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SUSTAINABILITY IN HAJJ AND UMRAH MANAGEMENT: EXPLORING ECO-FRIENDLY PRACTICES AND STRATEGIES

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ABSTRAK

Penelitian ini mengeksplorasi praktik *sustainability* saat ini dalam pengelolaan haji dan umrah serta mengidentifikasi strategi dan inisiatif ramah lingkungan yang potensial untuk mengurangi jejak lingkungan dari *event* ini. Melalui tinjauan literatur yang komprehensif, penelitian ini menilai dampak lingkungan dari haji dan umrah, dengan berfokus pada pengelolaan limbah, konservasi air, dan konsumsi energi. Penelitian ini juga mengkaji inisiatif keberlanjutan yang ada yang dilaksanakan oleh pemerintah Arab Saudi dan pemangku kepentingan lainnya, serta mengevaluasi efektivitasnya. Metodologi tinjauan literatur sistematis mencakup penentuan pertanyaan penelitian, identifikasi sumber yang relevan, analisis dan sintesis literatur, identifikasi kesenjangan dan peluang, penarikan kesimpulan, serta pembuatan rekomendasi. Temuan penelitian ini berkontribusi pada perkembangan pengetahuan tentang manajemen haji dan umrah yang *sustainable* dan memberikan wawasan berharga bagi para pemangku kepentingan yang terlibat dalam perencanaan dan pelaksanaan haji dan umrah, dengan tujuan untuk mengurangi dampak lingkungan

Kata Kunci : haji;keberlanjutan;lingkungan;manajemen;;umrah

ABSTRACT

This research explores the current sustainability practices in Hajj and Umrah management and identifies potential strategies and eco-friendly initiatives to reduce the environmental footprint of these large-scale religious events. hrough a comprehensive literature review, this study assesses the environmental impact of Hajj and Umrah, focusing on waste management, water conservation, and energy consumption. It also examines existing sustainability initiatives implemented by the Saudi government and other stakeholders and evaluates their effectiveness. The systematic literature review methodology includes determining research questions, identifying relevant sources, analyzing and synthesizing the literature, identifying gaps and opportunities, drawing conclusions, and making recommendations. The findings of this research contribute to the development of knowledge about sustainable Hajj and Umrah management and provide valuable insights for

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stakeholders involved in the planning and implementation of Hajj and Umrah, with the aim of reducing environmental impact

Keywords : *environment;hajj;management;sustainability;umrah*

INTRODUCTION

The Hajj and Umrah pilgrimages are among the largest religious gatherings in the world, attracting millions of Muslims every year to the holy city of Mecca in Saudi Arabia. In 2019, around 2.5 million pilgrims participated in the Hajj, while Umrah attracts around 7 million pilgrims annually (Saudi Gazette, 2020). The scale of these events poses significant challenges in terms of environmental sustainability, as the massive influx of people leads to increased resource consumption, waste generation, and carbon emissions (Alsebaei, 2014).

The environmental impact of Hajj and Umrah has been a growing concern for both the Saudi Arabian government and the global Muslim community. The Saudi General Authority for Statistics reported that during the 2019 Hajj season, pilgrims generated around 2,485 tons of solid waste per day (Saudi Gazette, 2020). Additionally, the transportation sector, which includes flights and ground transportation for pilgrims, is a significant contributor to greenhouse gas emissions (Al-Mulali et al., 2015).

Recognizing the need for sustainable practices, the Saudi government has launched various initiatives to mitigate the environmental impact of Hajj and Umrah. The Kingdom's Vision 2030 plan includes a focus on sustainable development, with the aim of reducing the ecological footprint of these religious events (Vision 2030, n.d.). In 2018, the Ministry of Hajj and Umrah introduced the "Green Hajj" program, which promotes eco-friendly practices such as the use of recyclable materials, energy-efficient transportation, and proper waste management (Saudi Gazette, 2018).

Despite these efforts, there is still a need for further research and implementation of sustainable strategies in Hajj and Umrah management. A study by Alabdulkarim et al. (2018) highlighted the importance of incorporating sustainability principles into the planning and execution of these events, emphasizing the need for collaboration among stakeholders, including government agencies, religious organizations, and the private sector.

One key area for improvement is waste management. A survey conducted by Alsebaei (2014) found that around 60% of pilgrims lacked awareness about proper waste disposal practices during Hajj. Implementing effective waste

segregation systems, promoting the use of biodegradable materials, and educating pilgrims on responsible waste management can significantly reduce the environmental impact of these events (Alsebaei, 2014; Alnuaim, 2018).

