction's stated study objectives. This synthesis highlights critical themes, methodologies, and gaps in the current body of knowledge. A preliminary study of the available databases led to the discovery of potential papers on mining heritage, tourist evaluation, historical mines, tourism, regional planning, and development based on these keywords. The resulting articles were used to compile a list of commonly used keywords and related phrases in the literature, shown in Table 1.

Table 1. Keywords and associated terms.

Keywords	Associated terms
Tourism	Infrastructure, urban tourism product model, leisure, resources, special events, choice freedom
Tourism management	Recurring visits, tourist experience, development, economic growth, job prospects, tourist satisfaction
Heritage	Development, tourism system, cultural heritage, WHS, identity
Mining heritage	Excavation tourism, mining, cultural heritage, quarry tours, mining culture
Artificial intelligence	Algorithms, chatbots, machine learning, cognitive science, image recognition, clustering, problem-solving, decision-making, creative solutions

Following that, a combination of these terms was tested in several databases, resulting in the string phrase:

((cultural heritage or identity or heritage or WHS) and (mining or mining culture or mining heritage or excavation tourism or quarry tours) and (tourism infrastructure or tourism or special events or choice freedom or leisure or urban tourism product model or resources) and (recurring visits or tourism management or tourist visits or tourist satisfaction or development or economic growth or job prospects) and (artificial intelligence or algorithm or chatbots or machine learning OR cognitive science or image recognition or

clustering or problem-solving or decision-making or creative solutions)).

Additional inclusion and removal criteria were developed because each search returned a large number of articles. The search only looked at peer-reviewed journal articles stored in electronic databases. Additionally, only English-language articles were allowed. Due to the lack of appropriate peer review in books, book chapters, reviews, and grey literature, the results do not include these items. The threat of linguistic and publishing discrimination in this systematic literature review (SLR) is rising with regulating English-language publications in peer-reviewed journals in electronic databases. This holds for the decision to remove grey literature from the SLR since there may not have been enough rigorous research techniques. During the literature search phase's filtering process, it was decided to include as many publications as practical relating to philosophies, methodologies, and town or regional zone as long as the research objectives and problem definition were met to counteract this potential prejudice. After the search phrase was created and evaluated in many reputable databases, it was uploaded to endnote and checked for duplicates, producing 356 unique articles. Titles and abstracts were searched for articles containing the chosen keywords. The resulting references were then transferred to an Excel spreadsheet for sieving and additional examination, along with the authors' names, the article's title, abstract, and the year it was published using Cooper's taxonomy for a thorough selection of articles that matched the paper's intended purpose, perspective, coverage, and target [47; 49]. Excel was used to export 297 articles. Each article's abstract was reviewed in Excel to prioritize those relevant to the study's goals. Through Cooper's taxonomy, 134 items were first discovered; however, few were books, books or book sections, and therefore excluded. Additionally, several articles could not be downloaded. Thus they were omitted. The final shortlist included 199 articles (refer to Appendix A and C). A flow diagram (refer to Figure 1) based on PRISMA 2009 flow diagram illustrates the literature search process for article selection for the SLR [48; 50; 51].

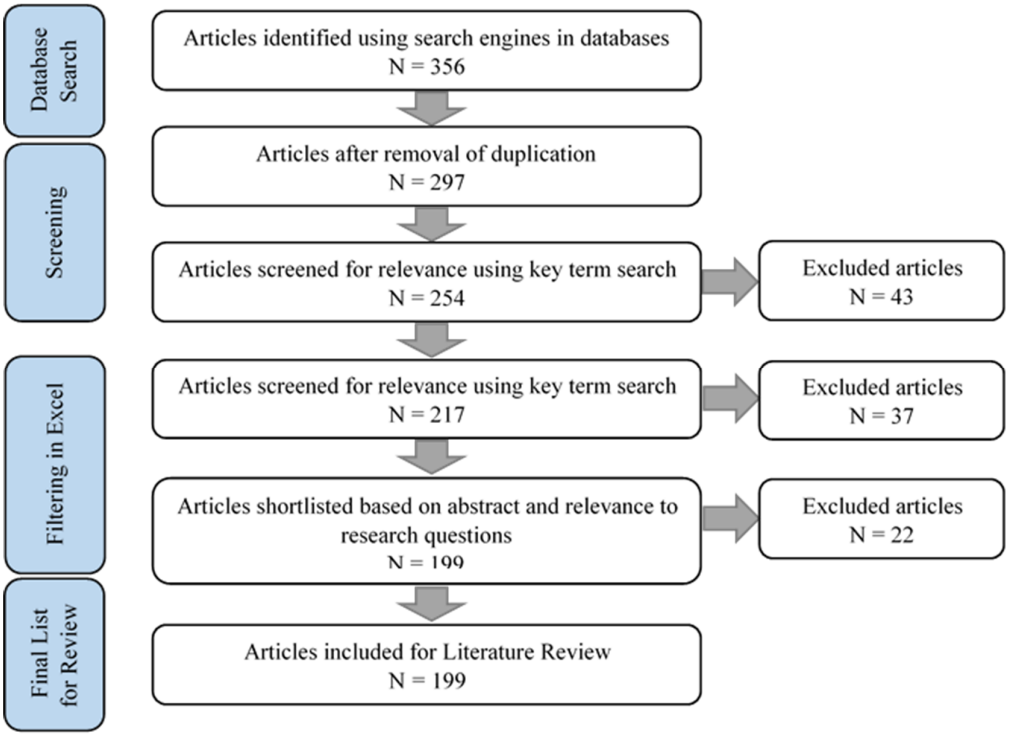

Figure 1. Procedure for searching the literature for articles to include in SLR (based on the PRISMA flow diagram, Heymans et al., 2019).

The research paper addressed the following questions related to the identified keywords, delving into the nuances of AI integration in heritage mining tourism (refer to Table 2).

Table 2. Key themes and their characteristics divulged in the SLR and the number of articles from the total 199 reviewed possessing the themes.

Tourism management	Tourism	Artificial intelligence	Mining heritage	Heritage
1. What is the significance of AI integration in mining heritage tourism?				
2. What is the prospective AI integrative approach in tourism management for mining tourism?				
3. What is the relationship between sustainable tourism and responsible management?		4. What are the potential benefits of AI integration? 5. What challenges are associated with AI integration?		
6. How can collaboration drive responsible AI implementation?				
7. What role does interdisciplinary research play?				
8. What are the potential future trends in AI and mining heritage tourism?				
9. What are the implications for the field?				

3.1. Interpretation of findings and discussion

The articles under review were all released during the last forty years. Indicating that the integration of AI with inter- and intra-regional planning and design of mining heritage sites in competitive heritage mining tourism is a relatively new and developing area of research; the majority (79.4%) of the articles under study were published in the last 15 years, with 63.3% of them taking place in the previous ten years (refer to Figure 2).

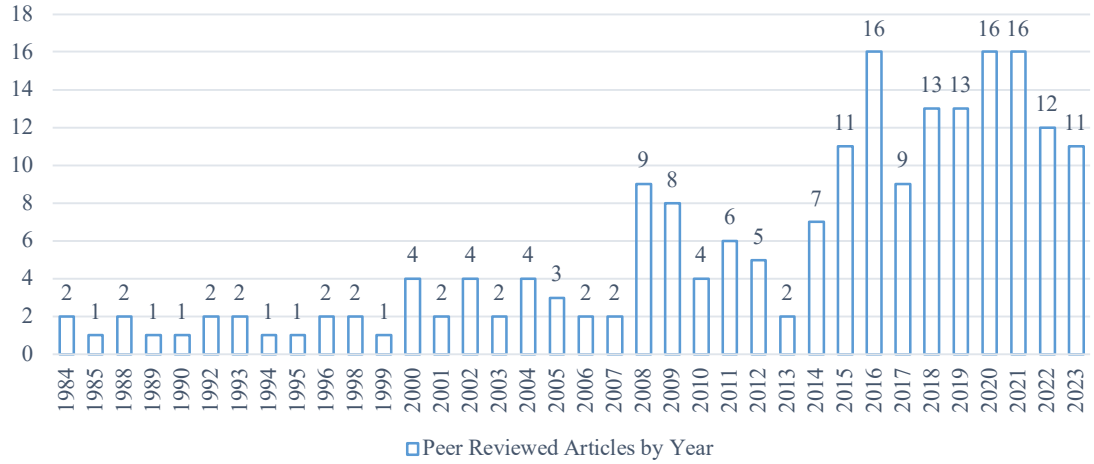

Figure 2. Peer-reviewed articles by year from 1984-2023 in the SLR (Source: Author).

A cross-disciplinary amalgamation of concepts and ideas from several disciplines may be seen in the rising popularity of this topic (refer to Appendix B). Research from the domains of tourism and urban planning, heritage conservation, cities, mining health, sustainability, environmental science and technology, tourism, construction research, and modelling and software were included in the literature review [47].

3.2. Key concept and theme identification and analysis

This text critically assesses current academic proposals and explores the overarching arguments driving historic tourist planning and design research. It explores key concepts and themes identified in the SLR and discusses the historical evolution of these theories. Significant concepts and hypotheses were identified and categorized based on publications and year of publication. Table 3 lists the five major issues discussed in the review.

Table 3. Key themes and their characteristics divulged in the SLR and the number of articles from the total 199 reviewed possessing the themes.

Theme	Characteristics	Articles containing theme
Tourism	Social progress Long-term commercial viability Destination planning Micro-level personal wellbeing Visitor satisfaction Perception creating Stakeholder engagement	95
Tourism management	Reorientation Commercialization Interconnectedness Policies and practices Revitalization initiatives	115
Heritage	Materiality Languages Conservation Restoration Cultural Income-producing prospects City liveability Originality	148
Mining heritage	Socially progressive political structure Preservation Catalyst and driving factor for change Resilience Adaptive capacity Growth Profitability Productivity Market share	83
Artificial intelligence	Integrated network Movement simulation Multi-scale Neural networking Cognitive planning Linguistic search Deep learning	15

3.2.1. Heritage

Heritage is the collective repository of human experiences, knowledge, and expressions passed down through generations, shaping identities, cultures, and societies. It encompasses tangible and intangible remnants of the past, including artifacts, traditions, stories, languages, rituals, and landmarks [52]. Heritage transcends geographical, temporal, and cultural boundaries, offering a window into the diverse tapestry of human existence and the continuum of human progress. It holds intrinsic value as a source of identity and belonging, anchoring communities to their roots, providing continuity amidst change, and reinforcing ties that bind families, groups, and nations [53]. By preserving and cherishing heritage, societies can honour their history and ensure that the legacies of the past continue to

shape their present and future trajectories. Heritage is vital for cultural expression and intergenerational dialogue, expressing human experiences through art, music, literature, and oral traditions [54]. It bridges generations and connects elders' wisdom with youth aspirations [55]. However, preservation and protection are complex due to urbanization, environmental degradation, globalization, and conflicts [56; 57]. Balancing development with preservation requires thoughtful strategies and collective efforts. Cultural heritage raises questions about ownership, representation, and ethical considerations, especially for artifacts with colonial or contested histories [58]. Heritage is a multifaceted concept that extends beyond memory and nostalgia, encompassing education, economics, and sustainable development [59]. Heritage tourism generates economic opportunities and cross-cultural exchanges through historical sites, monuments, and cultural experiences [60]. It offers valuable lessons that inform contemporary challenges and insights into societies' struggles and social transformations [61]. In a rapidly changing world, heritage is an anchor, grounding individuals and communities in their unique stories and shared histories. It emphasizes the importance of cultural diversity and the need to preserve and protect irreplaceable legacies that enrich humanity's collective narrative [55; 58]. By safeguarding heritage, societies honour their past while embracing their responsibilities to the future, ensuring the echoes of generations continue to resonate through time.

3.2.2. Mining heritage

Mining heritage encompasses the mining industry's historical, cultural, and physical remnants including mine sites, industrial infrastructure, artifacts, archival materials, cultural traditions, and stories associated with mining activities [59]. It plays a vital role in understanding and appreciating the historical development of regions shaped by mining activities, providing insights into the challenges, triumphs, and impacts of mining on local communities, economies, and landscapes [60]. Preserving and interpreting mining heritage helps communities retain a connection to their past and recognize the contributions and sacrifices of those involved in mining [61]. Physical remains of mining operations, such as mine shafts, tunnels, pithead structures, and processing plants, are essential to mining heritage [62]. Preserving and showcasing these physical remnants allows visitors to experience the mining industry's scale, technology, and architectural heritage [61; 63]. Artifacts and machinery associated with mining activities provide insights into miners' tools and technologies, helping to understand their daily lives, working conditions, and technological advancements. Mining museums and exhibitions often display these artifacts, allowing visitors to connect with the material culture of mining. Archive materials, such as documents, photographs, maps, and oral histories, provide valuable historical evidence and narratives that shed light on the economic, social, and cultural aspects of mining [60]. These records help researchers, historians, and visitors piece together the stories and significance of mining heritage [64]. Cultural traditions and intangible heritage associated with mining communities are also integral to mining heritage, providing a sense of identity and community pride [65]. Celebrating and preserving these traditions helps mining communities connect to their history and foster a sense of belonging [51; 59; 64]. Mining heritage is a global recognition that involves preserving and promoting sites and stories of mining activities [52]. Collaboration between governments, local communities, heritage organizations, and tourism initiatives supports historical and cultural preservation, sustainable tourism, economic development, and community revitalization [53; 64]. Preserving, interpreting, and celebrating mining heritage helps understand the significance of mining in shaping communities and landscapes, providing insights into the past, fostering community pride, and contributing to cultural appreciation and sustainable tourism.

