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Islamic Ecotheology on the Carbon Footprint of Artificial Intelligence in Contemporary Digital Civilization

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Abstract

The development of artificial intelligence (AI) in recent years has driven the massive expansion of digital data centers, cloud computing, and algorithmic processing systems on a global scale. Behind the acceleration of these innovations, AI requires high energy consumption and generates a digital carbon footprint that contributes to the contemporary ecological crisis. The discourse on AI has so far focused more on technological, economic, and social ethical aspects, while studies on the ecological impact of AI from an Islamic perspective are still relatively limited. This research aims to analyze the carbon footprint of AI in contemporary digital civilization through an Islamic ecotheological approach and formulate an ethical foundation for sustainable technology development. This study uses a qualitative method based on literature studies with an approach to Islamic ecology and technological ethics. Data was obtained from international scientific articles, global environmental reports, and literature on AI sustainability and Islamic environmental ethics. The results show that AI is not ecologically neutral because its infrastructure contributes significantly to energy consumption and carbon emissions. From an Islamic perspective, the digital ecological crisis is seen as a form of imbalance in the relationship between humans and nature due to exploitative technological orientation. The principles of maqashid al-shariah, especially the protection of life and environmental sustainability, can be used as a basis for building a sustainable AI ethics that places ecological responsibility as an integral part of the digital civilization of the future.

Keywords: *Islamic Ecotheology; Carbon Footprint; Artificial Intelligence; Digital Ethics; Sustainability*

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Introduction

The development of artificial intelligence (AI) in the past decade has significantly changed the landscape of global digital civilization [1]. This transformation has become more massive since the presence of generative AI technology such as OpenAI, ChatGPT, Google Gemini, DeepSeek, and Midjourney that is able to produce text, images, sounds, and visual simulations based on algorithmic processing [2]. AI is no longer viewed merely as a technological instrument, but has become the main infrastructure in the digital economy, creative industries, education, health, and global social systems. The International Energy Agency (IEA) 2024 report shows the increased use of AI and cloud computing has caused global data center electricity consumption to increase drastically and is projected to reach more than 1,000 TWh by 2026, equivalent to the electricity consumption of developed industrialized countries [3]. On the other hand, the process of training large-scale generative AI models requires thousands of high-power GPU that produce large amounts of carbon emissions [4].

This phenomenon shows that AI advances have ecological consequences that are not simple [5]. Modern AI infrastructure relies on the expansion of data centers, server cooling systems, and the exploitation of electrical energy on a global scale. Strubell et al.'s research shows that large-scale deep learning model training can produce carbon emissions equivalent to the emissions of five cars over their lifetime [6]. In addition, the report United Nations Environment Programme UNEP affirms the digital economy has become part of the cause of the new climate crisis through increased global energy consumption and e-waste [7]. Thus, AI actually presents a civilizational paradox: technology promoted as a symbol of future progress has the potential to accelerate ecological degradation if it is not accompanied by ethical orientation and environmental sustainability.

In the midst of this situation, academic discourse on AI is still dominated by technical, economic, and social ethical approaches. Most of the research focuses on issues of automation, data security, algorithmic bias, digital privacy, and industry transformation [8]. Studies on AI from an Islamic perspective also tend to focus on legal issues of the use of AI, the ethics of digital interaction, and the legitimacy of technology-based fatwas [9]. Meanwhile, Islamic ecological studies deal more with conventional environmental crises such as climate change, forest destruction, natural resource exploitation, and conservation ethics [10]. This condition shows the discussion of the ecological impact of AI in an Islamic perspective is still relatively limited and has not become a major concern in contemporary Islamic studies [11].

Based on a search of various scientific publications in the last five years, there has not been much research that integrates the issue of AI carbon footprint with a comprehensive approach to Islamic ecotheology. AI studies tend to separate technological issues from ecological dimensions and religious spirituality. In contrast, Islamic ecotheology research is still oriented towards the physical environmental crisis and has not touched on the digital ecological issues that arise due to the expansion of the global AI industry. Therefore, there is an important academic research gap to be studied, namely how AI as a product of modern digital civilization can be understood through the perspective of Islamic ecotheology and how Islamic principles can be the foundation of sustainable AI ethics.