Water conservation is another critical aspect of sustainability in Hajj and Umrah management. The holy sites of Mecca and Medina are located in a desert region with limited water resources, and the high demand for water during the pilgrimages puts additional strain on these resources (Obaid et al., 2017). Implementing water-efficient technologies, such as low-flow toilets and showerheads, and promoting responsible water usage among pilgrims can help conserve this precious resource (Alnuaim, 2018).

Energy efficiency is also crucial for reducing the carbon footprint of Hajj and Umrah. The use of renewable energy sources, such as solar power, can help minimize the reliance on fossil fuels and reduce greenhouse gas emissions (Al-Mulali et al., 2015). In 2014, the Saudi government launched a project to install solar panels at the holy sites of Mecca and Medina, with the aim of generating 100 megawatts of electricity (Rashad, 2014). Expanding such initiatives and promoting energy-efficient practices in accommodation and transportation can contribute to a more sustainable Hajj and Umrah experience.

Transportation is another significant contributor to the environmental impact of these pilgrimages. The large number of pilgrims traveling to and within the holy sites leads to traffic congestion and increased air pollution (Ameen & Mourshed, 2017). Encouraging the use of public transportation, implementing eco-friendly vehicles, and optimizing traffic management systems can help reduce the carbon footprint of transportation during Hajj and Umrah (Al-Mulali et al., 2015).

Accommodation facilities for pilgrims also present opportunities for sustainable practices. Implementing green building design principles, such as using energy-efficient appliances, incorporating natural ventilation, and utilizing sustainable construction materials, can minimize the environmental impact of these facilities (Alnuaim, 2018). Additionally, promoting responsible resource consumption among pilgrims, such as reducing food waste and conserving electricity, can contribute to a more sustainable Hajj and Umrah experience (Alsebaei, 2014).

To effectively implement sustainable practices in Hajj and Umrah management, it is essential to raise awareness and educate pilgrims about their role in reducing the environmental footprint of these events. A study by Almuhrzi and Alsawafi (2017) found that environmental awareness among pilgrims was relatively low, highlighting the need for educational campaigns

and initiatives to promote eco-friendly behaviors. Engaging religious leaders, community organizations, and media outlets in spreading awareness about sustainability can help foster a sense of shared responsibility among pilgrims (Alabdulkarim et al., 2018).

The purpose of this research is to explore and analyze the current sustainability practices in Hajj and Umrah management and to identify potential strategies and eco-friendly initiatives that can help reduce the environmental footprint of these large-scale religious events. The study aims to assess the current environmental impact of Hajj and Umrah, focusing on waste management, water conservation, and energy consumption; identify existing sustainability practices and initiatives implemented by the Saudi government and other stakeholders in Hajj and Umrah management and evaluate their effectiveness; and propose innovative and feasible strategies to enhance sustainability in Hajj and Umrah management, considering the unique challenges and cultural context of these events.

Given the limitations and inability to conduct field research, the study will rely on a comprehensive literature review as the primary research methodology. The literature review will be conducted in a systematic manner, beginning with defining the research questions, which will be guided by the research purpose and the specific objectives outlined above. This will be followed by identifying relevant sources through a thorough search for relevant scholarly articles, government reports, case studies, and other credible sources related to sustainability in Hajj and Umrah management, using databases such as Scopus, Web of Science, Google Scholar, and Saudi government websites.

By following this systematic literature review methodology, the research will provide a comprehensive overview of the current knowledge and practices related to sustainability in Hajj and Umrah management, identify gaps and opportunities for improvement, and propose evidence-based recommendations for reducing the environmental impact of these significant religious events. The findings of this study will contribute to the growing body of knowledge on sustainable event management in the context of religious tourism and provide valuable insights for stakeholders involved in the planning and execution of Hajj and Umrah.

In conclusion, sustainability in Hajj and Umrah management is a complex and multifaceted issue that requires the collaboration of various stakeholders, including government agencies, religious organizations, the private sector, and the pilgrims themselves. Implementing eco-friendly practices and strategies in waste management, water conservation, energy

efficiency, transportation, and accommodation can significantly reduce the environmental footprint of these events. Moreover, raising awareness and educating pilgrims about sustainable behaviors is crucial for fostering a sense of shared responsibility and ensuring the long-term sustainability of Hajj and Umrah. As the global Muslim community continues to grow, it is imperative that we address the environmental challenges associated with these pilgrimages and work towards a more sustainable future for generations to come).

THEORETICAL BASIS

Sustainability in event management has gained significant attention in recent years, as the environmental impact of large-scale events has become increasingly apparent. The concept of sustainability is rooted in the Brundtland Commission's definition, which describes sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, p. 43). In the context of event management, sustainability involves minimizing the negative environmental, social, and economic impacts of events while maximizing the positive outcomes for all stakeholders (Getz, 2009).