3.2.3. Tourism

Tourism is a dynamic and multifaceted phenomenon that embodies the human desire for exploration, connection, and cultural exchange [66]. It represents journeying beyond familiar horizons to engage with new landscapes, people, and experiences. It bridges geographical, cultural, and temporal divides, fostering a deeper understanding of the world and its diversity. Central to the allure of tourism is the promise of discovery and enrichment as travellers immerse themselves in unfamiliar environments, encountering unique customs, languages, and ways of life [67]. These encounters expand horizons, challenge preconceptions, and cultivate empathy, contributing to a more interconnected global society [68]. Tourism's economic impact cannot be

understated, as it is a cornerstone of many economies, generating revenue, creating jobs, and supporting local businesses. The influx of tourists sustains a multitude of industries, from hospitality and transportation to food services and entertainment [66; 69]. Moreover, tourism often invigorates communities that might have otherwise struggled economically, breathing new life into historical towns, remote villages, and cultural hubs [70]. However, the profound influence of tourism extends beyond economics, shaping conservation efforts, environmental awareness, and sustainable practices [8; 71]. Mining heritage tourism, also known as industrial heritage tourism or mining history tourism, focuses on preserving, interpreting, and promoting mining-related sites, artifacts, and stories for tourism and cultural appreciation [3; 18; 31]. It allows visitors to explore mining activities' rich history and cultural significance in specific regions or communities [11; 16; 23; 55; 68]. Mining heritage tourism provides insights into miners' challenges, working conditions, and technological advancements that revolutionized the industry over time [69; 70]. Preserved mine sites often include underground tours or guided visits to mine shafts, tunnels or galleries, giving visitors a sense of the daily environment and conditions miners face [71]. These experiences provide a unique perspective on miners' physical and emotional challenges and offer a glimpse into their lives, traditions, and community dynamics [72]. Museums, interpretive centers, and exhibitions dedicated to mining heritage are essential to mining tourism, showcasing mining artifacts, tools, machinery, and archival materials [6; 71; 73]. Migration heritage tourism contributes to the revitalization of former mining communities, as many towns and regions once reliant on mining have transformed their industrial heritage into tourist attractions [74]. Historic mining towns' distinct architecture and cultural traditions glimpse these communities' unique identity and resilience [22; 28; 48; 50; 75]. Visitors can explore preserved mining villages, visit heritage buildings, and engage with residents to gain a deeper understanding of the impact of mining on the area's social fabric [5; 76]. However, it is crucial to approach mining heritage tourism sensitively and respectfully, as mining activities often have environmental consequences [77]. Sustainable practices like land rehabilitation and environmental education should be incorporated into mining tourism initiatives to protect and preserve natural landscapes and ecosystems [1; 6; 16; 27; 61; 70; 77]. In summary, mining heritage tourism offers a unique opportunity to explore mining activities' historical, cultural, and social aspects, educate visitors about the past, support local economies, and foster a sense of pride and identity within mining communities [15; 42; 49].

3.2.4. Tourism management

Tourism management is a strategic and multidisciplinary approach that focuses on optimizing the benefits of tourism while mitigating its potential negative impacts [78]. It encompasses various activities, including planning, development, operation, and marketing, to enhance destinations' economic, social, and cultural dimensions [3; 47; 78]. Effective tourism management requires a comprehensive understanding of diverse elements, such as market trends, destination characteristics, infrastructure, regulatory frameworks, and stakeholder engagement [79]. By harmonizing these components, tourism managers aim to enhance destinations' economic, social, and cultural dimensions, attract visitors, create memorable experiences, and generate revenue contributing to local economies. Sustainable tourism management aims to balance financial gains with environmental preservation and social well-being, respecting local cultures and empowering communities to actively participate in and benefit from the industry [59; 60; 80]. Tourism managers seek to protect assets that attract visitors through responsible resource management, waste reduction, and community involvement [81; 82]. Strategic planning and development are essential for tourism management, including assessing a destination's strengths and weaknesses, identifying target markets, and creating initiatives that resonate with diverse traveller segments [9; 54; 80; 82; 83]. Infrastructure development must align with sustainability principles, ensuring the influx of visitors does not compromise the environment's integrity or disrupt local communities. Technology is crucial in modern tourism management, with digital platforms, social media, and online booking systems revolutionizing marketing and traveller engagement. Data analytics help identify trends, preferences, and areas of improvement, enabling tourism managers to tailor their strategies and offerings to evolving consumer behaviours [81; 84]. However, tourism management faces challenges such as balancing growth and preservation, managing mass tourism impacts, and addressing local communities' needs [85; 86; 87]. Overcrowding at popular destinations can strain

resources and diminish visitor experiences, leading to over-tourism. Balancing cultural authenticity and commercialization requires sensitivity and careful planning.

3.2.5. Artificial intelligence

Artificial Intelligence (AI) is a field of computer science that focuses on creating intelligent machines capable of simulating human-like cognitive processes [16; 17; 20; 28]. It involves developing algorithms and models that enable devices to learn from data, reason, make decisions, and perform tasks that typically require human intelligence [21; 23; 24]. One critical component of AI is machine learning, which involves training algorithms to analyse large volumes of data and recognize patterns. Machine, learning algorithms can be categorized as supervised, unsupervised or reinforcement learning, depending on the type of training data and learning approach [18; 89]. Supervised learning uses labelled data to make predictions or classifications on new data, while unsupervised learning focuses on unlabelled data to discover patterns, structures or relationships. Reinforcement learning trains agents to make sequential decisions based on predefined goals [90]. AI has numerous applications across various industries such as healthcare, where it can analyse medical images to detect diseases and abnormalities [17; 18; 19; 91]. AI-powered virtual assistants and chatbots provide personalized healthcare information and support, improving access to resources and services [92]. Artificial intelligence (AI) has revolutionized various industries, including transportation, finance, and healthcare [19; 93]. It has enabled the development of autonomous vehicles, virtual assistants, and language translation systems [94]. In finance, AI algorithms are used for fraud detection, risk assessment, and algorithmic trading, analysing vast amounts of financial data in real time [94; 95]. However, ethical considerations and concerns about AI's impact on society are being raised [96]. AI's responsible and ethical use is crucial to address potential challenges and ensure its positive impact on society [97]. Despite its potential in heritage mining tourism, few research publications exist on AI integration in this specialized subject [98; 99]. Despite the promise of AI in increasing heritage tourism, there are still unexplored areas for investigation and research [20; 55; 97]. Addressing bias in AI algorithms, job displacement, privacy, and security is crucial to ensure AI technologies' responsible and beneficial deployment [98; 99; 100].

3.2.5.1. Artificial intelligence and mining

Artificial intelligence (AI) can potentially revolutionize the mining industry by improving efficiency, safety, and decision-making processes [101] (refer to Table 4).

Table 4. AI application in mining.

Mining area	AI application	Reference
Exploration and resource assessment	Machine learning techniques can help predict the presence and quality of mineral resources, optimizing exploration efforts, and reducing costs.	[19; 95]
Autonomous and remote operation	Self-driving trucks, loaders, and drill rigs can navigate and operate in mining sites, improving productivity and safety. These autonomous systems use AI algorithms to perceive their surroundings, make decisions, and interact with other equipment.	[22; 97; 98]
Predictive maintenance	AI-powered predictive maintenance systems use sensors and data analysis to monitor the health and performance of mining equipment.	[96]
Safety and risk management	AI systems can enhance safety in mining operations. AI-powered systems can also assess risk factors and provide real-time alerts to prevent accidents and improve worker safety.	[15; 19; 21; 99]
Optimization of operations	AI algorithms can optimize mining processes by analysing vast data such as production rates, ore grades, and energy consumption.	[101; 102]
Environmental monitoring	AI can assist in environmental monitoring and management of mining operations. Machine learning algorithms can analyse sensor data and satellite imagery to detect and predict environmental impacts like water pollution or deforestation.	[102]
Decision support systems	AI-powered decision support systems can assist mining engineers and managers in making informed decisions. By analysing historical data, real-time information, and various factors, AI algorithms can recommend mine planning, production scheduling, and resource allocation, optimizing overall operational performance.	[91; 95; 103]

It is worth noting that the successful implementation of AI in mining requires high-quality and reliable data, as well as considerations of ethical and responsible AI practices [104]. By leveraging AI technologies, the mining industry can improve operational efficiency, safety, and sustainability, leading to more sustainable and productive mining practices.

3.2.5.2. Artificial intelligence and heritage

Artificial intelligence (AI) is increasingly used to preserve, interpret, and promote heritage sites and cultural artifacts [100] (refer to Table 5).

Table 5. AI intersection with heritage.

Heritage area	AI application	Reference
Conservation and restoration	AI can assist in conserving and restoring heritage sites and artifacts. Machine learning algorithms can analyse images, 3D scans, and historical data to identify damage, deterioration or missing components.	[16; 91]
Virtual reality and augmented reality	AI technologies enable immersive experiences through virtual reality (VR) and augmented reality (AR). AR applications can overlay historical information, images or videos onto real-world environments, enhancing visitors' understanding and engagement with heritage sites.	[94; 96]
Language translation and interpretation	AI-powered devices and apps can translate spoken or written information, ensuring visitors from different linguistic backgrounds can access and understand the heritage site's narratives and descriptions.	[5; 21; 85; 95]
Data analysis and historical research	Natural language processing algorithms can process and extract information from digitized texts, facilitating the identification of patterns, connections, and insights that might have been challenging to discover manually.	[98]
Cultural heritage digitization	Image recognition algorithms can automate the process of labeling and categorizing digital images of artworks, photographs, or archaeological finds.	[94]
Heritage content recommendation	By analysing user data and historical information, AI systems can suggest additional exhibits, tours or related heritage sites that visitors might find intriguing.	[102; 104; 105]
Preservation of endangered languages	Machine learning algorithms can analyse audio recordings and transcribe or translate them into written form, preserving linguistic heritage and facilitating language education and revitalization efforts.	[106]

While AI offers promising opportunities for heritage preservation and interpretation, it is essential to consider ethical and cultural sensitivity aspects [106]. The responsible use of AI in heritage should respect local cultural practices, protect privacy and data security, and involve community participation in decision-making processes [107]. Combining AI technologies with heritage conservation efforts can enhance accessibility, engagement, and understanding of our rich cultural heritage.

3.2.5.3. Artificial intelligence and tourism

Artificial intelligence (AI) is revolutionizing the tourism industry, transforming various aspects of travel planning, customer experience, and destination management [92; 104] (refer to Table 6).

It is important to note that ethical considerations such as data privacy, transparency, and accountability need to be addressed when implementing AI in the tourism industry. Responsible AI practices should ensure fairness, respect cultural sensitivities, and prioritize the human touch alongside AI-driven enhancements [107].

AI is transforming the tourism industry by offering personalized recommendations, efficient customer service, language translation, dynamic pricing, enhanced safety measures, and smart destination management. By leveraging AI technologies, the tourism sector can provide more tailored and seamless experiences, improving customer satisfaction and optimizing business operations.

4. Results and Discussion

AI technologies, encompassing machine learning, natural language processing (NLP), and computer vision, are revolutionizing the tourism landscape, offering innovative solutions that enhance various aspects of the industry [108]. These technologies capitalize on vast datasets and computational power to generate insights, automate processes, and create personalized experiences for travellers. Integrating artificial intelligence (AI) in tourism management for mining heritage sites presents a paradigm shift in how these sites are preserved, experienced, and

managed [109; 110]. This synthesis examines the key findings from existing literature, revealing a landscape rich with potential benefits, challenges, and opportunities in this intersection.

Table 6. AI intersection with tourism.

Tourism area	AI application	Reference
Personalized recommendations	AI algorithms can analyse large volumes of data such as user preferences, behaviour patterns, and historical travel information, to provide personalized recommendations to travellers.	[99]
Chatbots and virtual assistants	AI-powered and virtual assistants are becoming increasingly common in tourism. Chatbots offer instant and efficient customer service, addressing common queries and freeing up human staff to focus on more complex tasks.	[92; 96]
Natural language processing and translation	AI-powered language translation tools and apps can assist with real-time language translation, facilitating communication between tourists and locals in different languages.	[100; 102; 103]
Dynamic pricing and revenue management	Through dynamic pricing and revenue management systems, AI can adjust prices in real-time based on factors such as demand, seasonality, and availability, maximizing revenue for travel providers while offering competitive prices to consumers.	[101; 107]
Image and video recognition	AI-powered image and video recognition technologies enhance the travel experience by identifying landmarks, attractions, and points of interest in real time.	[107]
Safety and security	AI-powered surveillance systems can analyse video feeds and detect potential threats or suspicious activities in airports, hotels, and tourist destinations. Additionally, AI algorithms can analyse travel data to identify patterns and anomalies, helping to prevent fraud, identify risks, and enhance travel security.	[45; 59; 61; 102]
Smart destination management	AI-driven analytics can process large volumes of data including transportation patterns, tourist flows, and environmental factors, to optimize services and create more sustainable tourism practices.	[18; 91; 103]

4.1. Artificial intelligence integration in tourism management for mining heritage

Integrating Artificial Intelligence (AI) into tourism management for mining heritage holds immense promise, heralding a new era of innovation that can significantly enhance how we experience, understand, and preserve historical sites [16; 20; 22; 23]. This amalgamation of advanced technology and cultural heritage has the potential to unlock a multitude of benefits that encompass improved visitor engagement, data-driven decision-making, and enhanced preservation efforts [17; 18]. AI integration offers immersive and interactive ways to engage visitors with mining heritage [16; 20]. Virtual reality (VR) and augmented reality (AR) experiences, guided by AI algorithms, can transport visitors back in time, allowing them to explore mines, interact with digital reconstructions, and experience the sounds and sights of bygone eras [19; 111]. This technology educates and stimulates the imagination, fostering a deeper connection between visitors and the stories embedded within mining heritage sites [21; 23; 24]. AI's capacity to analyse and process vast data can revolutionize tourism managers' operation of mining heritage sites, generating insights that empower data-driven decision-making [19]. This enables managers to optimize routes for guided tours, allocate resources more efficiently, and tailor experiences to meet diverse expectations [24]. AI-driven predictive maintenance systems can monitor the condition of fragile structures and artifacts, issuing alerts when interventions are needed to prevent deterioration [111; 112]. By leveraging AI in preservation, mining heritage sites can inspire and educate future generations. AI-powered language translation and speech recognition technologies can break down language barriers, ensuring visitors from diverse backgrounds can access information seamlessly. AI also assists in managing visitor flows, preventing overcrowding at sensitive heritage sites, and reducing the ecological impact of tourism activities.

Nevertheless, while the benefits of AI integration in mining heritage tourism management are undeniable, ethical considerations and responsible implementation are essential. Striking a balance between technological advancement and preserving historical authenticity is paramount [112]. Collaborative efforts between heritage experts, technologists, and local communities can ensure that AI enhances these sites' cultural and educational value without overshadowing their intrinsic significance.