This research offers conceptual novelty through the development of ideas *Islamic ecological ethics of artificial intelligence*, which is an ethical framework that links AI technology with ecological responsibility in an Islamic perspective. This article not only discusses AI as a technological instrument, but also as a civilizational entity that has an ecological impact on the sustainability of human life and the environment. In this context, Islamic principles such as *Khilafah Fil Ardh*, *Mizan*, ecological mandate, and the prohibition of doing damage to the earth as stipulated in QS. al-A'raf: 56 becomes the normative foundation for building a technological ethics oriented towards ecological sustainability.

This study seeks to answer three main questions. First, how does AI generate a carbon footprint in contemporary digital civilization? Second, how does Islamic ecotheology view the ecological exploitation of digital technology? Third, how can Islamic principles build sustainable AI ethics? Based on the formulation of these problems, this study aims to analyze the ecological impact of AI, examine AI through the perspective of Islamic ecology, and formulate a sustainable AI ethical framework based on Islamic values. Thus, this article is expected to make a theoretical contribution to the development of Islamic studies and technology while expanding the discourse of Islamic ecotheology in facing the challenges of contemporary digital civilization.

Unlike previous studies that primarily discuss AI ethics from technological or legal perspectives, this article develops an Islamic ecotheological framework for understanding the environmental consequences of AI infrastructure and digital carbon emissions.

Method

This research is a literature-based qualitative research (*Library Research*) which places the scientific literature as the main source in the process of data collection and analysis. The qualitative approach is used because this study aims to understand in depth the relationship between the development of artificial intelligence (*Artificial Intelligence*/AI), the digital ecological crisis, and the construction of environmental ethics in an Islamic perspective. Qualitative research is not designed through statistical procedures, but rather emphasizes the interpretation, meaning, and critical analysis of social phenomena and intellectual discourse that develop in the contemporary digital society [12].

The main object of this research is the discourse on the carbon footprint of AI and its ecological implications which is analyzed through an Islamic ecotheological approach. In this context, this research also utilizes the interpretation of Qur'anic verses related to human relations and the environment, such as the concept of *Khilafah Fil Ardh*, *Mizan*, ecological mandate, and the prohibition of doing damage to the earth as explained in QS. al-A'raf: 56 and QS. ar-Rum: 41. This approach is used to build a sustainable technological ethical formulation based on Islamic values [13].

The primary data source of the research was obtained from articles in reputable international journals that discussed *AI sustainability*, *Islamic environmental ethics*, *Eco-Theology*, *Digital Ecology*, as well as the ethics of artificial intelligence [6], [4]. The main literature was selected based on the relevance of the theme, novelty of the publication, and academic credibility, particularly articles indexed by Scopus in the last five years. The secondary data sources come from reports from international institutions such as Intergovernmental Panel on Climate Change (IPCC) and International Energy Agency (IEA), global environmental policy documents, data center energy consumption reports, digital technology articles, as well as publications on the ecological impact of the AI industry [3], [14].

In addition to literature studies, this study also uses non-participatory observation techniques on the development of generative AI-based digital spaces. The observation was carried out by observing the trend of using AI platforms in digital media and social media, including the intensification of the use of computation-based systems *cloud*, generative algorithms, and infrastructure *Data Center* global that contributes to increasing digital energy consumption [8]. Observational techniques are used to help researchers

understand the empirical reality regarding the expansion of AI in contemporary social life.

Data collection techniques are carried out through documentation and literature search using scientific databases such as Google Scholar, Scopus, ScienceDirect, SpringerLink, and Taylor & Francis [15]. All the data obtained were then analyzed using three approaches. First, *Content Analysis* is used to identify patterns of argumentation and thought constructs regarding the ecological impact of AI in various scientific literature [1]. Second, *Critical Discourse Analysis* is used to examine the dominant narrative of digital technological advancements that often ignore the ecological consequences of the global AI industry [16]. Third, the Islamic normative-philosophical approach is used to interpret the problem of the digital ecological crisis through the framework of consequently Islamic ethics and maqashid al-shariah.