The theoretical framework for this research draws upon several key concepts and theories related to sustainability, event management, and religious tourism. The Triple Bottom Line (TBL) approach, introduced by Elkington (1997), provides a foundation for understanding sustainability in event management. The TBL framework emphasizes the importance of balancing economic, social, and environmental considerations in decision-making processes. In the context of Hajj and Umrah, this means considering not only the financial viability of the events but also their impact on the local community and the environment.

The Stakeholder Theory, developed by Freeman (1984), is another relevant concept in sustainable event management. This theory emphasizes the importance of considering the needs and interests of all stakeholders, including event organizers, participants, local communities, and the environment. In the case of Hajj and Umrah, stakeholders include the Saudi government, religious authorities, pilgrims, local businesses, and the global Muslim community. Effective sustainability strategies must take into account the diverse perspectives and needs of these stakeholders (Almuhrzi & Alsawafi, 2017).

The Circular Economy (CE) model has also gained traction in recent years as a framework for sustainable event management. The CE model aims to minimize waste and optimize resource use by designing out waste and

pollution, keeping products and materials in use, and regenerating natural systems (Ellen MacArthur Foundation, 2017). In the context of Hajj and Umrah, this could involve implementing closed-loop waste management systems, promoting the use of renewable energy sources, and encouraging the use of recyclable and biodegradable materials (Alsebaei, 2014).

Previous research on sustainability in Hajj and Umrah management has identified several key challenges and opportunities for improvement. A study by Alabdulkarim et al. (2018) highlighted the need for a comprehensive sustainability framework that integrates environmental, social, and economic considerations into the planning and execution of these events. The authors emphasized the importance of collaboration among stakeholders and the development of clear sustainability goals and metrics.

Water conservation has been identified as a critical issue in Hajj and Umrah management, given the limited water resources in the region. A study by Obaid et al. (2017) explored the potential for using treated wastewater for non-potable purposes during the pilgrimages, such as landscaping and cleaning. The authors found that using treated wastewater could significantly reduce the demand for fresh water and contribute to a more sustainable Hajj and Umrah.

Waste management is another significant challenge in Hajj and Umrah, given the large amounts of solid waste generated by pilgrims. A study by Alsebaei (2014) investigated the current waste management practices during Hajj and identified opportunities for improvement, such as implementing waste segregation systems and promoting the use of biodegradable materials. The author also highlighted the importance of educating pilgrims about proper waste disposal practices.

Energy consumption is a key contributor to the environmental impact of Hajj and Umrah. A study by Fayek (2021) explored the potential for using renewable energy sources, such as solar and wind power, to meet the energy needs of the pilgrimages. The author found that integrating renewable energy into the power grid could significantly reduce greenhouse gas emissions and contribute to a more sustainable Hajj and Umrah.

Transportation is another area where sustainability improvements can be made. A study by AlQahtany and Alkhalidi (2021) investigated the feasibility of using electric and hybrid vehicles for transportation during Hajj and Umrah. The authors found that using eco-friendly vehicles could reduce air pollution and greenhouse gas emissions while also improving the overall experience for pilgrims.

The importance of environmental education and awareness among pilgrims has also been highlighted in previous research. A study by Almuzaini et al. (2021) explored the potential for using social media and mobile apps to promote sustainable behaviors among pilgrims during Hajj and Umrah. The authors found that providing pilgrims with real-time information and guidance on sustainable practices could significantly reduce the environmental impact of the events.

In conclusion, the theoretical framework for this research draws upon key concepts and theories related to sustainability, event management, and religious tourism, including the Triple Bottom Line approach, Stakeholder Theory, and the Circular Economy model. Previous research on sustainability in Hajj and Umrah management has identified several challenges and opportunities for improvement, including water conservation, waste management, energy consumption, transportation, and environmental education. By building upon this existing knowledge and applying relevant theories and frameworks, this research aims to contribute to the development of comprehensive and effective sustainability strategies for Hajj and Umrah management.

RESULT AND DISCUSSION

The literature review conducted for this research has yielded several significant findings related to sustainability in Hajj and Umrah management. These findings are organized into themes, including the current environmental impact of the events, existing sustainability initiatives, and potential strategies for improvement.

Current Environmental Impact

The literature highlights the substantial environmental impact of Hajj and Umrah, particularly in terms of waste generation, water consumption, and energy use. The Saudi General Authority for Statistics reported that during the 2019 Hajj season, pilgrims generated around 2,485 tons of solid waste per day (Saudi Gazette, 2020). This high level of waste generation puts a strain on local waste management systems and contributes to environmental degradation. A study by Alsebaei (2014) found that the majority of this waste is composed of food waste, plastic bottles, and other recyclable materials, indicating a significant opportunity for waste reduction and recycling initiatives.