4.2. Challenges and limitations associated with AI integration in tourism management

Integrating Artificial Intelligence (AI) into tourism management brings a wealth of opportunities, but it also introduces a range of challenges and limitations that must be carefully navigated [17; 22; 112]. These challenges revolve around complex ethical considerations, data privacy concerns, cultural sensitivities, and technical barriers that can impact the successful implementation of AI in enhancing tourism experiences while preserving the authenticity of cultural heritage. AI integration faces challenges in data privacy, as it requires balancing the use of visitor data with safeguarding individual privacy [113]. Transparent data collection practices, robust security measures, and compliance with data protection regulations are essential to mitigate these concerns [19; 20; 24; 59]. Integrating AI in tourism management requires careful consideration of cultural sensitivity and the preservation of authenticity, as mining heritage sites hold significant cultural and historical significance for local communities [114]. AI applications must respect local traditions, values, and narratives to avoid unintentional misrepresentations or commercialization that may undermine the intrinsic value of these sites [20; 23]. Successful AI integration relies on robust technical infrastructure, which may not be uniformly available across all mining heritage sites. Limited internet connectivity, inadequate hardware, or lack of technological literacy in certain regions can hinder the implementation of AI-powered solutions. Equitable access and innovative solutions to address technical barriers are vital to ensure AI benefits are inclusive and reach diverse audiences. AI algorithms are not immune to biases present in the data they are trained on, and addressing algorithmic bias requires continuous monitoring, diverse and representative training data, and ethical guidelines prioritizing fairness and inclusivity [16; 19]. As AI integration becomes more prevalent, there is a growing need for skilled professionals to develop, manage, and maintain AI-powered systems [115]. The tourism sector, including mining heritage management, must address the skills gap and invest in training to ensure staff possess the expertise to harness the potential of AI effectively [116]. Dependency on external expertise could be a limitation if organizations are not equipped to manage AI systems independently [21; 26; 91; 101; 117]. AI integration in mining heritage sites offers potential for tourism management, but challenges must be addressed [118]. Mitigating data privacy, maintaining cultural authenticity, overcoming technical barriers, managing bias, and fostering skill development are crucial steps for responsible, inclusive, and meaningful tourism experiences [119]. Balancing technological advancements with ethical considerations is essential for respecting diverse communities' values and sensitivities.

4.3. Sustainable tourism and responsible management

AI integration in mining heritage tourism aligns with sustainable and responsible tourism principles, focusing on minimizing environmental impacts, promoting cultural authenticity, and enhancing local community well-being [120]. AI technologies can optimize tourist flow, avoid congestion, and predict peak visiting periods, reducing stress on fragile ecosystems and historic sites [121]. This preventative measure protects these sites' integrity for future generations while providing a more enjoyable experience [100; 101; 117; 121; 122]. AI's role in energy efficiency and resource management further emphasizes its contribution to sustainability [123]. Smart systems driven by AI algorithms can regulate lighting, heating, and cooling based on occupancy and external conditions, reducing energy consumption and minimizing the carbon footprint of heritage tourism operations [124; 125]. This promotes responsible resource consumption without compromising visitor comfort [18; 126]

AI's ability to enhance resource management in mining heritage sites carries added significance, as these sites may be particularly vulnerable to human impact due to their ecological balances and historical importance. AI's ability to mitigate such impact by ensuring controlled visitor numbers and efficient energy use aligns perfectly with responsible tourism goals [128]. AI-powered applications also promote accountable and sustainable tourism practices by offering interactive and educational encounters that enhance visitors' appreciation for these sites' cultural and historical significance. This deeper understanding fosters a sense of stewardship and respect, encouraging tourists to engage with these sites responsibly and contribute positively to their preservation [129].

4.4. Visitor-centric experiences and education

AI-driven personalization in mining heritage tourism is a transformative approach to enhance

visitor experiences [113; 130]. AI technologies use data analysis and predictive algorithms to create customized interactions that cater to individual preferences and interests [25; 131]. This approach fosters a deeper emotional connection to historical narratives and promotes sustainable and meaningful tourism experiences. Personalization involves analysing vast datasets such as visitation patterns, demographic information, and online behaviours, to create personalized itineraries, content recommendations, and interactive elements that align with each visitor's preferences [132]. This customized approach significantly enhances visitor engagement, as visitors are more likely to be emotionally invested and enthusiastic about their exploration of mining heritage sites [19; 24; 25]. This emotional connection enriches the immediate experience and leaves a lasting impression [133], encouraging visitors to reflect on and share their experiences with others, whether through word-of-mouth or social media [90; 104; 115; 134].

AI is crucial in promoting longer stays by offering personalized recommendations for activities, exhibits, and guided tours [135]. This extends visitors' time on-site and creates a sense of discovery, driving them to delve deeper into the mining heritage's historical narratives and cultural significance [136]. AI-powered interpretation tools enhance educational experiences by providing context-rich information beyond surface-level descriptions [115; 136]. These tools such as augmented reality, virtual reality, and interactive displays, engage visitors with 3D reconstructions, historical images, and multimedia content, fostering a deeper understanding and connection to the past and promoting a more comprehensive and meaningful educational experience [137].

4.5. Collaboration and interdisciplinary research

Integrating Artificial Intelligence (AI) into mining heritage tourism signifies a complex and multifaceted process that goes beyond technology [19; 23]. It necessitates a collaborative approach that brings together diverse stakeholders, including heritage experts, technologists, local communities, and various stakeholders associated with preserving and managing these sites [138]. Such collaboration is fundamental to ensure AI solutions' successful and responsible integration while respecting cultural authenticity, adhering to ethical guidelines, and maximizing the positive impacts on heritage preservation and visitor experiences [139; 140].

Heritage professionals have extensive knowledge of mining heritage sites' historical and cultural significance, which is crucial for guiding the application of AI technologies that preserve their authenticity and integrity [141]. They provide context for interpreting historical narratives and ensuring that AI-driven experiences align with the site's unique heritage [1; 10; 14; 52; 122]. The technologists and AI experts bring technical expertise to develop and implement AI solutions, leveraging machine learning, natural language processing, and computer vision to create immersive and innovative experiences [142; 143]. Collaborating with heritage experts ensures that these technological advancements enhance the cultural value of mining heritage [144; 145]. Local communities play a vital role in integrating AI technologies, as their perspectives, values, and traditions shape how AI interprets and presents mining heritage [146]. Collaborating with local communities ensures that AI applications resonate with their cultural sensitivities and maintain a respectful representation of their history [145; 147]. Stakeholders including government bodies, tourism agencies, and site managers play a critical role in shaping the direction of AI integration, guiding ethical considerations, regulatory compliance, and strategic planning [148]. Interdisciplinary research is the cornerstone of responsible AI integration, involving collaborations among heritage experts, technologists, social scientists, and ethicists to develop guidelines that prioritize authenticity, inclusivity, and ethical use. This collaborative approach drives innovation by combining diverse perspectives and knowledge, enabling stakeholders to brainstorm creative ways to use AI to enhance visitor experiences, promote sustainability, and foster cultural exchange [149; 150]. This collaborative approach ensures responsible implementation, where AI technologies are harnessed to enrich, educate, and engage visitors while preserving the integrity of heritage sites. Collaboration is crucial for reliable AI integration in mining heritage tourism. By combining heritage expertise, technological innovation, ethical considerations, and community engagement, AI solutions enhance visitor experiences while preserving cultural authenticity and adhering to ethical guidelines. This drives innovation, creates holistic solutions, and promotes a harmonious coexistence between technology and heritage.

4.6. Potential future trends and developments in intersection of AI and mining heritage tourism

The intersection of Artificial Intelligence (AI) and mining heritage tourism is poised to undergo significant evolution, driven by advancements in technology, changing visitor expectations, and a growing emphasis on sustainability and authenticity [122; 151]. These emerging trends and developments hold the potential to reshape how mining heritage sites are managed, experienced, and preserved (refer to Table 7).

Table 7. Intersection of AI and mining heritage tourism in future trends.

Future trends	Intersection of AI and mining heritage tourism	Reference
Immersive virtual reality experiences	In the future, immersive VR experiences will enable visitors to step back in time and witness miners' lives vividly. AI-powered simulations can reconstruct historical scenes, providing an unparalleled understanding of mining operations' challenges, innovations, and social dynamics.	[152]
Personalized and contextualized narratives	As visitors engage with exhibits, AI can dynamically tailor information based on their preferences, previous interactions, and real-time inputs. This ensures that each visitor's journey through mining heritage sites is unique, enhancing engagement and educational impact.	[148; 153]
Sustainable and eco-friendly practices	Sustainability will be a driving force in the future of mining heritage tourism. Intelligent waste management systems, energy-efficient technologies, and AI-driven environmental monitoring can contribute to preserving delicate ecosystems while enhancing the overall visitor experience.	[154]
Preservation through AI-enhanced conservation	AI's potential to document and preserve heritage sites will be harnessed more. AI-powered predictive maintenance systems can identify signs of decay or structural weaknesses, enabling proactive interventions to prevent deterioration.	[155]
Multilingual and inclusive experiences	AI-driven language translation and speech recognition technologies will make mining heritage sites more accessible globally. Visitors can interact with exhibits, signage, and guided tours in their preferred language, breaking down language barriers, and ensuring inclusivity for diverse groups.	[6; 37; 94; 156]
Real-time engagement and feedback	AI-powered chatbots and virtual assistants can provide real-time assistance to visitors, answering questions, offering directions, and providing historical context.	[9; 48; 61; 92; 122; 157]
Enhanced cultural interpretation	AI can help convey the cultural significance, rituals, and traditions associated with mining heritage sites, enriching the visitor experience and ensuring cultural authenticity is preserved and respected.	[8]

In conclusion, the future of mining heritage tourism is poised to be shaped by the seamless integration of AI technologies. As AI becomes more sophisticated and adaptable, it will contribute to more immersive, personalized, and sustainable visitor experiences. The convergence of technological innovation, cultural preservation, and sustainability will pave the way for a new era of mining heritage tourism that informs and profoundly resonates with those who seek to explore the past and forge connections with their shared human history.

4.7. Further research and collaboration areas

The dynamic intersection of Artificial Intelligence (AI) and mining heritage tourism offers a rich landscape for further research and collaboration as both domains continue to evolve and intertwine [158]. Exploring these areas can lead to transformative advancements in how we manage, experience, and conserve mining heritage sites while ensuring the responsible integration of AI technologies (refer to Table 8).

The convergence of AI and mining heritage tourism offers a fertile ground for interdisciplinary research and collaborative endeavours. By bringing together experts from heritage management, technology development, cultural studies, conservation, and ethics, the researchers can explore innovative solutions that enhance visitor experiences, preserve cultural authenticity, and contribute to the sustainable stewardship of mining heritage sites. These collaborative efforts hold the potential to shape the future of how we engage with our shared human history while harnessing the power of AI for positive impact.

Table 8. Intersection of AI and mining heritage tourism in future trends.

Collaboration areas	Responsible integration of AI technologies	reference
Visitor behaviour analysis and prediction	By analysing data collected from AI-powered systems, the researchers can uncover insights into visitor motivations, engagement levels, and the factors that influence their interactions with exhibits and historical narratives.	[49; 159]
Ethical and cultural considerations	Collaboration between cultural heritage experts, technologists, local communities, and ethicists is essential to navigating the ethical complexities of integrating AI in mining heritage tourism. Research can focus on establishing guidelines and best practices that ensure AI applications respect cultural authenticity, mitigate biases, and prioritize responsible representation.	[160; 161; 162]
Long-term sustainability and conservation	Further research can explore how AI can contribute to mining heritage sites' long-term sustainability and conservation. This involves investigating the effectiveness of AI-driven predictive maintenance, monitoring systems, and resource allocation in preventing environmental degradation and preserving historical authenticity.	[68; 99; 163]
Augmented reality and interactive storytelling	Augmented reality (AR) holds tremendous potential for enhancing visitor experiences by superimposing digital information onto the physical environment. Collaborations with content creators, designers, and technology developers can create immersive storytelling platforms that captivate and educate visitors.	[49; 63; 95; 164]
Social and cultural impact studies	Collaboration between social scientists and AI experts can shed light on the broader impacts of AI integration in mining heritage tourism. Studies can examine the social dynamics that emerge from personalized experiences, the influence of AI on visitor perceptions of authenticity, and the implications of AI-driven interactions on cultural exchange.	[7; 14; 120]
Inclusive and accessible AI solutions	Researchers can collaborate to develop AI-driven solutions prioritizing accessibility for individuals with disabilities. By incorporating features such as voice recognition, real-time language translation, and user-friendly interfaces, AI technologies can ensure that mining heritage sites are inclusive and welcoming to all visitors, regardless of their abilities or language proficiency.	[165; 166]
Public engagement and education	Collaborative efforts can focus on leveraging AI to engage the public in preserving mining heritage. Developing interactive educational tools, virtual exhibitions, and online platforms that connect people worldwide to the stories of these sites can foster a global community invested in their conservation.	[19; 26; 167; 168; 169]

4.8. AI-mining tourism inter- and intra-regional mining heritage site planning and design paradigm

In order to revitalize historical sites, engage contemporary audiences, and advance sustainable tourism practices, there is a need for innovative AI-mining tourism inter- and intra-regional mining heritage site planning and design paradigm [170; 171; 172]. The requirement for innovative AI-mining tourism inter- and intra-regional mining heritage site planning and design paradigm stems from various imperatives ranging from preservation and revival [173], visitor engagement [174; 175], sustainable tourism [19; 26; 85; 176], economic growth [22; 154; 169; 177], cultural exchange [147; 159; 170; 178], education and research to technological advancement [11; 27; 59; 63; 148; 159; 168; 179; 180].

AI can potentially revolutionize the selection and planning of historical mining sites for tourist development [181; 182]. By examining historical documents, geological information, and cultural importance, AI algorithms can identify locations with mining histories that could be popular tourist destinations. These sites can have an engaging narrative that combines the historical significance of mining with the attractiveness of tourism [183]. AI systems can use complex criteria to assess potential heritage sites for tourist growth, considering accessibility [184; 185], historical significance, cultural worth, ecological effect, and more [158; 172; 186]. Virtual tours of historical locations can be offered using AI-driven VR and AR experiences, giving visitors a deeper understanding of their layout, architectural intricacies, and historical setting [187]. AI algorithms can analyse a person's interests, travel history, and time restrictions, creating customized itinerary suggestions for visitors [188]. They can design optimized itineraries by incorporating historical locations of interest and considering variables like opening hours, nearby events, and means of transportation [11; 122; 188]. AI-powered translation services can provide real-time

language translation for visitors, enhancing the tourist experience [189]. AI-powered translation services can also provide cultural interpretation by giving background information, stories, and cultural importance [190]. AI-powered monitoring skills can be used to safeguard historical places, analysing environmental factors, structural integrity, and potential dangers [154; 191]. AI-powered platforms help stakeholders collaborate, involving historians, architects, local communities, and tourism authorities in planning [192]. AI can evaluate how tourism-related activities affect historical places, suggest solutions to lessen negative consequences, and support global initiatives to protect cultural assets and the environment [193; 194; 195; 196; 197]. AI-driven platforms can connect historical locations across different geographies in a thematic way, building integrated travel routes that pass through multiple sites and highlighting lesser-known destinations, distributing tourism's advantages more fairly [11; 16; 19; 29; 37; 56; 85; 164; 185; 190; 198; 199].