Through a combination of these approaches, this study seeks to produce a conceptual formulation of the *Islamic ecological ethics of artificial intelligence* as a new ethical paradigm that integrates the development of digital technology with ecological responsibility and environmental sustainability in an Islamic perspective.

Results

The results show the development of artificial intelligence (*Artificial Intelligence*/AI) in the contemporary digital civilization has significant ecological consequences for the sustainability of the global environment. Expansion of generative-based AI usage *machine learning*, cloud computing, and large-scale data centers have been proven to massively increase global electrical energy consumption [3]. Modern AI infrastructure requires thousands of graphics processing units (*graphics processing unit*/GPU), server cooling systems, and high-power data storage capacity that contribute to increased digital carbon emissions. This condition shows the findings indicate that AI infrastructure significantly contributes to rising digital carbon emissions and resource exploitation, but is part of the digital climate crisis that is developing in the modern technological society.

The study also found the global AI ethical discourse is still dominated by data privacy issues, algorithmic bias, cybersecurity, and economic automation, while the ecological dimension of AI has not received proportionate attention [8]. In the context of Islamic studies, discussions about AI focus more on legal issues of the use of technology and digital ethics, while the ecological impact of the AI

industry on environmental sustainability is still relatively limited. This shows there is an epistemological vacuum in contemporary Islamic studies related to the relationship between digital technology and the global ecological crisis.

Through an Islamic ecotheological approach, this study finds the digital ecological crisis can be understood as a new form of *Fasad Fil Ardh* due to the exploitation of technology that goes beyond the principle of natural balance. Concept *Khilafah Fil Ardh*, *Mizan*, and ecological mandate in Islam affirms that humans have a moral responsibility to maintain harmony between technological development and environmental sustainability as explained in QS. al-A'raf: 56 and QS. ar-Rum: 41 [17]. Thus, the exploitation of energy and natural resources in the AI industry is seen as contrary to the principles of ecological sustainability in Islam.

This study further found that maqashid al-shariah has strong relevance in building a sustainable AI ethical paradigm. The principle of life protection (*Hifz al-Nafs*) and environmental protection (*Hifz al-Bi'ah*) can be used as a normative foundation in the development of environmentally friendly digital technology. Based on these findings, this study formulated the concept of *Islamic ecological ethics of artificial intelligence* as an alternative ethical paradigm that integrates technological innovation with ecological responsibility and Islamic spirituality. This paradigm places AI not only as an instrument of digital progress, but also as part of human moral responsibility for the sustainability of life and the balance of global nature.

Discussion

The Expansion of Artificial Intelligence and the Digital Ecological Crisis

The development of artificial intelligence (*Artificial Intelligence*/AI) has driven fundamental changes in the structure of the global digital civilization [18]. The transformation is characterized by increased use of data centers, cloud computing, as well as large-scale algorithmic processing systems that are the main foundation of modern AI technology. The presence of generative AI such as OpenAI, ChatGPT, Google Gemini, and various models *machine learning* others require digital infrastructure with high computing capacity that operates non-stop [6]. This condition has caused global energy consumption to increase significantly, especially in the data center and digital computing services sector [19].