The waste generated during Hajj and Umrah is substantial, posing a significant environmental challenge. As previously noted, Mecca generates approximately 600 tons of waste per day during the Hajj season, much of which

consists of plastic and food waste (Al-Khatib et al., 2014). This volume of waste overwhelms the local waste management infrastructure, leading to improper disposal and increased environmental pollution.

Research by Abubakar (2018) highlights that a significant portion of the waste generated during Hajj includes single-use plastics, such as water bottles, food packaging, and disposable utensils. These items contribute to the growing problem of plastic pollution, which has long-term environmental consequences, including harm to wildlife and ecosystems.

Water consumption is another major concern during Hajj and Umrah, as the events take place in a region with limited water resources. A study by Obaid et al. (2017) estimated that during the Hajj season, water demand increases by 30% in Mecca and Medina, putting additional strain on the already scarce water supply. The authors found that the main sources of water consumption during Hajj are ablution, drinking, and domestic use, highlighting the need for water conservation measures and awareness campaigns.

The average pilgrim consumes around 20 liters of water per day, resulting in millions of liters being used daily during peak periods (Khatib et al., 2014). This extensive use of water strains local resources, especially in arid regions like Saudi Arabia where water scarcity is a persistent issue.

The high demand for water is driven by the need for drinking, hygiene, and ritual purification. The availability of Zamzam water, a sacred resource for Muslims, further complicates water management, as it must be sustainably sourced and distributed to meet the needs of pilgrims while preserving its sanctity.

Energy consumption during Hajj and Umrah is also a significant contributor to the environmental impact of the events. A study by Fayek (2021) found that the energy demand during Hajj increases by approximately 50% compared to the rest of the year, with air conditioning and lighting being the main sources of energy consumption. The author also noted that the majority of this energy is generated from fossil fuels, contributing to greenhouse gas emissions and air pollution.

The transportation sector, which includes flights and ground transportation for pilgrims, is another major contributor to the environmental impact of Hajj and Umrah. A study by Al-Mulali et al. (2015) found that the transportation sector accounts for a significant portion of the carbon footprint associated with these events, with air travel being the largest contributor. The authors estimated that the carbon footprint of Hajj travel alone is equivalent to

the annual emissions of a small country.

The carbon footprint associated with Hajj and Umrah is substantial, primarily due to the transportation of millions of pilgrims. Air travel is the main contributor, with flights to Saudi Arabia generating significant greenhouse gas emissions (Gössling et al., 2012). Additionally, the extensive use of buses and other vehicles within Mecca and Medina adds to the overall carbon footprint. Research by Al-Saud (2019) indicates that the annual carbon emissions from Hajj-related activities are equivalent to the emissions of a small country. This level of emissions has a considerable impact on global climate change, underscoring the need for sustainable transportation solutions.

Existing Sustainability Initiatives

The literature review also identified several existing sustainability initiatives implemented by the Saudi government and other stakeholders in Hajj and Umrah management. The Saudi Vision 2030 plan, launched in 2016, includes a focus on sustainable development and aims to reduce the environmental footprint of Hajj and Umrah (Vision 2030, n.d.). As part of this plan, the government has implemented various initiatives to promote sustainability, such as the "Green Hajj" program, which encourages the use of recyclable materials, energy-efficient transportation, and proper waste management (Saudi Gazette, 2018).

Several eco-friendly waste management practices have been introduced in Hajj and Umrah management, albeit with varying degrees of success. The "Green Hajj" initiative by the Saudi government aims to reduce waste and promote recycling among pilgrims (Ghazali, 2018). This initiative includes the distribution of reusable water bottles, the installation of recycling bins, and public awareness campaigns on waste reduction.

A study by Ali et al. (2015) found that these measures have led to a modest reduction in waste generation, but challenges remain. The primary obstacles include the lack of participation and awareness among pilgrims, as well as logistical issues in waste collection and processing.

Water conservation efforts during Hajj and Umrah include the use of water-efficient fixtures in accommodation facilities and the implementation of greywater recycling systems. The use of Zamzam water is regulated to ensure sustainable extraction and distribution.

Research by Al-Zahrani et al. (2016) highlights the effectiveness of these measures in reducing water consumption. However, the study also notes that further improvements are needed, particularly in educating pilgrims about

water conservation practices and optimizing the efficiency of water-saving technologies.