Lastly, the unprecedented AI-mining tourism inter- and intra-regional mining heritage site planning and design paradigm imagines a day when AI technologies seamlessly combine historical relevance with cutting-edge tourism experiences [200]. This paradigm can revitalize mining heritage, educate tourists, and support sustainable local economies using AI's analytical strength, immersive skills, and personalization possibilities [46; 201]. We can build immersive, personalized experiences that connect the dots between historical relevance and modern expectations using AI technology. This strategy promotes the tourist sector via cutting-edge technology while simultaneously boosting local economies, fostering cross-cultural interaction, and preserving the legacy of mining history. However, the success of such initiatives depends on taking a balanced approach that considers ethical issues and protects the integrity of the mining history.

5. Conclusions

A comprehensive understanding has been established in exploring the integration of Artificial Intelligence (AI) in tourism management for mining heritage. The literature review uncovered a landscape rich with potential benefits, challenges, and opportunities at the intersection of AI, heritage preservation, and tourism. AI technologies including machine learning, natural language processing, and computer vision offer innovative solutions that enhance visitor experiences, streamline operations, and ensure sustainability in the context of mining heritage sites. The convergence of AI and mining heritage tourism yields a multitude of benefits. These encompass improved visitor engagement through personalized experiences, dynamic storytelling, and tailored recommendations. AI-driven analytics optimize resource allocation, visitor flow management, and energy consumption, ensuring a harmonious balance between heritage preservation and sustainable tourism practices. However, this integration also presents challenges such as data privacy concerns, algorithmic biases, and the imperative to maintain cultural authenticity. Ethical considerations emerge as a pivotal factor, demanding a collaborative approach that involves heritage experts, technologists, local communities, and stakeholders. Interdisciplinary research ensures AI solutions respect cultural sensitivities, adhere to ethical guidelines, and maximize positive impacts. The implications of AI integration extend into fostering longer stays, emotional connections, and enriched educational experiences for visitors. AI technologies personalize interactions, leading to deeper engagement with the narratives of mining heritage sites. Moreover, collaborative efforts drive innovation and responsible implementation, fostering a dynamic environment where AI becomes a catalyst for enhancing the exploration and appreciation of cultural heritage.

Heritage sites hold significant cultural and historical significance, often tied to the identity and traditions of local communities. To ensure the authenticity and integrity of these sites, collaboration with heritage experts is crucial. These professionals possess valuable insights into the narratives, traditions, and sensitivities associated with mining heritage, ensuring that AI-driven interpretations align with the site's rich history and resonate with the communities that hold it dear. Ethical considerations are paramount when integrating AI into heritage tourism, and collaboration with ethicists, legal experts, and cultural representatives helps identify potential pitfalls and ensure responsible AI solutions. Working together allows stakeholders to anticipate ethical challenges and collectively design solutions that uphold the highest standards of reliable implementation. A collaborative approach aims to maximize the positive impacts of AI integration, with local communities, residents, and cultural custodians being important voices that should be heard. Collaborative efforts enable the identification of opportunities where AI can benefit visitors, the local economy, education, and the

sustainable development of the area surrounding the heritage site. Interdisciplinary research plays a pivotal role in harnessing the potential of AI for heritage tourism, fostering innovative ideas that merge technological advancements with a profound understanding of historical context. This leads to the development of AI applications that provide accurate interpretations, engaging narratives, and educational content that resonate with visitors while preserving cultural authenticity. Involving local communities and stakeholders from the outset fosters a sense of ownership and engagement in the AI integration process, leading to sustainable management practices prioritizing the well-being of the heritage site, its environment, and its people.

The limited availability of research articles on AI integration in heritage mining tourism reflects this emerging intersection's intricate and specialized nature. This dearth of scholarly attention may stem from the unique convergence of heritage preservation, technology, and tourism management within mining heritage. Given the relatively recent prominence of AI integration in the broader tourism sector and the specific complexities associated with mining heritage sites, it's understandable that academic exploration in this field is still burgeoning. The niche focus of heritage mining tourism and its intricate blend of historical narratives, technological innovation, and sustainable management may pose challenges for researchers seeking to address all aspects comprehensively. Additionally, the interdisciplinary nature of this research, requiring collaboration between heritage experts, technologists, and local stakeholders, can further contribute to the scarcity of available literature. However, while the limited research articles may signify a current gap, it also highlights a promising opportunity for scholars to embark on pioneering studies that unravel the potential benefits, challenges, and ethical considerations of integrating AI in preserving and promoting mining heritage. As the potential of AI in heritage mining tourism becomes more recognized, future research will likely fill this gap and contribute invaluable insights to guide the responsible and innovative integration of technology in this unique realm.

In the evolving realm of AI-driven mining tourism, a novel, and uncharted paradigm exists involving inter- and intra-regional mining heritage site planning and design. This emerging landscape prompts further exploration to unlock its full potential. This new paradigm calls for an in-depth investigation to establish best practices, frameworks, and ethical guidelines that will shape the future of inter- and intra-regional mining heritage site planning and design, ultimately contributing to a more enriching and responsible tourism experience through questions like "What are the optimal AI-driven strategies for inter- and intra-regional mining heritage site planning and design, considering factors such as visitor engagement, cultural authenticity, sustainability, and local community involvement? A comprehensive exploration of AI integration to enhance the planning and design paradigms of mining heritage sites within and across regions."

In conclusion, the literature review synthesis reveals that AI integration in tourism management for mining heritage is a complex yet promising endeavour. This study serves as a vital stepping stone in unravelling the potential of AI integration within the context of mining heritage tourism. Through collaboration, interdisciplinary research, and a conscious alignment with ethical considerations, AI stands poised to reshape how heritage sites are experienced, managed, and preserved. This synthesis underscores that the responsible integration of AI has the potential to forge a harmonious balance between technological advancement, cultural preservation, and sustainable tourism practices, ensuring that the legacy of mining heritage is safeguarded for generations to come.

6. Practical Application of AI in Heritage Site Management

The integration of Artificial Intelligence (AI) into heritage site management is a multifaceted endeavor that yields practical applications across various dimensions, redefining how heritage sites are managed and experienced. These applications span interpretation, accessibility, conservation, sustainability, and crowd management, offering innovative solutions that cater to modern visitors' diverse needs while preserving the cultural and historical significance of these cherished locations.

AI-driven interpretive tools and virtual assistants, for instance, revolutionize visitor engagement by providing personalized guided tours and augmenting reality with historical insights. This creates immersive, educational experiences that deepen understanding. In the realm of accessibility, AI empowers inclusivity by enabling voice-activated navigation and real-time translation, breaking down language barriers and facilitating communication for all visitors. For conservation efforts, AI offers real-time

environmental monitoring through smart sensors and predictive maintenance through data analysis. These technologies safeguard structural integrity and reduce long-term conservation costs. Sustainability benefits from AI-driven energy optimization and waste management, minimizing resource consumption and environmental impact. Crowd management becomes more efficient with AI-powered predictive analytics and navigation apps, enhancing visitor experiences. Data-driven decision-making ensures resources are allocated optimally, promoting cost-effectiveness and operational efficiency. Accessibility is enhanced through braille signage and real-time accessibility information, while environmental preservation benefits from AI's ecosystem monitoring and climate control optimization. Cultural preservation is upheld as AI ensures cultural sensitivity and authenticity in interpretive content. Personalized experiences are crafted through AI algorithms, tailoring content to individual preferences and creating memorable encounters. These practical applications showcase AI's transformative potential in heritage site management, aligning modern expectations with the preservation of cultural and historical significance.

These practical applications of AI represent a transformative shift in heritage site management, offering innovative solutions that cater to the evolving needs and expectations of visitors while preserving the cultural and historical significance of these cherished sites.

References

[1] Pahlevan-Sharif, S., Mura, P. and Wijesinghe, S.N.R. (2019). A systematic review of systematic reviews in tourism. *Journal of Hospitality and Tourism Management*, Vol. 39, pp. 158–165.

[2] Comerio, N. and Strozzi, F. (2019). Tourism and its economic impact: a literature review using bibliometric tools. *Tourism Economics*, Vol. 25, No. 1, pp. 109-131.

[3] Ghosh, P. (2021). Mining Tourism Potential Assessment of Raniganj Coalfield, India. *Advances in Hospitality and Tourism Research*, Vol. 9, No. 2, pp. 341-367.

[4] Meyfroidt, P. *et al*. (2018). Middle-range theories of land system change. *Global Environmental Change*, Vol. 53, pp. 52-67.

[5] Carney, P.A. *et al*. (2012). Impact of a community gardening project on vegetable intake, food security and family relationships: a community-based participatory research study. *Journal of Community Health*, Vol. 37, pp. 874–881.

[6] Curran, M. and Bulmer, C. (1999). Forestry as an end use for reclaimed mines: some considerations. *In Proceedings of the 23rd Annual British Columbia mine reclamation symposium: mine decommissioning, Kamloops, 1999, The British Columbia Technical and Research Committee on Reclamation*, pp. 84–95.

[7] Kołodziej, B. *et al*. (2016). Soil physical properties of agriculturally reclaimed area after lignite mine: a case study from central Poland. *Soil and Tillage Research*, Vol. 163, pp. 54–63.

[8] Li, Y., Chen, L., and Wen, H. (2015). Changes in the composition and diversity of bacterial communities 13 years after soil reclamation of abandoned mine land in eastern China. *Ecological Research*, Vol. 30, pp. 357–366.

[9] Ellis, E.C. *et al*. (2020). People have shaped most of terrestrial nature for at least 12,000 years. *PNAS*, Vol. 118, No. 17.

[10] Pouresmaieli, M., Ataei, M., and Taran, A. (2023). Future mining based on internet of things (IoT) and sustainability challenges. *International Journal of Sustainable Development & World Ecology*, Vol. 30, No. 2, pp. 211-228.

[11] K.C., A. (2017). Community Forestry Management and its Role in Biodiversity Conservation in Nepal. I*n (Ed.), Global Exposition of Wildlife Management. IntechOpen*.

[12] Poulsen, M.N., Neff, R.A., and Winch, P.J. (2017). The multi-functionality of urban farming: perceived benefits for neighbourhood improvement. *The International Journal of Justice and Sustainability*, Vol. 22, No. 11, pp. 1411-1427.

[13] Tyrväinen, L. *et al*. (2005). Benefits and Uses of Urban Forests and Trees. *In: Konijnendijk, C., Nilsson, K., Randrup, T., and Schipperijn, J. (Eds.) Urban Forests and Trees. Springer, Berlin, Heidelberg*, pp. 81-114.

[14] Velan, M. and Prasad, M.N.V. (2018). Chapter 20 - Neyveli Lignite Mine Waste Rehabilitation for Sustainable Development. *Bio-Geotechnologies for Mine Site Rehabilitation*, pp. 347-370.

[15] Beer, F. and Marais, M. (2005). Rural communities, the natural environment and development – some challenges, some successes. *Community Development Journal*, Vol. 40, No. 1, pp. 50–61.

[16] Li, D., Du, P., and He, H. (2022). Artificial Intelligence-Based Sustainable Development of Smart Heritage Tourism. *Wireless Communications & Mobile Computing*, No. 5441170.

[17] Loureiro, S.M.C. *et al*. (2022). Culture, heritage looting, and tourism: A text mining review approach. *Frontiers in Psychology*, Vol. 13:944250. https://doi.org/10.3389/fpsyg.2022.944250.

[18] Mzembe, A.N., Koens, K., and Calvi, L. (2023). The institutional antecedents of sustainable development in cultural heritage tourism. *Sustainable Development*, Vol. 31, No. 4, pp. 2196-2211. https://doi.org/10.1002/sd.2565.

[19] Dai, T.C., Zheng, X., and Yan, J. (2021). Contradictory or aligned? The nexus between authenticity in heritage conservation and heritage tourism, and its impact on satisfaction. *Habitat International*, Vol. 107, No. 102307.

[20] Brooks, C. *et al.* (2023). Exploring the relationships between heritage tourism, sustainable community development and host communities' health and wellbeing: A systematic review. *PLoS One*, Vol. 18, No. 3:e0282319.

[21] Lee, Y. J. (2023). Destination fascination, well-being, and the reasonable person model of behavioural intention in heritage tourism. *Current Issues in Tourism*, pp. 1-17.

[22] Tsai, S. P. (2020). Augmented reality enhancing place satisfaction for heritage tourism marketing. *Current Issues in Tourism*, Vol. 23, No. 9, pp. 1078-1083.

[23] Chark, R. (2021). Midnight in Paris: On heritage and nostalgia. *Annals of Tourism Research*, Vol. 90, No. 103266.

[24] Yang, W. *et al.* (2022). How do aesthetics and tourist involvement influence cultural identity in heritage tourism? The mediating role of mental experience. *Frontiers in Psychology*, Vol. 13, No. 990030.

[25] Larsen, R.K. *et al.* (2022). The impacts of mining on Sámi lands: A knowledge synthesis from three reindeer herding districts. *The Extractive Industries and Society*, Vol. 9, No. 101051.

[26] Fernández-Vázquez, E. (2022). Mine closures and local diversification: Job diversity for coal-mining areas in a post-coal economy. *The Extractive Industries and Society*, No. 101086.

[27] Acquah, P.C. and Boateng, A. (2008). Planning for mine closure: Some case studies in Ghana. *Minerals & Energy - Raw Materials Report*, Vol. 15, No. 1, pp. 23-30.

[28] Siyongwana, P.Q. and Shabalala, A. (2018). The socio-economic impacts of mine closure on local communities: evidence from Mpumalanga Province in South Africa. *GeoJournal*, Vol. 84, pp. 367-380.

[29] Brueckner, M. *et al*. (2021). Mining legacies—Broadening understandings of mining impacts. *The Extractive Industries and Society*, Vol. 8, No. 3:100950.

[30] Mhlongo, S.E. and Amponsah-Dacosta, F. (2015). A review of problems and solutions of abandoned mines in South Africa. *International Journal of Mining, Reclamation and Environment*, Vol. 30, No. 4, pp. 279-294.

