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Geotourism and geomorphological analysis and evaluation of Sarein township based on M GAM model[1]

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Abstract
Background and Objective: The aim of the present study is to analyze and evaluate the geotourism and geomorphological capabilities of Sarein County using the M GAM model. Sarein County is located in the northwest of Iran and in the geographical area of 47 degrees and 48 minutes to 48 degrees and 11 minutes east longitude and 38 degrees and 3 minutes to 38 degrees and 15 minutes north latitude.
Methodology: The present research is of an applied type and its research method is a descriptive survey conducted using a questionnaire. In this study, eight geosites in Sarein County (Verghesaran Suspension Bridge, Viladreh, Alvares Ski Resort, Goldasht Kalkhoran, Gharkenzagh, Ali Darvish Valley, Saridareh Valley, and Imamzadeh Atashgah) were evaluated by providing 20 questionnaires to tourists present in the study areas and also providing 20 written questionnaires to experts and specialists in these geosites and collecting their data. In this study, first some geomorphological landforms were identified and their boundaries were determined using library studies, aerial photographs, satellite images, field surveys and interviews. Then, using the M-GAM model, the tourism potentials of the landforms were examined.
Results and findings: The results of the M-GAM model evaluation showed that, based on the evaluation of experts and visitors to the geotourism area, the Verghesaran Suspension Bridge has the highest core value. In terms of complementary values, the highest score was for the Atashgah Shrine with a score of 91.11, and in total scores, the highest score was for the Atashgah Shrine and the lowest total score was for Villadreh. Also, the M-GAM matrix using the main and complementary values obtained from the analysis shows that the geosites of Goldasht Kalkhoran, Imamzadeh Atashgah, Darreh Saridareh, and Verge Saran Suspension Bridge are located in the Z23 field in terms of main values, and in terms of complementary values, they have a high level of potential for geotourism. The Ali Darvish Valley, Ghar Kanzagh, and Alvares Track geosites also have a medium value for geotourism in terms of primary and complementary value (primary and complementary value Z22), and finally, Viladreh is at a medium level in terms of primary value and at a low level in terms of complementary value for geotourism development.Therefore, it is concluded that there is a lot of room for improving geotourism in these places, and by investing in improving the infrastructure of these geosites and improving planning and promotional activities, these areas can attract many tourists and travelers, which will create jobs and increase the income of local people. Finally, it is suggested that the geotourism and geomorphological potential of Sarein County be analyzed and evaluated based on artificial intelligence and geotourism occurrence models.

Keywords: Geotourism, geomorphological, Sarein, M-GAM model,Sarein township.

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Extended Abstract

Introduction

Geotourism is one of the types of tourism that is recognized within the framework of the modern geological paradigm (Hose, 2016). In the present era; geotourism is not only a geological and geographical category, but also a tourism movement that is mainly focused on phenomena and objects that constitute the Earth's heritage, as well as scientific activities including documentation, evaluation and geographical interpretation of this heritage (with a focus on tourist access) and area management that determine geotourism (Valente et al, 2021; Trempała, 2002). In fact, geotourism is another form of tourism that emphasizes the geological features of the Earth and may have both positive and negative effects on geographical heritage sites (Newsome and Dowling, 2018, 305-321). The term “geotourism” has emerged in recent years and was first coined by Thomas Ahuz, a professor of earth sciences, at the University of Bristol in the United Kingdom in 1995 (Antic & Tomic, 2917; Grover & Mahanta, 2018, 345-360). Geotourism introduces geomorphological and geological phenomena to tourists while preserving their spatial identity. Geotourism utilizes multiple sciences such as geomorphology, geology, and climatology and invites geoscience experts and nature enthusiasts to visit the earth's attractions. In the term geotourism, any place that is visited due to its special geographical conditions, such as environment, vegetation, potential beauty, and cultural features, falls into this category (Robert, 2009: 23).