One notable initiative is the use of solar energy to power the iconic Al-Shae'r Mosque in Mina, which accommodates up to 1.5 million worshippers during Hajj (Alamoudi, 2021). The mosque is equipped with over 1,000 solar panels, which generate enough electricity to power the mosque's lighting and air conditioning systems, reducing its reliance on fossil fuels and minimizing its carbon footprint.

The use of renewable energy sources, such as solar power, is being increasingly adopted in Mecca and Medina. Solar panels have been installed on the rooftops of several buildings, and there are plans to expand this initiative to more locations.

According to Al-Saud (2019), the use of solar energy has significantly reduced the reliance on fossil fuels, contributing to lower greenhouse gas emissions. Additionally, energy-efficient lighting and cooling systems have been implemented in various facilities, further enhancing energy conservation.

Efforts to improve transportation sustainability during Hajj and Umrah include the expansion of public transportation networks, such as the Mecca Metro, and the promotion of electric and hybrid vehicles. These measures aim to reduce traffic congestion and emissions within the holy cities.

A study by Al-Hasanat (2016) found that the introduction of the Mecca Metro has significantly reduced the number of private vehicles on the roads, leading to lower emissions and improved air quality. However, the study also notes that additional measures are needed to further enhance the efficiency and capacity of public transportation.

Green building practices have been integrated into the construction of new facilities in Mecca and Medina. These practices include the use of sustainable materials, energy-efficient designs, and waste minimization during construction.

Research by Al-Mutairi et al. (2017) indicates that green building practices have led to significant energy savings and reduced environmental impacts. The study emphasizes the importance of adopting green building standards in all new construction projects to ensure long-term sustainability.

Another initiative is the "Hajj Hackathon," an annual event that brings together developers, designers, and entrepreneurs to create innovative solutions for sustainable Hajj and Umrah management (Saudi Gazette, 2019). The event

has resulted in the development of several promising technologies, such as a smart waste management system that uses sensors and data analytics to optimize waste collection and recycling, and a mobile app that provides pilgrims with real-time information on water consumption and conservation tips.

The Saudi government has also implemented a number of regulations and standards to promote sustainable construction and infrastructure development for Hajj and Umrah facilities. For example, the Saudi Building Code (SBC) includes provisions for energy efficiency, water conservation, and waste management in the design and construction of buildings (Almazroui et al., 2021). The Ministry of Hajj and Umrah has also issued guidelines for the sustainable design and operation of pilgrim accommodations, including requirements for energy-efficient appliances, water-saving fixtures, and waste recycling facilities (Ministry of Hajj and Umrah, 2021).

Despite these initiatives, the literature suggests that there is still significant room for improvement in terms of sustainability in Hajj and Umrah management. A study by Alabdulkarim et al. (2018) found that while there are several sustainability initiatives in place, there is a lack of coordination and integration among stakeholders, leading to fragmented and ineffective efforts. The authors emphasized the need for a comprehensive sustainability framework that engages all relevant stakeholders and sets clear goals and metrics for success.

Potential Strategies for Improvement

The literature review identified several potential strategies for improving sustainability in Hajj and Umrah management. One key strategy is the implementation of a circular economy model, which aims to minimize waste and optimize resource use. A study by Alkhuzaim (2021) explored the potential for implementing a circular economy model in Hajj and Umrah waste management, focusing on the design and implementation of a sustainable waste management system that prioritizes waste reduction, reuse, and recycling. The author proposed a framework for integrating circular economy principles into the planning and operation of waste management facilities, including the use of advanced technologies such as waste-to-energy conversion and anaerobic digestion.

A comprehensive waste management system that includes waste minimization, segregation, recycling, and composting is essential to reduce the environmental impact of Hajj and Umrah. This system should be supported by robust public awareness campaigns to educate pilgrims about proper waste

disposal practices.

Ali et al. (2015) suggest that the introduction of biodegradable and compostable materials can further enhance waste management efforts. Additionally, collaborating with local waste management authorities and private sector partners can improve the efficiency of waste collection and processing.

To further reduce water consumption, the implementation of advanced water-saving technologies and practices is necessary. These include the use of smart water management systems that monitor and optimize water usage in real-time.

Al-Zahrani et al. (2016) recommend the integration of water-efficient fixtures with advanced sensors that reduce water flow based on usage patterns. Furthermore, expanding greywater recycling systems and promoting the use of alternative water sources, such as treated wastewater for non-potable uses, can significantly reduce the demand for fresh water.

Expanding the use of renewable energy sources, particularly solar power, is crucial to reducing the carbon footprint of Hajj and Umrah. This includes the installation of solar panels on a larger scale and the integration of renewable energy systems in new and existing facilities.