[31] Bennett, K. (2016). Abandoned mines — environmental, social and economic challenges. *In AB Fourie & M Tibbett (Eds.), Mine Closure 2016: Proceedings of the 11th International Conference on Mine Closure, Australian Centre for Geomechanics, Perth*, pp. 241-252.

[32] Macías, F. *et al*. (2017). A geochemical approach to the restoration plans for the Odiel River basin (SW Spain), a watershed deeply polluted by acid mine drainage. *Environ Sci Pollut Res*, Vol. 24, pp. 4506–4516.

[33] Anawar, H.M. (2015). Sustainable rehabilitation of mining waste and acid mine drainage using geochemistry, mine type, mineralogy, texture, ore extraction and climate knowledge. *Journal of Environmental Management*, Vol. 158, pp. 111–121.

[34] Johnston, D. *et al*. (2008). Abandoned mines and the Water Environment: Science project SC030136-41, *Environment Agency, the Scottish Environment Protection Agency (SEPA), the Coal Authority (The Environment Agency et al.), Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol.* Retrieved from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291482/LIT_8879_df7d5c.pdf.

[35] UNEP and Cochilco, (2001). Abandoned Mines - Problems, Issues and Policy Challenges for Decision-makers: Summary Workshop Report. *UNEP & Cochilco, Chile, United Nations Environment Programme & Chilean Copper Commission.* Retrieved from: https://wedocs.unep.org/bitstream/handle/20.500.11822/8116/-Adandoned%20Mines%20_%20Problems%2C%20Issues%20and%20Policy%20Challenges%20for%20Decision%20Makers-20011376.pdf?sequence=2&isAllowed=y.

[36] Singh, A.N., Srinivas, M., and Naik, B.N. (2015). Forecasting the impact of surface mining on surrounding cloud computing. *Journal of Computer Sciences and* Applications, Vol. 3, No. 6, pp. 118-122.

[37] Miller, D. (2008). Using Aquaculture as a Post-mining Land Use in West Virginia. *Mine Water and the Environment*, Vol. 27, No. 122.

[38] Narrei, S. and Osanloo, M. (2011). Post-Mining Land-Use Methods Optimum Ranking, using Multi-attribute Decision Techniques with Regard to Sustainable Resources Management. *OIDA International Journal of Sustainable Development*, Vol. 2, No. 11, pp. 65-76. Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1981431#.

[39] Miao, Z. and Marrs, R. (2000). Ecological restoration and land reclamation in open-cast mines in Shanxi Province, China. *Journal of Environmental Management*, Vol. 59, No. 3, pp. 205-215.

[40] Ashby, A.D. and Van-Etten, E.J.B. (2021). Exploring abandoned mines through a public lens. *In AB Fourie, M Tibbett & A Sharkuu (Eds.), Mine Closure 2021: Proceedings of the 14th International Conference on Mine Closure, QMC Group*.

[41] Archer, D.W. *et al*. (2008). Social and political influences on agricultural systems. *Renewable Agriculture and Food Systems*, Vol. 23, pp. 272-284.

[42] Zasada, I. (2011). Multifunctional peri-urban agriculture—A review of societal demands and the provision of goods and services by farming. *Land Use Policy*, Vol. 28, No. 4, pp. 639-648.

[43] Blanchette, M.L. and Lund, M.A. (2016). Pit lakes are a global legacy of mining: an integrated approach to achieving sustainable ecosystems and value for communities. *Current Opinion in Environmental Sustainability*, Vol. 23, pp. 28-34.

[44] Kean, S. (2009). Eco-Alchemy in Alberta. *Science*, Vol. 326, No. 5956, pp. 1052-1055.

[45] Otcherea, F.A. *et al*. (2002). Mining and Aquaculture: A Sustainable Venture. *British Columbia Mine Reclamation Symposium*.

[46] Singh, R.S. and Ghosh, P. (2021). Geotourism potential of coal mines: An appraisal of Sonepur-Bazari open cast project, India. *International Journal of Geoheritage and Parks*, Vol. 9, No. 2, pp. 172-181.

[47] Nag, A. and Mishra, S. (2023). Stakeholders' perception and competitiveness of heritage towns: A systematic literature review. *Tourism Management Perspectives*, Vol. 48, No. 101156.

[48] Heymans, A. *et al*. (2019). Ecological Urban Planning and Design: a Systematic Literature Review. *Sustainability*, Vol. 11, No. 13.

[49] Cooper, H.M. (1988). Organizing knowledge syntheses: A taxonomy of literature reviews. *Knowledge in Society,* Vol. 1, No. 104.

[50] PRISMA. (2019a). PRISMA statement. Retrieved from: http://www.prisma-statement.org/PRISMAStatement/Checklist.aspx

[51] PRISMA. (2019b). PRISMA statement. Retrieved from: http://www.prisma-statement.org/PRISMAStatement/.

[52] Pouresmaieli, M. *et al*. (2022). Recent progress on sustainable phytoremediation of heavy metals from soil. *Journal of Environmental Chemical Engineering*, Vol. 10, No. 5:108482.

[53] Mastrogianni, A. *et al*. (2014). Reclamation of lignite mine areas with Triticum aestivum: the dynamics of soil functions and microbial communities. *Applied Soil Ecology*, Vol. 80, pp. 51–59.

[54] Alavi, I., Ebrahimabadi, A., and Hamidian, H. (2022). A New Technical and Economic Approach to Aptimal Plant Species Selection for Open-pit Mine Reclamation Process. *Journal of Mining and Environment*, Vol. 13, No. 4, pp. 1091-1105.

[55] Chodak, M., Pietrzykowski, M., and Niklińska, M. (2009). Development of microbial properties in a chronosequence of sandy mine soils. *Applied Soil Ecology,* Vol. 41, pp. 259–268.

[56] UAK. (2017). University of Agriculture in Krakow: Current challenges in reclamation to forest. Retrieved from: http://reclamation 2016.ur.krakow.pl/.

[57] Szczepiński, J. *et al*. (2010). Reclamation of polish lignite open pits by flooding. *Biuletyn Państwowego Instytutu Geologicznego*, Vol. 441, No. 441, pp. 167–174. Retrieved from: https://geojournals.pgi.gov.pl/bp/article/view/28887.

[58] Esch, M. (2016). Hydroelectric engineers find potential in centuries-old mine. *Energy & Green Tech*. Retrieved from: https://phys.org/news/2016-12-hydroelectric-potential-centuries-old.html

[59] Life in Quarries Project. (2017). Retrieved from: http://www.lifeinquarries.eu/en/.

[60] Šebelíková, L., Řehounková, K., and Prach, K. (2016). Spontaneous revegetation vs. forestry reclamation in post-mining sand pits. *Environmental Science and Pollution Research*, Vol. 23, pp. 13598–13605.

[61] Jurek, V. (2014). Wildlife return at the quarry "Břidla": possibilities of natural habitat restoration. *Czech Republic, Brno, Quarry Life Award Project*. Retrieved from: https://www.slideshare.net/QuarryLifeAward/wildlife-return-at-the-quarry-bidla-possibilities-of-natural-habitat-restoration-by-vilm-jurek-czech-republic.

[62] Lopes, M.E. *et al*. (2015). Recovery of ancient groundwater supply systems and old abandoned mines: coupling engineering geosciences and geoheritage management. *In: Lollino, G., Giordan, D., Marunteanu, C., Christaras, B., Yoshinori, I., and Margottini, C. (Eds.) Engineering geology for society and territory*, Vol. 8, pp. 227–230.

[63] Brandão, J.M. (1998). Património mineiro português: um filão a explorar. *Bio-Geotechnologies for Mine Site Rehabilitation, In Proceedings of Seminário Arqueologia e Museologia Mineiras, Lisbon, Museu do IGM*, pp. 5–9. Retrieved from: https://books.google.co.in/books?id=Zh8wDwAAQBAJ&pg=PA27&lpg=PA27&dq=Patrim%C3%B3nio+mineiro+portugu%C3%AAs:+um+fil%C3%A3o+a+explorar.+In+Proceedings+of+Semin%C3%A1rio+Arqueologia+e+Museologia+Mineiras,+Lisbon,&source=bl&ots=keuMiE1Hy-

&sig=ACfU3U2V36yl_xb3EwhleIv5shn2UZXBRA&hl=en&sa=X&ved=2ahUKEwj6xfb_jt_4AhXsS2wGHaZYApoQ6AF6BAgCEAM#v=onepage&q=Patrim%C3%B3nio%20mineiro%20portugu%C3%AAs%3A%20um%20fil%C3%A3o%20a%20explorar.%20In%20Proceedings%20of%20Semin%C3%A1rio%20Arqueologia%20e%20Museologia%20Mineiras%2C%20Lisbon%2C&f=false.

[64] Ping, L. (2012). The activation, transformation, and updates of the abandoned mining area: take the Quantai, Xuzhou mining area's concept design of landscape for example. *In Proceedings of the 2nd international conference on consumer electronics, communications and networks (CECNet), Yichang*, pp. 3547–3550.

[65] Ellis, E.C. (2021). Land Use and Ecological Change: A 12,000-Year History. *Annual Review of Environment and Resources*, Vol. 46, pp. 1-33.

[66] Kanianska, R. (2016). Agriculture and Its Impact on Land-Use, Environment, and Ecosystem Services. *In (Ed.), Landscape Ecology - The Influences of Land Use and Anthropogenic Impacts of Landscape Creation. IntechOpen.*

[67] Dobrovodská, M. *et al*. (2010). Research and maintenance of biodiversity in historical structures in the agricultural landscape of Slovakia. *In: Barančoková M, Krajčí J, Kollár J, Belčáková I, editors. Landscape Ecology – Methods, Applications and Interdisciplinary Approach. Bratislava: ILE SAS*, pp. 131–140.

[68] Kim, A.R. *et al*. (2021). Principle of restoration ecology reflected in the process creating the National Institute of Ecology. *Journal of Ecology and Environment*, Vol. 45, No. 12.

[69] Bing-yuan, H. and Li-xun, K. (2014). Mine Land Reclamation and Eco-Reconstruction in Shanxi Province I: Mine Land Reclamation Model. *The Scientific World Journal*, Vol. 2014, No. 483862.

[70] Zobrist, J. *et al*. (2009). Environmental and socioeconomic assessment of impacts by mining activities—a case study in the Certej River catchment, Western Carpathians, Romania. *Environmental Science and Pollution Research*, Vol. 16, pp. 14–26.

[71] Macdonald, S.E. *et al*. (2015). Forest restoration following surface mining disturbance: challenges and solutions. *New Forests*, Vol. 46, pp. 703–732.

[72] Edwards, J.A. and Coit, J.C.L. (1996). Mines and quarries: Industrial heritage tourism. *Annals of Tourism Research*, Vol. 23, No. 2, pp. 341-363.

[73] Różycki, P. and Dryglas, D. (2017). Mining tourism, sacral and other forms of tourism practiced in antique mines - analysis of the results. *Acta Montanistica Slovaca*, Vol. 22, No. 1, pp. 58-66. Retrieved from: https://www.researchgate.net/publication/317163871_Mining_tourism_sacral_and_other_forms_of_tourism_practiced_in_antique_mines_-_Analysis_of_the_results.

[74] McCullough, C.D., Schultze, M., and Vandenberg, J. (2020). Realizing Beneficial End Uses from Abandoned Pit Lakes. *Minerals*, Vol. 10, No. 2:133.

[75] Havrlant, J. and Krtička, L. (2014). Reclamation of devastated landscape in the Karviná region (Czech Republic). *Environmental & Socio-economic Studies*, Vol. 2, Nno. 4, pp. 1–12.

[76] Orewere, E., Owonubi, A., and Zainab, S. (2020). Landscape Reclamation for Abandoned Mining Site for Outdoor Recreation on the Jos Plateau. *Journal of Environmental Sciences and Resources Management*, Vol. 12, No. 2, pp. 26-50. Retrieved from: https://www.researchgate.net/publication/350190399_LANDSCAPE_RECLAMATION_FOR_ABANDONED_MINING_SITE_FOR_OUTDOOR_RECREATION_ON_THE_JOS_PLATEAU.

[77] Gilewska, M. and Otremba, K. (2015). Water reservoirs under construction as a result of the activities of "Konin" and "Adamów" brown coal mines. *Journal of Ecological Engineering*, Vol. 16, No. 5, pp. 138–143.

[78] Xiao, W. *et al*. (2011). A study of land reclamation and ecological restoration in a resource-exhausted city – a case study of Huaibei in China. *International Journal of Mining, Reclamation and Environment*, Vol. 25, No. 4, pp. 332-341.

[79] Yu, X., Mu, C., and Zhang, D. (2020). Assessment of Land Reclamation Benefits in Mining Areas Using Fuzzy Comprehensive Evaluation. *Sustainability*, Vol. 12, No. 5.

[80] Spyridou, L.P. (2019). Analysing the active audience: Reluctant, reactive, fearful, or lazy? Forms and motives of participation in mainstream journalism. *Journalism*, Vol. 20, No. 6, pp. 827-847.

[81] Luttik, J. (2000). The value of trees, water and open space as reflected by house prices in the Netherlands. *Landscape and Urban Planning*, Vol. 48, No. 3–4, pp.161-167.

[82] Breber, P., Povilanskas, R., and Armaitienė, A. (2008). Recent evolution of fishery and land reclamation in Curonian and Lesina Jagoons. *Hydrobiologia*, Vol. 611, No. 105.

[83] Zande, A.N. *et al*. (1984). Impact of outdoor recreation on the density of a number of breeding bird species in woods adjacent to urban residential areas. *Biological Conservation*, Vol. 30, No. 1, pp. 1-39.

[84] Allan, J.D. (2004). Landscapes and Riverscapes: The Influence of Land Use on Stream Ecosystems. *Annual Review of Ecology, Evolution, and Systematics*, Vol. 35, pp. 257-284.

[85] McCullough, C.D. and Lund, M.A. (2006). Opportunities for Sustainable Mining Pit Lakes in Australia. *Mine Water and the Environment*, Vol. 25, pp. 220–226.

[86] Lagarense, B.E.S. and Walansendow, A. (2014). Exploring Residents' Perceptions and Participation on Tourism and Waterfront Development: The Case of Manado Waterfront Development in Indonesia. *Asia Pacific Journal of Tourism Research*, Vol. 20, No. 2, pp. 223-237.

[87] Vaugeois, N. *et al*. (2009). "Made in BC" Innovation in Sustainable Tourism. *Fostering Innovation in Sustainable Tourism*. DOI: 10.13140/RG.2.2.34237.36323, Retrieved from: https://web.viu.ca/sustainabletourism/Innovation%20manual%20Final%20June%204.pdf.