Methodology

Model M GAM

The present study is of an applied type and its research method is a descriptive survey conducted using a questionnaire. In this study, eight geosites in Sarein County (Vergeh-Saran Suspension Bridge, Vila-Dare, Alvares Track, Goldasht Kalkhoran, Ghar-Kanzagh, Ali-Darvish Valley, Sar-Dare Valley, Imamzadeh Atashgah) were evaluated by presenting 20 questionnaires to tourists present in the study areas and also presenting 20 written questionnaires to experts and specialists familiar with these geosites and collecting their data. In this study, some geomorphological landforms were first identified and their boundaries determined using library studies, aerial photographs, satellite images, field surveys, and interviews. Then, using the M-GAM model, the tourism potentials of the landforms were examined. M-GAM is a physical assessment model of primary geomorphosites for assessing the planning and sustainable management of natural heritage sites and their transformation into tourism destinations. This method consists of two main and complementary values. The main values include scientific and educational values, aesthetic and scenic values, and conservation values, and the complementary values include functional values and tourism values. Each of these values also has sub-criteria. In total, 12 sub-indices in the core values and 15 sub-indices in the supplementary values section are evaluated in terms of importance from zero to one.

Results and Findings

In the present study, eight geotourism areas of Vargehsaran Suspension Bridge, Viladreh, Alvares Ski Resort, Goldasht Kalkhoran, Gharkenzagh, Ali Darvish Valley, Sari Darreh Valley, and Imamzadeh Atashgah were evaluated as tourism geosites in Sarein County using the (M GAM) model. In the first part, based on the M-GAM model, the scores obtained from the experts' opinions were analyzed and examined. Then, considering that the distinguishing feature of the M-GAM model, in addition to paying attention to the opinions of specialists and experts, is the importance and attention to the opinions of visitors and tourists, the importance (Im) of each of the 27 criteria was determined at five levels, from zero to one, according to the opinions of visitors and tourists. And then, based on the multiplication of the importance

(Im) of each criterion from the visitors' point of view by the expert scores, the total sum was obtained in line with the modified M-GAM model, which will result in more accurate results. The main and complementary value and score for the geosites of Sarein County have been provided by experts and visitors. According to the M-GAM relationship, in relation to scientific and educational values, the results indicate that in terms of the rarity index at the regional level, according to experts, the highest score with a value of 0.57 belongs to Imamzadeh Atashgah and the lowest with a value of 0.34 belongs to Ghazkanzq, which shows that this region has the highest number of similar places and Imamzadeh Atashgah has the lowest number of similar places nearby. In terms of representativeness, the Verghesaran Suspension Bridge has the highest score, and the lowest score belongs to the Saridare Valley, which shows that this geosite, unlike the Suspension Bridge, has the least exemplary and informative features in terms of its values and structure. In terms of knowledge about geological issues, the highest score is related to the Verghesaran Suspension Bridge and the lowest score belongs to Viladre.. In terms of interpretability, the highest value is for the Verghesaran Suspension Bridge and the lowest is for the Sari Darreh Valley. In terms of landscape values, in terms of the landscape index, the highest score with a value of 0.89 belongs to the Verghesaran Suspension Bridge, and the lowest value with a value of 0.5 belongs to the Ghar Kanzq Geosite. In terms of geosite surface, the highest value is for the Ali Darreh Valley, and the lowest scores belong to the Ghar Kanzq, Vila Darreh, and the Verghesaran Bridge. The highest value of the surrounding landscape and nature is obtained by the Verghesaran Suspension Bridge and the lowest value is obtained by Goldasht Kalkhouran. Also, the highest and lowest environmental balance scores of the site, with a value of 0.90 and 0.51, belong to Kanzeq Cave and Goldasht Kalkhouran, respectively. In terms of protection in terms of the current status index of the geosite, the highest value with a score of 0.69 belongs to Ali Darvish Valley. The highest level of protection is also given to Imamzadeh Atashgah, and the lowest score belongs to the Verge Saran Suspension Bridge with a value of 0.22. In terms of vulnerability index, the lowest score belongs to the Alvares Ski Resort and the highest score belongs to the Verge Saran Suspension Bridge. The highest number of tourists is accepted by Goldasht Kalkhoran, and the lowest is by the Alvares Ski Resort.