Al-Saud (2019) highlights the potential for further expansion of solar energy use, including the deployment of solar-powered streetlights and public transportation vehicles. Additionally, exploring other renewable energy sources, such as wind and geothermal energy, can diversify the energy mix and enhance sustainability.

Another potential strategy is the use of smart technologies to promote sustainability. A study by Khan et al. (2021) investigated the potential for using the Internet of Things (IoT) and big data analytics to optimize resource use and reduce waste during Hajj and Umrah. The authors proposed a framework for integrating smart sensors, data analytics, and decision support systems to monitor and manage resource consumption in real-time, enabling event organizers to make data-driven decisions and respond quickly to changing conditions.

Sustainable transportation is another key area for improvement in Hajj and Umrah management. A study by Alkhaldy et al. (2022) explored the potential for using electric and hybrid vehicles for transportation during the events, as well as the development of a comprehensive sustainable transportation plan that includes mass transit systems, pedestrian and bicycle

infrastructure, and incentives for sustainable travel choices. The authors found that while there are significant challenges to implementing sustainable transportation solutions, such as the need for charging infrastructure and the high upfront costs of electric vehicles, the long-term benefits in terms of reduced greenhouse gas emissions and improved air quality are substantial.

To further improve transportation sustainability, additional measures should be taken to enhance the efficiency and capacity of public transportation. This includes expanding the Mecca Metro network, increasing the frequency of service, and introducing dedicated lanes for public transport.

Al-Hasanat (2016) suggests promoting the use of electric and hybrid vehicles among pilgrims through incentives and subsidies. Additionally, implementing a carpooling program and providing dedicated parking areas for shared vehicles can reduce the number of private cars on the roads.

The adoption of green building standards for all new construction projects in Mecca and Medina is essential to ensure long-term sustainability. This includes the use of sustainable construction materials, energy-efficient designs, and waste minimization practices.

Al-Mutairi et al. (2017) recommend the integration of green building certifications, such as LEED (Leadership in Energy and Environmental Design), to guide the construction of new facilities. Additionally, retrofitting existing buildings with energy-efficient systems and sustainable materials can further enhance environmental performance.

Education and awareness-raising are also critical strategies for promoting sustainability in Hajj and Umrah management. A study by Alotaibi (2020) investigated the role of environmental education in promoting sustainable behaviors among pilgrims, focusing on the design and implementation of educational programs and campaigns that promote waste reduction, water conservation, and energy efficiency. The author found that effective environmental education programs should be tailored to the specific needs and cultural context of Hajj and Umrah pilgrims, and should include a mix of formal and informal learning opportunities, such as workshops, exhibits, and social media campaigns.

Discussion

The findings of this literature review highlight the complex and multifaceted nature of sustainability in Hajj and Umrah management, revealing a range of challenges, opportunities, and potential strategies for reducing the

environmental impact of these events. The discussion will delve deeper into the implications of these findings, examining the interconnections between the various themes and identifying key areas for future research and practice.

One of the most striking findings of this review is the sheer scale of the environmental impact of Hajj and Umrah, particularly in terms of waste generation, water consumption, and energy use. The fact that pilgrims generate over 2,400 tons of solid waste per day during Hajj (Saudi Gazette, 2020) underscores the urgent need for effective waste management strategies that prioritize waste reduction, reuse, and recycling. The implementation of a circular economy model, as proposed by Alkhuzaim (2021), could be a promising approach to addressing this challenge, as it seeks to minimize waste and optimize resource use through the design and implementation of sustainable waste management systems.

However, the success of such a model would require a fundamental shift in the way waste is perceived and managed during Hajj and Umrah, as well as significant investments in infrastructure, technology, and human resources. This highlights the need for a holistic and integrated approach to sustainability that engages all relevant stakeholders, including government agencies, religious authorities, event organizers, and waste management service providers.

The findings related to water and energy consumption during Hajj and Umrah also raise important questions about the sustainability of these events in the face of growing environmental pressures. The fact that water demand increases by 30% during Hajj (Obaid et al., 2017) and energy demand increases by 50% (Fayek, 2021) suggests that current practices are unsustainable in the long term, particularly given the limited water resources and reliance on fossil fuels in the region.

While the use of solar energy to power the Al-Shae'r Mosque (Alamoudi, 2021) is a promising example of how renewable energy can be integrated into Hajj and Umrah infrastructure, much more needs to be done to reduce the overall energy and water footprint of these events. This could include the widespread adoption of energy-efficient technologies, such as LED lighting and smart cooling systems, as well as the implementation of water conservation measures, such as low-flow fixtures and greywater recycling.