[88] Shafaei, F. and Mohamed, B. (2015). A Stage-Based Model Development Study on Tourism Social Impact Assessment. *International Journal of Scientific and Research Publications*, Vol. 5, No. 3, pp. 1-6. Retrieved from: https://www.ijsrp.org/research-paper-0315/ijsrp-p3942.pdf.

[89] Riley, R.W., and Doren, C.S.V. (1992). Movies as tourism promotion: A 'pull' factor in a 'push' location. *Tourism Management*, Vol. 13, No. 3, pp. 267-274.

[90] Ap, J. and Crompton, J.L. (1993). Residents' Strategies for Responding to Tourism Impacts. *Journal of Travel Research*, Vol. 32, No. 1, pp. 47-50.

[91] Zhuang, X., Yao, Y., and Li, J. (2019). Sociocultural Impacts of Tourism on Residents of World Cultural Heritage Sites in China. *Sustainability*, Vol. 11, No. 3:840.

[92] Almeyda-Ibáñez, M. and George, B.P. (2017). The evolution of destination branding: A review of branding literature in tourism. *Journal of Tourism, Heritage & Services Marketing*, Vol. 3, No. 1, pp. 9-17.

[93] Zhu, P. *et al*. (2022). Traveller pro-social behaviours at heritage tourism sites. *Frontiers in Psychology*, Vol. 13, No. 901530.

[94] Zhao, Z. and Liu, Z. (2021). Development Path of Industrial Heritage Tourism: A Case Study of Kitakyushu (Japan). *Sustainability*, Vol. 13, No. 21:12099.

[95] Zhang, S. *et al*. (2023). Research on global cultural heritage tourism based on bibliometric analysis. *Heritage Science*, Vol. 11, No. 1:139.

[96] Xu, Y. *et al*. (2020). Towards sustainable heritage tourism: A space syntax-based analysis method to improve tourists' spatial cognition in Chinese historic districts. *Buildings*, Vol. 10, No. 2:29.

[97] Scarpi, D. and Raggiotto, F. (2023). A construal level view of contemporary heritage tourism. *Tourism Management*, Vol. 94, No. 104648.

[98] Jiang, S. *et al*. (2023). Augmented reality and the enhancement of memorable tourism experiences at heritage sites. *Current Issues in Tourism*, Vol. 26, No. 2, pp. 242-257.

[99] Zhu, Y. (2021). Heritage tourism: from problems to possibilities. *International Journal of Heritage Studies*, Vol. 28, No. 1, pp. 127-129. DOI10.1080/13527258.2021.1969985.

[100] Lin, Z. and Rasoolimanesh, S.M. (2023). Influencing factors on the intention of sharing heritage tourism experience in social media. *Journal of Hospitality and Tourism Technology*, Vol. 14, No. 4, pp. 675-700.

[101] Tu, H.M. (2020). Sustainable heritage management: Exploring dimensions of pull and push factors. *Sustainability*, Vol. 12, No. 19:8219.

[102] Peng, K.H. and Tzeng, G.H. (2019). Exploring heritage tourism performance improvement for making sustainable development strategies using the hybrid-modified MADM model. *Current issues in tourism*, Vol. 22, No. 8, pp. 921-947.

[103] Lee, C.K. *et al*. (2023). Sustainable intelligence and cultural worldview as triggers to preserve heritage tourism resources. *Tourism Geographies*, Vol. 25, No. 2-3, pp. 899-918.

[104] Tu, H.M. (2022). Confirmative biophilic framework for heritage management. *PLoS One*, Vol. 17,No. 3:e0266113.

[105] Shen, Y., Li, Y., and Li, Z. (2022). Application of intelligent inspection robot in coal mine industrial heritage landscape: Taking Wangshiwa coal mine as an example. *Frontiers in Neurorobotics*, Vol. 16, No. 865146.

[106] Sousa, J.J. *et al*. (2023). Using machine learning and satellite data from multiple sources to analyze mining, water management, and preservation of cultural heritage. *Geo-spatial Information Science*, pp. 1-20.

[107] Gallwey, J. *et al*. (2019). Bringing lunar LiDAR back down to earth: Mapping our industrial heritage through deep transfer learning. *Remote Sensing*, Vol. 11, No. 17: 1994.

[108] Huang, L. and Song, Y. (2022). Intangible Cultural Heritage Management Using Machine Learning Model: A Case Study of Northwest Folk Song Huaer. *Scientific Programming*, Vol. 2022, No. 1383520.

[109] Liu, X. *et al*. (2022). Cultural Heritage Resource Development and Industrial Transformation Resource Value Assessment Based on BP Neural Network. *Computational Intelligence and Neuroscience*, Vol. 2022. DOI: 10.1155/2022/2288358.

[110] Becker, D.R. *et al*. (2003). A participatory approach to social impact assessment: the interactive

community forum. *Environmental Impact Assessment Review*, Vol. 23, No. 3, pp. 367-382.

[111] Pettersson, R. (2004). Sami tourism in Northern Sweden: Supply, demand and interaction. Retrieved from: http://library.arcticportal.org/1663/1/Saami_tourism.pdf.

[112] Ibănescu, B.C. *et al*. (2018). The Impact of Tourism on Sustainable Development of Rural Areas: Evidence from Romania. *Sustainability*, Vol. 10, No. 10:3529.

[113] Angel, P.N. *et al*. (2009). The Forestry Reclamation Approach and the Measure of Its Success in Appalachia 1. *Journal of the American Society of Mining and Reclamation*, pp. 18-36.

[114] Acharya, K.P. (2004). Does Community Forests Management Supports Biodiversity Conservation? Evidences from Two Community Forests from the Mid Hills of Nepal. *Journal of Forest and Livelihood*, Vol. 4, No. 1, pp. 44–54. Retrieved from: https://www.researchgate.net/publication/274955290_Does_Community_Forests_Management_Supports_Biodiversity_Conservation_Evidences_from_Two_Community_Forests_from_the_Mid_Hills_of_Nepal.

[115] Pokharal, B.K. (2001). Livelihoods, Economic Opportunities and Equity: Community Forestry and People's Livelihoods. *Journal of Forestry and Livelihood*, Vol. 1, No. 1, pp. 16–18. Retrieved from: https://www.forestaction.org/app/webroot/vendor/tinymce/editor/plugins/filemanager/files/6.%20Bharat.pdf.

[116] Karjalainen, E. and Tyrväinen, L. (2002). Visualization in forest landscape preference research: a Finnish perspective. *Landscape and Urban Planning*, Vol. 59, No. 1, pp. 13-28.

[117] Burger, J.A. *et al*. (2003). White Pine Growth and Yield on a Mined Site in Virginia: Response to Thinning aAnd Pruning. Jou*rnal of the American Society of Mining and Reclamation*, pp. 96-102. DOI: 10.21000/JASMR03010069.

[118] Tyrväinen, L. and Väänänen, H. (1998). The economic value of urban forest amenities: an application of the contingent valuation method. *Landscape and Urban Planning*, Vol. 43, No. 1–3, pp. 105-118.

[119] Tretiak, V.M. and Marchenkova, T.P. (2020). Recreational land use: issues of development and assessment of potential. *Land management, cadastre and land monitoring*, Vol. 26, No.1.

[120] Costa, S.S.S. and Santos, E.N. (2016). Mining Tourism and Geotourism: Alternatives Solutions to Mine Closure and Completion. *In book: 24th World Mining Congress Proceedings: Sustainability in mining Edition: 1Publisher: IBRAM*, pp. 301-309.

[121] Bangian, A.H. *et al*. (2011b). Fuzzy analytical hierarchy processing to define optimum post mining land use for pit area to clarify reclamation costs. *Mineral resources management (Gospodarka surowcami mineralnymi),* Vol. 56, No. 2, pp. 145-168.

[122] Pouresmaieli, M., Ataei, M., and Qarahasanlou, A. N. (2023). A scientometrics view on sustainable development in surface mining: Everything from the beginning. *Resources Policy*, Vol. 82, No. 103410.

[123] Dickinson, J.E. (2015). Travel, tourism, climate change, and behavioural change: travellers' perspectives from a developing country, Nigeria. *Journal of Sustainable Tourism*, Vol. 23, No. 3, pp. 437-454.

[124] García, F.A., Vázquez, A.B., and Macías, R.C. (2015). Resident's attitudes towards the impacts of tourism. *Tourism Management Perspectives*, Vol. 13, pp. 33-40.

[125] Deery, M., Jago, L., and Fredline, L. (2012). Rethinking social impacts of tourism research: a new research agenda. *Tourism Management*, Vol. 33, No. 1, pp. 64-73.

[126] McKercher, B. and Ho, P.S.Y. (2011). Assessing the Tourism Potential of Smaller Cultural and Heritage Attractions. *Journal of Sustainable Tourism*, Vol. 14, No. 5, pp. 473-488. DOI: 10.2167/jost620.0.

[127] Choi, H.S.C. and Sirakaya, E. (2005). Measuring Residents' Attitude toward Sustainable Tourism: Development of Sustainable Tourism Attitude Scale. *Journal of Travel Research*, Vol. 43, No. 4, pp. 380-394.

[128] Seifullina, A. *et al*. (2018). A Lean Implementation Framework for the Mining Industry. *IFAC-PapersOnLine*, Vol. 51,N. 11, pp. 1149-1154.

[129] Roberts, S. and Tribe, J. (2008). Sustainability Indicators for Small Tourism Enterprises – An Exploratory Perspective. *Journal of Sustainable Tourism*, Vol. 16, No. 5, pp. 575-594. DOI: 10.1080/09669580802159644.

[130] Mason, P. and Cheyne, J. (2000). Residents' attitudes to proposed tourism development. *Annals of Tourism Research*, Vol. 27, No. 2, pp. 391-411.

[131] Rayel, J.J., Manoka, B., and Boin, C. (2012). Residents' Perception on the Implications of Tourism and the Proposed Mining Operations along Kokoda Track in Papua New Guinea. *International Journal of Tourism Sciences*, Vol. 12, No. 1, pp. 69-92.

[132] Michaud, L.H. and Bjork, D. (1995). The feasibility of constructing solid waste landfills as a reclamation method for abandoned mine lands. *In Hynes TP, Blanchette MC, editors: Proceedings of the conference on mining and the environ¬ment (Sudbury '95), Sudbury, Canada Communication Group – Publishing*, pp. 227–237. Retrieved from: http://pdf.library.laurentian.ca/medb/conf/Sudbury95/MiningSociety/MS1.PDF.

[133] Hunsberger, E.L. and Michaud, L.H. (1994). The development of a field method for evaluating the success of reclamation efforts on abandoned mine lands. *International Land Reclamation and Mine Drainage Conference and Third*, pp. 304–313. Retrieved from: https://books.google.co.in/books?id=ZgwsWKSUdvYC&pg=PA304&lpg=PA304&dq=The+development+of+a+field+method+for+evaluating+the+success+of+reclamation+efforts+on+abandoned+mine+lands%09Hunsberger&source=bl&ots=u0RR77lp7O&sig=ACfU3U18iq_N6zx6iC1N22vtr_2PRf3PSg&hl=en&sa=X&ved=2ahUKEwir3bDZht_4AhUkSmwGHTXfAHoQ6AF6BAgCEAM#v=onepage&q=The%20development%20of%20a%20field%20method%20for%20evaluating%20the%20success%20of%20reclamation%20efforts%20on%20abandoned%20mine%20lands%09Hunsberger&f=false.

[134] Chambers, J.C. and Wade, G.L. (1992). Evaluating Reclamation Success: The Ecological Consideration-Proceedings of a Symposium. *General Technical Report NE-164, United States Department of Agriculture, Forest Service: Charleston, WV, USA, 1992*. Available online: https://www.nrs.fs.fed.us/pubs/gtr/gtr164.pdf (accessed on 15 May 2019).

[135] Bangian, A.H., *et al*. (2011a). The Application of Fuzzy MADM Modelling to Define Optimum Post Mining Land Use for Pit Area to Recognize Reclamation Costs in Open Pit Mining. *Archives of Mining Science*, Vol. 56, No. 1, pp. 91–116.

[136] Cao, X. (2007). Regulating Mine Land Reclamation in Developing Countries: The Case of China. *Land Use Policy*, Vol. 24, No. 2, pp. 472-483.

[137] Kavourides, C., Pavloudakis, F., and Filios, P. (2002). Environmental protection and land reclamation works in West Macedonia Lignite Centre in North Greece current practice and future perspectives. *In: Ciccu R. (ed.) SWEMP 2002: Proceedings of the 7th International Symposium on Environmental Issues and Waste Management in Energy and Mineral Production, SWEMP 2002, Cagliari, Italy. University of Cagliari.*

[138] Saperstein, L.W. (1990). Reclamation (Introduction). *In: Kennedy B.A. (Ed.) Surface Mining. 2nd Edition. Littleton, Colorado: Society for Mining, Metallurgy, and Exploration, Inc.*, pp. 749.

[139] Hajkazemiha, N. *et al*. (2021). Evaluation of Mine Reclamation Criteria Using Delphi-Fuzzy Approach. *Journal of Mining and Environment*, Vol. 12, No. 2, pp. 367-384.

[140] Wirth, P. *et al.* (2018). Green infrastructure: a planning concept for the urban transformation of former coal-mining cities. *International Journal of Coal Science & Technology*, Vol. 5, pp. 78–91.

[141] Zhang, J. *et al*. (2011). Land Use-based Landscape Planning and Restoration in Mine Closure Areas. *Environmental Management*, Vol. 47, pp. 739–750.

[142] Vrablikova, J., Wildova, E., and Vrablik, P. (2016). Sustainable Development and Restoring the Landscape after Coal Mining in the Northern Part of the Czech Republic. *Journal of Environmental Protection*, vol. 7, no. 11.

[143] Kasztelewicz, Z. (2014). Approaches to Post-Mining Land Reclamation in Polish Open-Cast Lignite Mining. *Civil and Environmental Engineering Reports*, Vol. 12, No. 1, pp. 55-67.

[144] Wapwera, S.D., Ayanbimpe, G.M., and Odita, C.E. (2015). Abandoned mine, potential home for the people: a case study of Jos Plateau Tin-Mining Region. *Journal of Civil Engineering and Architecture*, Vol. 9, pp. 429–445. DOI: 10.17265/1934-7359/2015.04.007.

[145] Hu, Z., Wang, P., and Li, J. (2012). Ecological Restoration of Abandoned Mine Land in China. *Journal of Resources and Ecology*, Vol. 3, No. 4, pp. 289-296.