Now, according to the research findings, we will proceed to rank the geosites of Sarein County based on the main and complementary value scores in the M-GAM model, and the highest main value in the M-GAM model is related to the Verghesaran Suspension Bridge. In terms of complementary values, the highest score was for Imamzadeh Atashgah with a score of 91.11. In terms of total scores, the highest score was for Imamzadeh Atashgah and the lowest total score was for Viladreh. The M-GAM matrix using the main and complementary values obtained from the analysis shows that the geosites of Goldasht Kalkhoran, Imamzadeh Atashgah, Saridare Valley, and Verge Saran Suspension Bridge have medium potential for geotourism in terms of main values (main value Z23) and have high potential for geotourism in terms of complementary values (complementary value Z23). The Ali Darvish Valley, Ghar Kanzagh, and Alvares Track geosites also have a medium value for geotourism in terms of primary and complementary value (primary and complementary value Z22), and finally, Viladreh is at a medium level in terms of primary value and at a low level in terms of complementary value for geotourism development.

Conclusion

The geotourism and tourism development program is a solution for economic development and income generation. The results and analysis showed that almost all geomorphosites are suitable for geotourism, which can have positive feedback for the development of a geotourism strategy in the studied areas and the growth of the local economy. The present study has investigated the analysis and geotourism and geomorphological feasibility of Sarein

County based on the M GAM model. In fact, this part of the research results and findings was able to provide a comprehensive analysis of all geosites in this region and was also effective in filling the theoretical gap in this field. According to the results in the M-GAM model, the highest main value is for the Verghesaran suspension bridge. In terms of complementary values, the highest score is for the Atashgah Shrine with a score of 91.11, and in terms of total scores, the highest score is for the Atashgah Shrine and the lowest total score is for Viladreh. Also, the M-GAM matrix using the main and complementary values obtained from the analysis shows that the geosites of Goldasht Kalkhoran, Imamzadeh Atashgah, Darreh Saridareh, and Verge Saran Suspension Bridge are located in the Z23 field in terms of main values, and in terms of complementary values, they have a high level of potential for geotourism. The Ali Darvish Valley, Ghar Kanzagh, and Alvares Track geosites also have a medium value for geotourism in terms of primary and complementary value (primary and complementary value Z22), and finally, Viladreh is at a medium level in terms of primary value and at a low level in terms of complementary value for geotourism development.

Declarations

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•**Conflict of Interest:** The authors declare no conflict of interest.

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References

Adolfo Quesada, R. Lidia Torres, B. Maynor, A. Manuel Rodríguez, M. Gema Velázquez, E. Catalina Espinosa, V. Jaime, T. Hugo Rodríguez, B. 2021. Geodiversity, Geoconservation, And Geotourism In Central America. 11(1), 48; Pp 1- 16.

Akbari, M., Bustan Ahmadi, V., Ansari, M., Sohrabi, V., (2022), Measuring the position of Islamic countries in terms of global competitiveness indicators of travel and tourism using the MABAC technique, Quarterly Journal of Regional Planning, Volume 12, Issue 45, pp. 1-18. https://jzpm.marvdasht.iau.ir/article_4302.html**[In Persian]**.

Aydin, G. and Karamehmet, B. (2017), Factors affecting health tourism and international health-care facility choice, International Journal of Pharmaceutical and Healthcare Marketing, Vol.11 No. 1, pp.16-36.

Büyüközkan, G, Mukul, E, Kongar, E. (2020), Health tourism strategy selection via SWOT analysis and integrated hesitant fuzzy linguistic AHP-MABAC approach, Socio-Economic Planning Sciences, 107-120.

Carrion ,M ., Mero , P., Salamea ,I., Carballo ,F., Aguilar, M., Ruiz , K. and Berrezueta , E.(2021). A Mineralogical Muesum as a Geotourism Attraction: A Case Study , Minerals

Chen, Anze, Lu, Yunting, C. Y. Ng Young. 2014. The Principle of Geotourism Science. Springer.