The role of transportation in the environmental impact of Hajj and Umrah is another critical area for discussion. The finding that air travel is the largest contributor to the carbon footprint of these events (Al-Mulali et al., 2015) highlights the need for more sustainable transportation options, such as high-

speed rail and electric or hybrid vehicles. However, the implementation of such options would require significant investments in infrastructure and a fundamental shift in the way transportation is planned and managed during Hajj and Umrah.

The potential for smart technologies, such as IoT and big data analytics, to promote sustainability in Hajj and Umrah management (Khan et al., 2021) is another promising area for discussion. The use of smart sensors and data analytics to monitor and manage resource consumption in real-time could enable event organizers to make data-driven decisions and respond quickly to changing conditions, optimizing resource use and reducing waste. However, the implementation of such technologies would require significant investments in infrastructure and human resources, as well as the development of robust data governance and security frameworks.

The importance of education and awareness-raising in promoting sustainable behaviors among Hajj and Umrah pilgrims (Alotaibi, 2020) is another key theme that emerges from this review. The finding that effective environmental education programs should be tailored to the specific needs and cultural context of pilgrims highlights the need for a more nuanced and culturally sensitive approach to sustainability education in this context. This could include the development of educational materials and campaigns that draw on Islamic teachings and values related to environmental stewardship and responsibility.

However, the effectiveness of such programs would also depend on the level of engagement and commitment from religious authorities and community leaders, who play a critical role in shaping the attitudes and behaviors of pilgrims. This highlights the need for a more collaborative and inclusive approach to sustainability education that engages all relevant stakeholders, including religious leaders, educators, and community organizations.

Finally, the findings of this review also raise important questions about the broader social, economic, and cultural dimensions of sustainability in Hajj and Umrah management. While the focus of this review has been primarily on the environmental impact of these events, it is clear that sustainability in this context is not just about reducing waste, conserving resources, and minimizing carbon emissions. It is also about ensuring that the spiritual, social, and cultural benefits of Hajj and Umrah are preserved and enhanced for future generations.

This requires a more holistic and integrated approach to sustainability that takes into account the complex interplay between environmental, social,

and economic factors. For example, the development of sustainable transportation and infrastructure for Hajj and Umrah could not only reduce the environmental impact of these events but also improve the safety, comfort, and accessibility of the pilgrimage experience for all participants.

Similarly, the implementation of sustainable waste management practices could not only reduce the environmental burden of these events but also create new economic opportunities for local communities, such as through the development of recycling and composting facilities. The integration of sustainable practices into the planning and management of Hajj and Umrah could also help to strengthen the cultural and spiritual significance of these events, by demonstrating the compatibility of Islamic values with environmental stewardship and responsibility.

The analysis of current eco-friendly practices in Hajj and Umrah management reveals significant progress in addressing environmental challenges. However, the implementation of these practices has been uneven, with varying degrees of success. The proposed strategies aim to build on existing efforts and address the remaining gaps to achieve a more sustainable pilgrimage experience.

For instance, while the "Green Hajj" initiative has made strides in waste management, the introduction of a comprehensive waste management system can further enhance waste reduction and recycling efforts. Similarly, expanding the use of advanced water-saving technologies and promoting alternative water sources can significantly improve water conservation.

The adoption of renewable energy sources and sustainable transportation options has already contributed to lower emissions, but further expansion and diversification of these initiatives are necessary to achieve long-term sustainability. Finally, the widespread adoption of green building standards can ensure that new and existing facilities are environmentally responsible and energy-efficient.

The proposed strategies have the potential to significantly reduce the environmental footprint of Hajj and Umrah. By implementing a comprehensive waste management system, the volume of waste sent to landfills can be minimized, reducing pollution and conserving resources. Enhanced water conservation measures can alleviate pressure on local water supplies, ensuring that water resources are used efficiently and sustainably.

The expanded use of renewable energy can substantially lower greenhouse gas emissions, contributing to global climate change mitigation

efforts. Promoting sustainable transportation options can reduce traffic congestion, improve air quality, and enhance the overall pilgrim experience. Finally, the adoption of green building standards can lead to significant energy savings and reduced environmental impacts, ensuring the long-term sustainability of pilgrimage infrastructure.

The adoption of sustainable practices in Hajj and Umrah management offers numerous long-term benefits. These include the preservation of natural resources, reduced environmental pollution, and enhanced resilience to climate change. Sustainable practices also contribute to the overall well-being of pilgrims, providing a cleaner and healthier environment for their spiritual journey.

Furthermore, the implementation of eco-friendly practices can enhance the reputation of Hajj and Umrah as environmentally responsible events, attracting positive attention and support from the global community. This can lead to increased collaboration and funding opportunities for further sustainability initiatives.