[146] Luo, P., Miao, Y., and Chang, J. (2020). The "Classification - Strategies" method for the eco-transition of "mine-city" system-taking Xuzhou city as an example. *Journal of Urban Management*, Vol. 9, No. 3, pp. 360-371.

[147] Saigustia, C. and Robak, S. (2021). Review of Potential Energy Storage in Abandoned Mines in Poland. *Energies*, Vol. 14, No. 19:6272.

[148] Jelen, J. (2018). Mining Heritage and Mining Tourism. *Czech Journal of Tourism*, Vol. 7, No. 1, pp. 93-105.

[149] Burkhard, B. and Müller, F. (2008). Driver–pressure–state–impact–response. *In: Jorgensen SE, Fath BD, editors. Ecological indicators. Vol. 2 of Encyclopedia of ecology. Oxford: Elsevier*, pp. 967–970.

[150] Tian, P. *et al*. (2021). Impacts of reclamation derived land use changes on ecosystem services in a typical gulf of eastern China: A case study of Hangzhou bay. *Ecological Indicators*, Vol. 132, No. 108259.

[151] Sihem, E. (2019). Economic and socio-cultural determinants of agricultural insurance demand across countries. *Journal of the Saudi Society of Agricultural Sciences*, Vol. 18, No. 2, pp. 177-187.

[152] Diekmann, L.O., Gray, L.C., and Thai, C.L. (2020). More than Food: the Social Benefits of Localized Urban Food Systems. *Front. Sustain. Food Syst*., Vol. 4, No. 534219.

[153] Brehm, J.M. and Eisenhauer, B.W. (2008). Motivations for Participating in Community-Supported Agriculture and their Relationship with Community Attachment and Social Capital. *Journal of Rural Social Sciences*, Vol. 23, No. 1.

[154] Adesipo, A.A. *et al*. (2021). An Approach to Thresholds for Evaluating Post-Mining Site Reclamation. *Sustainability*, Vol. 13, No. 10:5618.

[155] Shan-Shan, F. *et al*. (2009). Re-use strategy of subsided land based on urban space ecological compensation: case study for Xuzhou mining area for example. *Procedia Earth and Planetary Science*, Vol. 1, No. 1, pp. 982-988.

[156] Singh, R.S. and Ghosh, P. (2019). Potential of Mining Tourism: a Study of Select Coal Mines of Paschim Bardhaman District, West Bengal. *Indian Journal of Landscape Systems and Ecological Studies*, Vol. 42, pp. 101-114. Retrieved from: https://www.researchgate.net/publication/344372938_POTENTIAL_OF_MINING_TOURISM_A_STUDY_OF_SELECT_COAL_MINES_OF_PASCHIM_BARDHAMAN_DISTRICT_WEST_BENGAL_INDIAN_JOURNAL_OF_LANDSCAPE_SYSTEM_AND_ECOLOGICAL_STUDIES.

[157] Li, Y., Chen, L., and Wen, H. (2014). Changes in the composition and diversity of bacterial communities 13 years after soil reclamation of abandoned mine land in eastern China. *Ecological Research*, Vol. 30, pp. 357–366.

[158] George-Laurentiu, M., Florentina-Cristina, M., and Andreea-Loreta, C. (2016). The Assessment of Social and Economic Impacts Associated to an Abandoned Mining Site Case study: Ciudanovita (Romania). *Procedia Environmental Sciences*, Vol. 32, pp. 420-430.

[159] Lynch, A.J. *et al*. (2016). The social, economic, and environmental importance of inland fish and fisheries. *Environmental Reviews*, Vol. 24, No. 2, pp. 115-121.

[160] Pouresmaieli, M. and Osanloo, M. (2019). Establishing a Model to Reduce the Risk of Premature Mine Closure. *In IOP Conference Series: Earth and Environmental Science*, Vol. 362, No. 1, pp. 012005. IOP Publishing.

[161] Kuter, N. (2013). Reclamation of Degraded Landscapes due to Opencast Mining. *Advances in Landscape Architecture, Rijeka, Croatia, InTech,* pp. 823–858.

[162] Kim, A. (2011). Chapter 16 - United States Bureau of Mines-Study and Control of Fires in Abandoned Mines and Waste Banks. *Coal and Peat Fires: A Global Perspective*, Vol. 1, pp. 267-305.

[163] Pouresmaieli, M. and Osanloo, M. (2020). A Valuation Approach to Investigate the Sustainability of Sorkhe-Dizaj Iron Ore Mine of Iran. *In: Topal, E. (Eds.) Proceedings of the 28th International Symposium on Mine Planning and Equipment Selection - MPES 2019. MPES 2019, pp. 431-446. Springer Series in Geomechanics and Geoengineering.* Springer, Cham.

[164] Mahr T. and Malgot J. (1985). Devastation of the environment by landslides activated by construction. *Bulletin of the International Association of Engineering Geology*, Vol. 31, pp. 81–88.

[165] Favas, P.J.C., Martino, L.E., and Prasad, M.N.V. (2018). Chapter 1 - Abandoned Mine Land Reclamation—Challenges and Opportunities (Holistic Approach). *Bio-Geotechnologies for Mine Site Rehabilitation*, pp. 3-31.

[166] Otchere, F.A. *et al*. (2004). Transforming open mining pits into fish farms: Moving towards sustainability. *Natural Resources Forum*, Vol. 28, pp. 216-223.

[167] Sheoran, V., Sheoran, A.S., and Poonia, P. (2010). Soil Reclamation of Abandoned Mine Land by Revegetation: A Review. *International Journal of Soil, Sediment and Water*, Vol. 3, No. 2.

[168] Ghose, M.K. (1989). Land reclamation and protection of environment from the effect of coal mining operation. *Mine technology*, Vol. 10, No. 5, pp. 35-39.

[169] Kimball, B.A., Church, S.E., and Besser, J.M. (2006). Lessons Learned From The U.S. Geological Survey Abandoned Mine Lands Initiative – 1997-2002. *7th International Conference on Acid Rock Drainage (ICARD), March 26-30, 2006, St. Louis MO. R.I. Barnhisel (Ed.) Published by the American Society of Mining and Reclamation (ASMR), 3134 Montavesta Road, Lexington, KY 40502*, pp. 944-963.

[170] Centobelli, P. and Ndou, V. (2019). Managing customer knowledge through the use of big data analytics in tourism research. *Current Issues in Tourism*, Vol. 1, No. 15, pp. 1862-1882.

[171] Yang, E.C.L., Khoo-Lattimore, C., and Arcodia, C. (2017). A systematic literature review of risk and gender research in tourism. *Tourism Management*, Vol. 58, pp. 89-100.

[172] O'Brien, A.M. and Guckin, C.M. (2016). The Systematic Literature Review Method: Trials and Tribulations of Electronic Database Searching at Doctoral Level. *In SAGE Research Methods Cases Part 1. SAGE Publications, Ltd. London, UK.*

[173] Siddaway, A.P., Wood, A.M., and Hedges, L.V. (2019). How to Do a Systematic Review?: a Best Practice Guide for Conducting and Reporting Narrative Reviews, Meta-Analyses, and Meta-Syntheses. *Annual Review of Psychology*, Vol. 70, pp. 747-770.

[174] Eusébio, C. *et al*. (2021). The impact of air quality on tourism: a systematic literature review. *Journal of Tourism Futures*, Vol. 7, No. 1, pp. 111-130.

[175] Kim, C. S. *et al*. (2018). Review of reviews: A systematic analysis of review papers in the hospitality and tourism literature. *International Journal of Hospitality Management*, Vol. 70, pp. 49–58.

[176] Janjua, Z.A., Krishnapillai, G., and Rahman, M. (2021). A Systematic Literature Review of Rural Homestays and Sustainability in Tourism. *SAGE Open*, Vol. 11, No. 2.

[177] Garcês, S., Pocinho, M., and Jesus, S.N.D. (2018). Review of optimism, creativity and spirituality in tourism research. *Tourism and Hospitality Management*, Vol. 24, No.1, pp. 107–117. DOI:10.20867/thm.24.L6.

[178] Wijesinghe, S.N.R., Mura, P., and Bouchon, F. (2017). Tourism knowledge and neo-colonialism: A systematic critical review of the literature. *Current Issues in Tourism*, Vol. 22, No.11, pp. 1263–1279.

[179] Moher, D. *et al*. (2009). Reprint—Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Physical Therapy & Rehabilitation Journal,* Vol. 89, No. 9, pp. 873-880.

[180] Chabukdhara, M. and Singh, O.P. (2016). Coal mining in northeast India: an overview of environmental issues and treatment approaches. *International Journal of Coal Science & Technology*, Vol. 3, pp. 87–96.

[181] Venkateswarlu, K. *et al*. (2016). Abandoned metalliferous mines: ecological impacts and potential approaches for reclamation. *Rev Environ Sci Biotechnol,* Vol. 15, No. 2, pp. 327–354.

[182] Agboola, O. *et al*. (2020). A review on the impact of mining operation: Monitoring, assessment and management. *Results in Engineering*, Vol. 8, No. 100181.

[183] Mwakesi, I., Wahome, R., and Ichang, D. (2020). Mining impact on communities' livelihoods: A case study of Taita Taveta County, Kenya. *AIMS Environmental Science*, Vol. 7, No. 3, pp. 286-301. DOI: 10.3934/environsci.2020018.

[184] Rao, P.M. and Pathak, K. (2007). Socio-economic impacts of mine closure: a case study using satellite imagery. *International Journal of Environmental Studies*, Vol. 62, No. 5, pp. 555-570.

[185] Bainton, N. and Holcombe, S. (2018). A critical review of the social aspects of mine closure. *Resources Policy*, Vol. 59, pp. 468-478.

[186] Sesele, K., Marais, L., and Rooyen, D.V. (2021). Women and mine closure: A case study of policy in South Africa. *Resources Policy*, Vol. 72, No. 102059.

[187] Singh, P.K. and Singh, R.S. (2016). Environmental and Social Impacts of Mining and their Mitigation. *National Seminar ESIMM-2016, Carbon sequestration through revegetated mine wasteland.* Retrieved from: https://www.researchgate.net/publication/308937912.

[188] UNEP. (2002). EIA Training Resource Manual. Topic 13 Social Impact Assessment. Retrieved from: http://unep.ch/etu/publications/eia_2ed/eia_e_top13_body.pdf.

[189] Benckert, A.G. (2000). Remediation of tailings dams *In: Rofer, C.K., Kaasik, T. (Eds.) Turning a problem into a resource: remediation and waste management at the Sillamäe Site, Estonia. Dordrecht: Kluwer Academic Publishers in cooperation with NATO Scientific Affairs Division*, pp. 75-80.

[190] Skousen, J.G., Ziemkiewicz, P.F., and McDonald, L.M. (2019). Acid mine drainage formation, control and treatment: Approaches and strategies. *The Extractive Industries and Society*, vol. 6, no. 1, pp. 241-249.

[191] Howard, A.J. et al. (2016). Assessing riverine threats to heritage assets posed by future climate change through a geomorphological approach and predictive modelling in the Derwent Valley Mills WHS, UK. *Journal of Cultural Heritage*, Vol. 19, pp. 387-394.

[192] Das, S.K., Mahamaya, M., and Reddy, K. R. (2020). Coal mine overburden soft shale as a controlled low strength material. *International Journal of Mining, Reclamation and Environment*, Vol. 34, No. 10, pp. 725-747.

[193] Singh, G. *et al*. (2020). Soil pollution by fluoride in India: distribution, chemistry and analytical methods. *Environmental Concerns and Sustainable Development*, pp. 307-324.

[194] Ebrahimabadi, A. *et al*. (2018). Comparing two methods of PROMETHEE and Fuzzy TOPSIS in selecting the best plant species for the reclamation of Sarcheshmeh copper mine. *Asian journal of water, Environment and Pollution*, Vol. 15, No. 2, pp. 141-152.

[195] Cooke, S.J. and Suski, C.D. (2008). Ecological Restoration and Physiology: an Overdue Integration. *BioScience*, Vol. 58, No. 10, pp. 957–968.

[196] Bradshaw, A.D. (1984). Ecological principles and land reclamation practice. *Landscape Planning*, Vol. 11, No. 1, pp. 35-48.

[197] Bradshaw, A.D. (1996). Underlying principles of restoration. *Can. J. Fish. Aquat. Sci.,* Vol. 53, No. 1, pp. 3–9. Retrieved from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.548.4717&rep=rep1&type=pdf.

[198] Jansen, I.J. and Melsted, S.W. (1988). Land Shaping and Soil Construction. *In: Hossner L.R. (ed.) Reclamation of Surface-Mined Lands. Florida: CRC Press, Inc*, Vol. 1, pp. 125-136. Retrieved from: https://eurekamag.com/research/001/874/001874495.php.

[199] Sengupta, M. (1993). Environmental Impacts of Mining Monitoring, Restoration, and Control. *USA: CRC Press.* Retrieved from: https://www.routledge.com/Environmental-Impacts-of-Mining-Monitoring-Restoration-and-Control/Sengupta/p/book/9780367579890.

[200] Dudley, N. *et al*. (2018). Measuring progress in status of land under forest landscape restoration using

abiotic and biotic indicators. *Soc. Ecol. Restor*. Vol. 26, No. 1, pp. 5–12.

[201] Nilsson, C. *et al*. (2016). Evaluating the process of ecological restoration. *Ecology and Society*, Vol. 21, No. 1, pp. 1–18

Appendix A

Table 9. List of journals and number of articles reviewed for the SLR (Source: author).