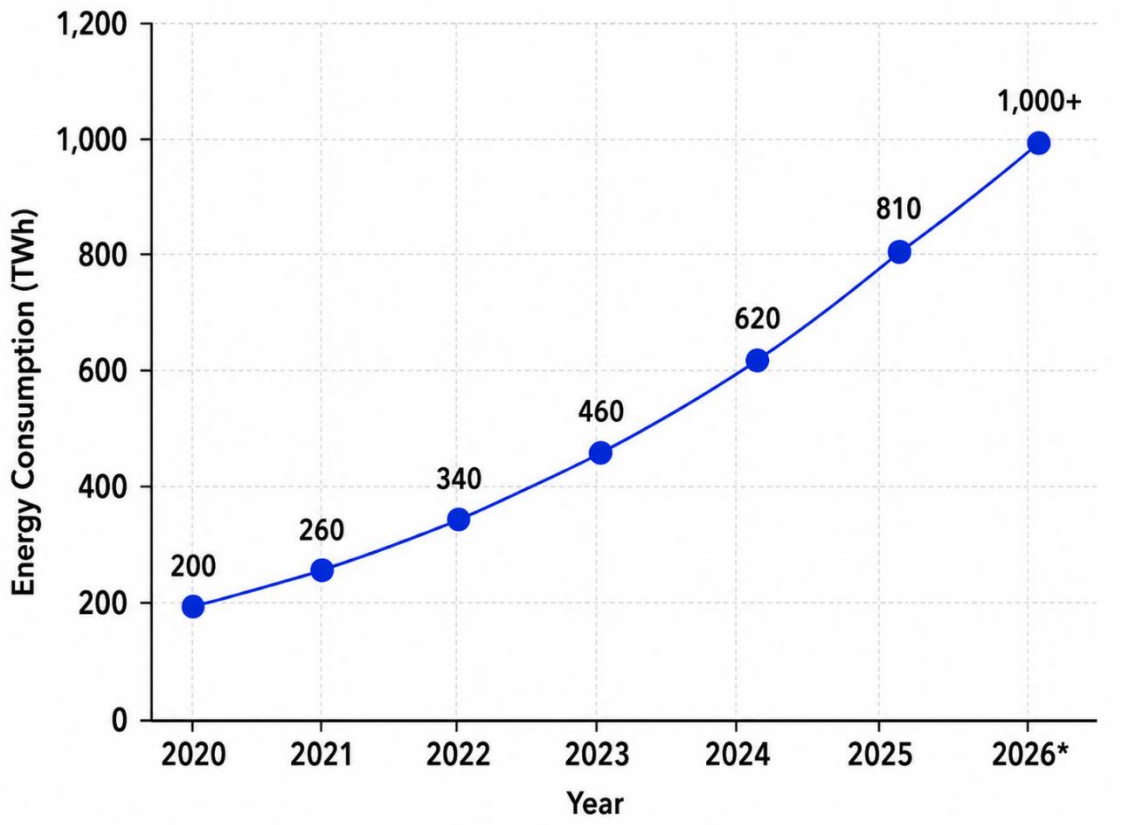

Figure 1. Ecological Impact of AI Infrastructure

Reports International Energy Agency The International Energy Agency (IEA) by 2024 shows that global data center electricity consumption is projected to reach more than 1,000 TWh by 2026, an increase of almost double compared to the previous period [3]. The increase was triggered by the acceleration of the use of generative AI and the need for massive data processing. In addition to electrical energy consumption, the AI industry also needs a large amount of water-based server cooling systems to maintain the operational stability of the hardware. Li et al.'s research revealed the training of generative AI models can consume millions of liters of water during the computational process [20]. Thus, AI not only impacts the increase in carbon emissions, but also expands the exploitation of global natural resources [21].

This phenomenon shows that AI presents what can be called *Invisible Environmental Crisis*. The digital ecological crisis does not always appear physically like conventional industrial pollution, but works through virtual infrastructures hidden behind the convenience of modern digital technologies. The narrative of AI as a green technology and a solution of the future often

ignores the fact that AI computing systems rely on the exploitation of fossil energy, large-scale hardware production, and the expansion of global data centers [22]. This paradox shows that digital civilization actually holds a large ecological cost behind the image of efficiency and technological innovation.

In this context, AI can no longer be understood simply as an instrument of technological advancement, but rather as part of the structure of global digital industrialization that has serious ecological impacts. Carbon emissions resulting from algorithm training, data storage, and cloud computing activities show the development of AI is directly correlated with the acceleration of the global climate crisis [4]. Therefore, the discussion about AI needs to be expanded from just a technological issue to a discourse on ecological ethics and environmental sustainability.

The Carbon Footprint of AI in the Perspective of Contemporary Digital Civilization

Contemporary digital civilization is developing through the logic of technological capitalism that makes data the main commodity of the global economy. In this system, AI functions as an instrument to accelerate the production, distribution, and consumption of information on a massive scale [23]. The ever-increasing accumulation of digital data drives the expansion of global data centers and increases the need for computing energy [24]. This condition gave birth to a new form of ecological exploitation that was no longer based on traditional manufacturing industries, but through the industrialization of data and digital algorithms.