Dawling, Ross., Newsome, David. 2018. Handbook of geotourism. Edward Elgar Publishing.

Dezilia,D, Harnani,H (2023).Geotourism Assessment Using The M- Gam Method (Modified Deosite Assessment Model) Sawahlunto Region, West Sumatra,Journal of earth and marine technology ,Vol 4, No 1

Dowling, R.K. 2015. Geopark. In C. Cater, B. Garrod and T. Low (eds) The Encyclopedia of Sustainable Tourism (pp. 230–231). Oxford: CABI.

Ebrahimpour, H., Nemati, V., Nezafat Takleh, B. (2023). Identifying the geotourism potential of Sarein County using the National Park Model and the Hadzik Model. Geography and Human Relations, 5(3), 161-183. doi: 10.22034/gahr.2023.381439.1795**[In Persian]**.

Esfandiari Darabad, F., Nezafat Takleh, B. (2025). 6. Geotourism and geomorphological potential assessment of protected areas in Meshkinshahr County using quantitative models. Quarterly Journal of Sustainable Urban and Regional Development Studies, 6(3), 78-85. https://www.srds.ir/article_216380.html**[In Persian]**.

Esfandiari Darabad, F., Nezafat Takleh, B., Shahbazi Shorfeh, Z. (2022), Investigation and evaluation of the impact of risks on tourism development (case study of Meshkinshahr city), Geography and Human Relations, Volume 5, Issue 3. https://www.gahr.ir/article_166434.html**[In Persian]**.

Esfandiari Darabad, F., Nezafat Takleh, B., Shahbazi Shorfeh, Z., Nemati, V. (2023). Evaluation of geotourism and geomorphological capabilities of Sarein County using Kobalikwa and Feyolt models. Environmental Science Studies, 8(4), 7644-7658. doi: 10.22034/jess.2022.371296.1914**[In Persian]**.

Fakhari, S. (2014), Geomorphological Modeling for Sustainable Development (Case Study: Proposed Geoparks of Damavand Region), PhD Thesis, Supervisor, Ezzatollah Qanavati, Kharazmi University. https://elmnet.ir/doc/10839138-1761**[In Persian]**.

Gricelda Herrera, F. Karla, E. Carlos Mora, F. Paúl Carrión, M. Edgar, B (2021). Evaluation of a Paleontological Museum as Geosite and Base for Geotourism. 1208–1227.

Hashemi Dizaj, A. (2014). Investigating the extent and impact of competitiveness and geotourism capabilities on the economy of Ardabil province using the Comansco, Hadzik and Pavlova models (case study: the cities of Sarein, Meshginshahr, Hir). Environmental Sciences Studies, 7(4), 5624-5639. doi: 10.22034/jess.2022.345030.1798. **[In Persian]**.

Hose, T.A. (2016). (Ed.) Introduction: Geoheritage and geotourism. In Geoheritage and Geotourism. A European Perspective; The Heritage Matters Series 19; Boydell Press: Woodbridge, UK, 2016; pp. 1–13. https://doi.org/9781783271474

Jahan Tighmand, S., Karam, A., Qanavati, A. (2022), Explaining the potential and tourism management of geosites based on the assessment of land diversity areas (Case study: Tangeh Vashi tourism area in Firouzkouh city), Applied Research in Geographic Sciences, No. 65, pp. 312-332. https://jgs.khu.ac.ir/browse.php?a_id=2758&sid=1&slc_lang=fa**[In Persian]**.

Lai LS, To WM.(2015), Content analysis of social media: A grounded theory approach. Journal of Electronic Commerce Research16, 125-138

Letunovska, N., Kwilinski, A., & Kaminska, B. (2020). Scientific Research In The Health Tourism Market: A Systematic Literature Review. Health Economics and Management Review. 1.8-19.

Mahato, M. K., & Jana, N. C. (2021). Exploring the potential for development of Geotourism in Rarh Bengal, Eastern India using M-GAM. International Journal of Geoheritage and Parks, 9(3): 313-322.