Journal	No. of articles reviewed
Acta Montanistica Slovaca	1
Advances in Hospitality and Tourism Research	1
AIMS Environmental Science	1
Annals of Tourism Research	3
Annual Review of Ecology, Evolution, and Systematics	1
Annual Review of Environment and Resources	1
Annual Review of Psychology	1
Applied Soil Ecology	2
Archives of Mining Science	1
Asia Pacific Journal of Tourism Research	1
Asian journal of water, Environment and Pollution	1
Bio-Geotechnologies for Mine Site Rehabilitation	2
Biological Conservation	1
BioScience	1
Biuletyn Państwowego Instytutu Geologicznego	1
Buildings	1
Bulletin of the International Association of Engineering Geology	1
Can. J. Fish. Aquat. Sci.	1
Civil and Environmental Engineering Reports	1
Coal and Peat Fires: A Global Perspective	2
Community Development Journal	1
Computational Intelligence and Neuroscience	1
Current Issues in Tourism	6
Current Opinion in Environmental Sustainability	1
Czech Journal of Tourism	1
Ecological Indicators	2
Ecological Research	2
Ecology and Society	1
Energies	1
Environ Sci Pollut Res	1
Environmental & Socio-economic Studies	1
Environmental Concerns and Sustainable Development	1
Environmental Impact Assessment Review	1
Environmental Management	1
Environmental Reviews	1
Environmental Science and Pollution Research	2
Front. Sustain. Food Syst.	1
Frontiers in Neurorobotics	1
Frontiers In Psychology	3
GeoJournal	1
Geo-spatial Information Science	1

Journal	No. of articles reviewed
Global Environmental Change	1
Habitat International	1
Heritage Science	1
Hydrobiologia	1
IFAC-PapersOnLine	1
Indian Journal of Landscape Systems and Ecological Studies	1
InTech	1
International Journal of Coal Science & Technology	2
International Journal of Environmental Studies	1
International Journal of Geoheritage and Parks	1
International Journal of Heritage Studies	1
International Journal of Hospitality Management	1
International Journal of Mining, Reclamation and Environment	3
International Journal of Scientific and Research Publications	1
International Journal of Soil, Sediment and Water	1
International Journal of Sustainable Development & World Ecology	1
International Journal of Tourism Sciences	1
Journal of Civil Engineering and Architecture	1
Journal of Community Health	1
Journal of Computer Sciences and Applications	1
Journal of Cultural Heritage	1
Journal of Ecological Engineering	1
Journal of Ecology and Environment	1
Journal of Environmental Chemical Engineering	1
Journal of Environmental Management	2
Journal of Environmental Protection	1
Journal of Environmental Sciences and Resources Management	1
Journal of Forest and Livelihood	1
Journal of Forestry and Livelihood	1
Journal of Hospitality and Tourism Management	1
Journal of Hospitality and Tourism Technology	1
Journal of Mining and Environment	2
Journal of Resources and Ecology	1
Journal of Rural Social Sciences	1
Journal of Sustainable Tourism	3
Journal of the American Society of Mining and Reclamation	2
Journal of the Saudi Society of Agricultural Sciences	1
Journal of Tourism Futures	1
Journal of Tourism, Heritage & Services Marketing	1
Journal of Travel Research	2
Journal of Urban Management	1
Journalism	1
Knowledge in Society	1
Land management, cadastre, and land monitoring	1
Land Use Policy	2

Journal	No. of articles reviewed
Landscape and Urban Planning	3
Landscape Planning	1
Mine technology	1
Mine Water and the Environment	2
Mineral resources management (Gospodarka surowcami mineralnymi)	1
Minerals	1
Minerals & Energy - Raw Materials Report	1
Natural Resources Forum	1
New Forests	1
OIDA International Journal of Sustainable Development	1
Physical Therapy & Rehabilitation Journal	1
PLoS One	2
PNAS	1
Procedia Earth and Planetary Science	1
Procedia Environmental Sciences	1
Remote Sensing	1
Renewable Agriculture and Food Systems	1
Resources Policy	3
Results in Engineering	1
Rev Environ Sci Biotechnol	1
SAGE Open	1
Science	1
Scientific Programming	1
Soc. Ecol. Restor	1
Soil and Tillage Research	1
Sustainability	7
Sustainable Development	1
The Extractive Industries and Society	4
The International Journal of Justice and Sustainability	1
The Scientific World Journal	1
Tourism and Hospitality Management	1
Tourism Economics	1
Tourism Geographies	1
Tourism Management	4
Tourism Management Perspectives	2
Wireless Communications & Mobile Computing	1

Appendix B

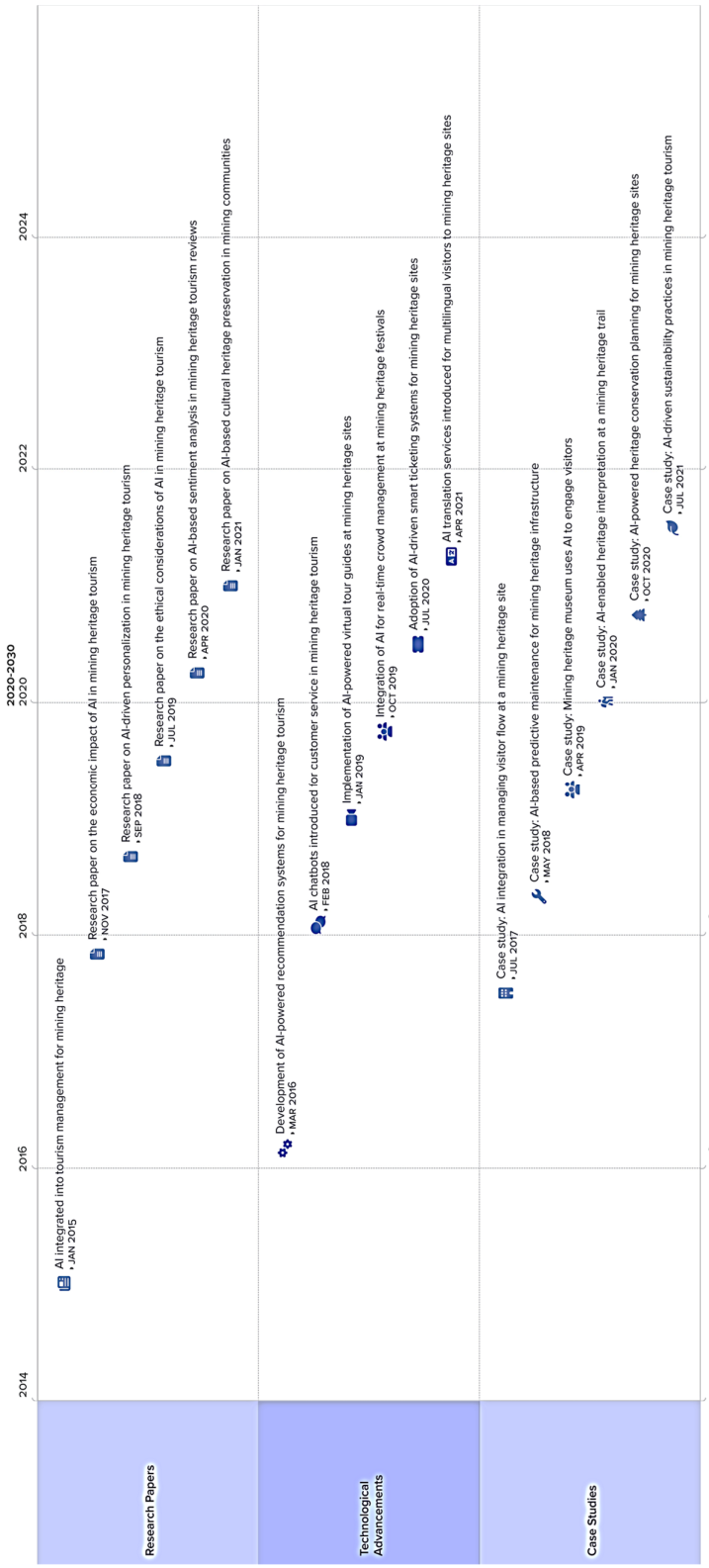

Figure 3. AI generative research paper search on 'tourism management with AI Integration for Mining Heritage' (generated using Preceden.com).

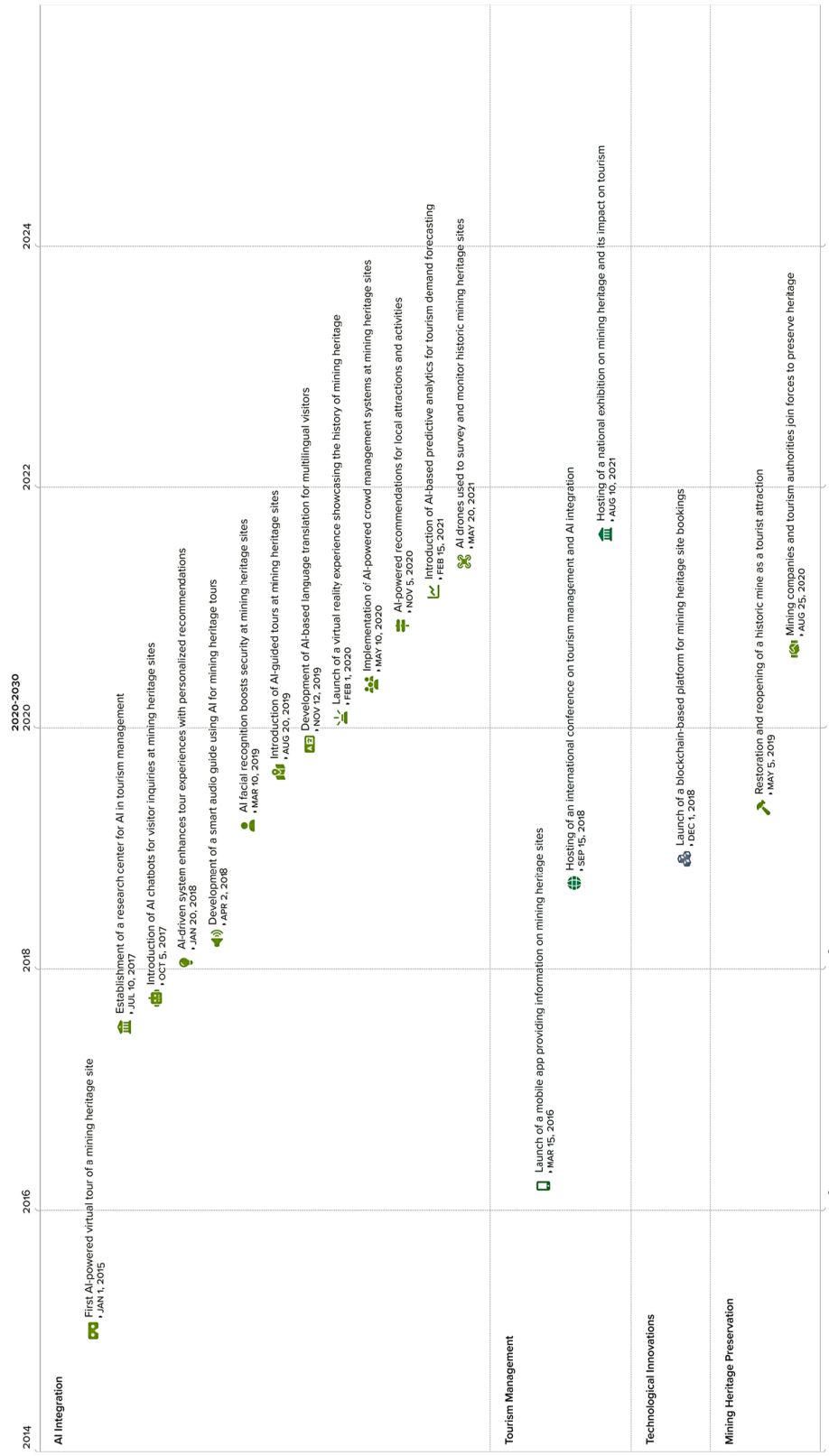

Figure 4. AI generative search on 'tourism management with AI Integration for Mining Heritage' (generated using Preceden.com).

Appendix C

Figure 5. Knowledge map on 'AI-mining heritage tourism' (generated using Openknowledgemaps.org, Source: https://openknowledgemaps.org/map/c3060f60526df6091a42334738567add).

مدیریت گردشگری با ادغام هوش مصنوعی برای میراث معدن: رویکرد بررسی ادبیات

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ارسال ۲۰۲۳/۰۸/۱۸، پذیرش ۲۰۲۳/۰۹/۲۸

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چکیده:

ادغام هوش مصنوعی (AI) در گردشگری میراث، راه‌های جدیدی را برای تغییر تعامل بازدیدکنندگان با مکان‌های تاریخی باز کرده است. این مقاله تحقیقاتی به یک پارادایم جدید می پردازد، با تمرکز بر ادغام هوش مصنوعی در برنامه ریزی و طراحی سایت میراث معدنی بین منطقه‌ای و درون منطقه‌ای. با شناخت چالش‌ها و فرصت‌های منحصربه‌فرد این زمینه، هدف این مطالعه کشف ایده‌ها و تئوری‌های مهم در مورد اینکه چگونه هوش مصنوعی تجربه بازدیدکنندگان را افزایش می‌دهد، حفظ فرهنگی، پایداری و همکاری ذی‌نفعان را ارتقاء می‌دهد. با اذعان به چالش‌ها و فرصت‌های متمایز ارائه شده توسط بافت‌های میراث معدنی بین‌منطقه‌ای و درون منطقه‌ای، این کار تحقیقاتی بر اهمیت حیاتی ایجاد تعادل هماهنگ بین پیشرفت‌های فناوری و حفظ میراث تاریخی و فرهنگی تأکید می‌کند. این مطالعه با استفاده از یک رویکرد بین رشته‌ای، پیامدهای عمیق ادغام هوش مصنوعی در استراتژی‌های برنامه‌ریزی و طراحی سایت‌های میراث معدنی را بررسی می‌کند. این مطالعه ۱۹۹ مقاله در مورد مزایای برنامه‌ریزی و طراحی مبتنی بر هوش مصنوعی را بررسی می کند و مزایای بالقوه را بررسی می‌کند. ملاحظات اخلاقی، سوگیری‌های الگوریتمی، و نقش تحقیقات بین رشته‌ای نیز مورد بررسی قرار می‌گیرند. این مطالعه بر تعامل پیچیده بین تعامل با هوش مصنوعی، شیوه‌های گردشگری مسئولانه و بازنمایی معنادار فرهنگ‌های محلی تاکید می‌کند. این تحقیق با روشن کردن این قلمرو ناشناخته، به توسعه استراتژی‌های آگاهانه کمک می‌کند که از پتانسیل هوش مصنوعی برای شکل‌دهی برنامه‌ریزی و طراحی سایت میراث معدنی بین‌منطقه‌ای و درون‌منطقه‌ای، پرورش تجربیات گردشگری مسئولانه و تأثیرگذار کمک می‌کند. با کاوش در این پارادایم، امیدوار است محققان، سیاست گذاران، دست اندرکاران، و سایر ذی‌نفعان را با اطلاعات و درک مسلح کند که به آنها کمک کند آینده‌ای مترقی و اخلاقی درست کنند، که در آن فناوری به طور مسالمت آمیز با اقدامات برای حفظ فرهنگ همزیستی و گردشگری پایدار کند.

کلمات کلیدی: روش المان محدود، بسته شدن معدن، لرزه خیزی القایی، مطالعات مدلسازی، مدلسازی دینامیکی.