Modern technology consumption culture also strengthens the increase in AI's carbon footprint [25]. The contemporary digital society lives in an ecosystem that encourages the continuous use of AI-based services, ranging from social media, *Streaming*, digital transactions, to algorithm-based automation systems [26]. The phenomenon creates a pattern digital overconsumption that indirectly increases global energy consumption [27]. In this perspective, digital humans are not only users of technology, but also producers of new ecological crises through virtual activities that depend on large-scale energy infrastructure.

Table 1. The Relationship between Digital Capitalism and the AI Ecological Crisis

Digital Phenomenon	Characteristics	AI Impact	Ecological Consequences
Digital Overconsumption	Unlimited consumption	Data traffic increases	Large electricity consumption
Algorithmic Capitalism	Data monetization	Massive AI expansion	Carbon emissions are increasing
Streaming and AI Content	High data production	Global server load	Digital energy crisis
Cloud Dependency	Cloud dependency	Fast-growing data centers	Resource exploitation
Digital Modernity	Technology as a lifestyle	AI Intensification	Virtual ecological crisis

The analysis of this study shows that AI is an integral part of the *Techno-capitalism*, which is an economic system that integrates digital technology with the logic of global capital accumulation [28]. This orientation has led AI development to focus more on economic efficiency and market dominance rather than ecological sustainability [29]. As a result, the issue of environmental degradation (*Ecological Degradation*) is often marginalized in the discourse of technological innovation [30].

This phenomenon shows the paradox of contemporary digital society. On the one hand, AI is promoted as an efficient and intelligent future solution. But on the other hand, the expansion of digital technology is actually accelerating energy consumption, carbon emissions, and the exploitation of global natural resources. Thus, the digital ecological crisis is not just a side effect of technological developments, but a structural consequence of digital modernity based on algorithmic capitalism.

Reconstruction of Islamic Ecotheology to the Digital Environmental Crisis

In an Islamic perspective, man's relationship with nature is built through the principles of balance and moral responsibility. Humans are positioned as *Khilafah Fil Ardh* who have the mandate to maintain the sustainability of life and ecological harmony as mentioned in QS. al-Baqarah: 30. The concept emphasizes that humans do not have the legitimacy to exploit nature destructively for economic and technological interests alone [31].

The Qur'an explicitly prohibits acts of destruction on earth as stated in QS. al-A'raf: 56:

وَلَا تُفْسِدُوا فِي الْأَرْضِ بَعْدَ إِصْلَاحِهَا وَادْعُوهُ خَوْفًا وَطَمَعًا ۚ إِنَّ رَحْمَتَ اللَّهِ قَرِيبٌ مِنَ الْمُحْسِنِينَ

"*And do not make any damage on the earth after (Allah) has repaired it.*"

The paragraph shows that ecological damage, including in the digital context, is a form of violation of the principle of balance (*Mizan*) that God has ordained. In the context of AI, the exploitation of energy and natural resources through the industrialization of data can be understood as a new manifestation of *fasad fil ardh*.

This study found that technology is never value-free [32]. AI is not just a neutral computing system, but a product of civilization that carries a certain economic, political, and ideological orientation [33]. Therefore, the development of digital technology must be subject to the ethical principles of sustainability and ecological responsibility [34]. Islam views that technological advances that sacrifice environmental balance are contrary to the principles of ecological trust and cosmic justice.