In conclusion, the comprehensive adoption of sustainable practices in Hajj and Umrah management is essential to minimize their environmental footprint and ensure their long-term viability. By learning from global best practices and adapting them to the unique context of these pilgrimages, stakeholders can create a more sustainable and spiritually fulfilling experience for future generations of pilgrims.

In conclusion, the findings of this literature review underscore the urgent need for a more comprehensive, integrated, and collaborative approach to sustainability in Hajj and Umrah management. While the challenges are significant, the opportunities for positive change are also substantial, and there is a growing recognition among stakeholders of the need for action.

However, realizing these opportunities will require a fundamental shift in the way sustainability is perceived and practiced in this context, as well as significant investments in infrastructure, technology, and human resources. It will also require a more inclusive and participatory approach to decision-making that engages all relevant stakeholders, including government agencies, religious authorities, event organizers, service providers, and local communities.

Ultimately, the goal of sustainability in Hajj and Umrah management should not be seen as a burden or a constraint, but rather as an opportunity to enhance the spiritual, social, and cultural benefits of these events while also ensuring their long-term viability and resilience in the face of growing

environmental pressures. By embracing this opportunity and working together towards a shared vision of sustainability, all stakeholders can help to ensure that Hajj and Umrah remain a source of inspiration, unity, and hope for generations to come.

CLOSURE

The Hajj and Umrah pilgrimages are of immense spiritual significance to Muslims worldwide, attracting millions of pilgrims to the holy city of Mecca every year. However, the large-scale nature of these events poses significant challenges in terms of environmental sustainability, with issues such as waste management, water conservation, and energy consumption requiring urgent attention.

This research has explored the current state of sustainability in Hajj and Umrah management through a comprehensive literature review, identifying key challenges, existing initiatives, and potential strategies for improvement. The findings highlight the need for a holistic and collaborative approach to sustainability, engaging all relevant stakeholders and taking into account the unique cultural, religious, and logistical aspects of these events.

The literature review has revealed several promising strategies for promoting sustainability in Hajj and Umrah management, including the implementation of a circular economy model, the use of smart technologies, the promotion of sustainable transportation, and the development of effective education and awareness-raising programs. However, the success of these strategies relies on the commitment and cooperation of all stakeholders, including government agencies, religious authorities, event organizers, and pilgrims themselves.

The Saudi government's Vision 2030 plan, which includes a focus on sustainable development and reducing the environmental footprint of Hajj and Umrah, provides a strong foundation for future initiatives. However, achieving true sustainability will require ongoing efforts and investments in infrastructure, technology, and human capital.

This research has contributed to the growing body of knowledge on sustainability in event management and religious tourism, providing valuable insights and recommendations for policymakers, event organizers, and researchers. However, further research is needed to assess the effectiveness of specific sustainability initiatives, explore the potential of emerging technologies, and investigate the socio-cultural factors that influence sustainability behaviors among pilgrims.

In conclusion, promoting sustainability in Hajj and Umrah management is a complex and multifaceted challenge that requires a long-term, collaborative approach. By building on the existing knowledge and best practices identified in this research, and by fostering a culture of sustainability among all stakeholders, significant progress can be made in reducing the environmental impact of these important religious events.

The findings of this research have several practical implications for stakeholders involved in Hajj and Umrah management. Government agencies and religious authorities should prioritize the development and implementation of comprehensive sustainability strategies, setting clear targets and allocating sufficient resources to support these efforts. Event organizers should integrate sustainability considerations into all aspects of their planning and operations, from waste management and resource conservation to transportation and accommodation.

Moreover, engaging and educating pilgrims about sustainable practices is crucial for the success of any sustainability initiative. Stakeholders should invest in the development of effective communication and awareness-raising campaigns, leveraging both traditional and digital media channels to reach a wide audience. By empowering pilgrims with the knowledge and tools to make sustainable choices, organizers can create a ripple effect of positive change that extends far beyond the duration of the events themselves.

Ultimately, the goal of sustainability in Hajj and Umrah management should be to preserve the spiritual, cultural, and environmental integrity of these sacred events for generations to come. By embracing the principles of sustainability and working together towards a common vision, stakeholders can ensure that the Hajj and Umrah pilgrimages continue to be a source of spiritual fulfillment, cultural exchange, and environmental stewardship.

As the global community faces increasingly urgent sustainability challenges, the lessons learned from Hajj and Umrah management can provide valuable insights and inspiration for other large-scale events and gatherings. By demonstrating leadership and innovation in sustainability, the Muslim world can set an example for other faith communities and contribute to the global effort to build a more sustainable and resilient future for all.

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