Moghimi, A., Zare Ahmadabad, M., Mokhtari, D. (2014), Evaluating the potential of geomorphological forms resulting from the activity of the Tabriz fault in the development of geotourism using the Paniza method, Urban and Regional Policy, Volume 1, Issue 1, pp. 1-13. https://sanad.iau.ir/Journal/pur/Article/927356/FullText**[In Persian]**.

Mukhtari, D. (2015), The importance of topographic maps in the management of geomorphic sites in Iran, (Case study: Payam Pass), Scientific and Research Journal of Geography and Planning, Year 16, Issue 37, pp. 151-172. https://journals.tabrizu.ac.ir/article_558.html**[In Persian]**.

Nazafat Takleh, B., Esfandiari Darabad, F., Karam, A., Obidi Hamelabad, S. (2014). 10. Geotourism and geomorphological capabilities in tourist villages of Ardabil province. Quarterly Journal of Sustainable Urban and Regional Development Studies, 5(3), 151-172. https://www.srds.ir/article_211308.html. **[In Persian]**.

Nilashia,b., Sarminah. S, Abdul Manafd. A, Ahmadie. H, A. Rashidf. T,. (2019). Factors influencing medical tourism adoption in Malaysia: A DEMATELFuzzy TOPSIS approach, Computers & Industrial Engineering 137, 53-67.

Rafael Altoe, A. Kátia Leite, M. Wellington Francisco, S. 2022. New Approach on the Quantitative Assessment of Geotouristic Potential: A Case Study in the Northern Area of the Rio De Janeiro Cliffs and Lagoons Geopark Project.

Rahimi, M., Henry, F., Rumiani, A., (2022), Planning and foresight of sustainable tourism development in Khuzestan province, Quarterly Journal of Regional Planning, Volume 12, No. 45, pp. 51-66. https://jzpm.marvdasht.iau.ir/article_4247.html**[In Persian]**.

Robert, B (2009). Geotourism Ambassadors: Blackstone Valley Story: Billington Blackstone Valley Tourism Council Sustainable Tourism Planning Laboratory Rhode Island.

Rosta, A., (2014), Explaining the effects of tourist experience and motivation in urban areas on tourist satisfaction and loyalty (case study: Kish and Qeshm tourist areas), Quarterly Journal of Regional Planning, Volume 12, Issue 45, pp. 228-211. https://jzpm.marvdasht.iau.ir/article_5299.html**[In Persian]**.

Sasanian, A., Nemati, V., Nezafat Takleh, B. (2002). Evaluating the geomorphological and geotourism potentials of Astara city using Hadzik and Feoult models. Geography and Human Relations, 6(3), 768-785. doi: 10.22034/gahr.2023.409888.1920**[In Persian]**.

Taherkhani, M., Jahan Tighmand, S., Salimi Sobhan, M. R. (2019), Prioritizing Geo-Tourism Potentials of Geosites (Case Study: Alamut Qazvin), Geography (Quarterly Scientific-Research and International Journal of the Geographical Society of Iran), Year 18, Issue 64, 106-119. https://mag.iga.ir/article_245851_62eef55197f3aeddcae43e033db26ab6.pdf**[In Persian]**.

Trempała, E. (2002). Czym jest nieformalna edukacja. In Edukacja w Dialogu i Reformie; Karpińska, A., Ed.; Trans Humana: Białystok, Poland, 2002.

Zand Moghadam, M. R. (2009), Investigating the potential of the desert plain as a geopark of central Iran and its role in the sustainable development of Semnan province, Geographical Journal of Environmental Planning, Year 2, Issue 6, pp. 1-20. https://ensani.ir/fa/article/246261**[In Persian]**.

Zand Moghadam, M. R., Tousinejad, N., (2014), Evaluation and development of urban tourism with a sustainable development approach (case study: Region 11 of Tehran), Quarterly Journal of Geography and Urban Planning, Zagros Landscape, Volume 14, Issue 52, pp. 169-147. https://journals.iau.ir/article_693061.html**[In Persian]**.