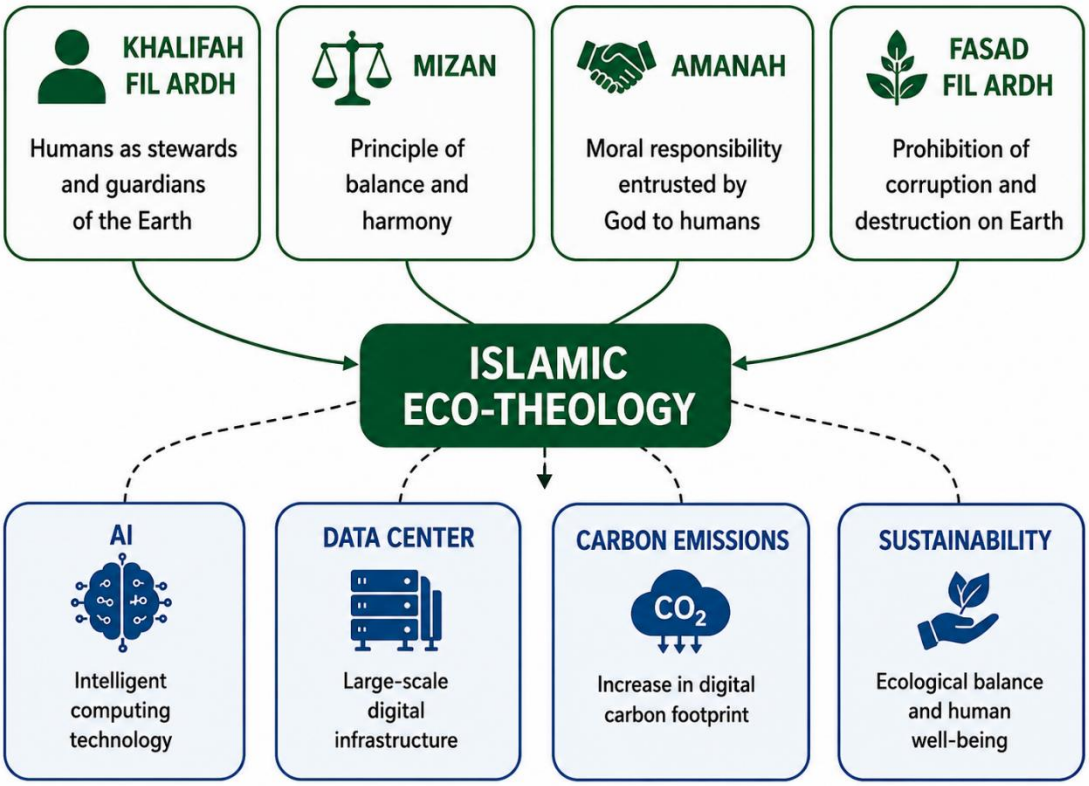

Figure 2. Integration of Islam and AI

In addition, QS. ar-Rum: 41 explains the damage on land and sea occurs as a result of human actions [35]. This verse has strong relevance to the contemporary digital ecological crisis because it shows the exploitation of technology without limits can result in systemic ecological damage [36]. Thus, the reconstruction of Islamic ecotheology is important as an alternative paradigm in dealing with the expansion of global AI technology [37].

Maqashid Al-Shariah as the Foundation of Sustainable AI Ethics

The development of the global ecological crisis demands a reinterpretation of maqashid al-shariah in the context of contemporary digital technology. So far, maqashid al-sharia is understood in the framework of the protection of religion, soul, intellect, descendants, and property. However, the increasing ecological threats due to the industrialization of AI demonstrate the need for the expansion of maqashid towards environmental protection (*Hifz al-Bi'ah*) as an integral part of the sustainability of human life [38].

In the context of AI, the principle *Hifz al-Nafs* It can be interpreted as an effort to maintain the sustainability of human life from the impact of the digital climate crisis. Meanwhile, *Hifz al-Mal* not only related to economic protection, but also the development of a sustainable and non-exploitative digital economy on natural resources [39]. This approach gave birth to a new paradigm that can be referred to as *Green Artificial Intelligence Ethics in Islamic Perspective* [40].

The paradigm emphasizes that AI must be developed through the principle of energy efficiency, *Sustainable computing*, and global ecological awareness [41]. Digital technologies should not only be oriented towards accelerating innovation and economic gain, but should also consider environmental sustainability and ecological justice [42]. Thus, maqashid al-shariah can be a normative foundation in building an environmentally friendly digital civilization [43].

The study also found the concept of sustainability in Islam has a strong spiritual dimension [44]. Nature is understood as part of the signs of God's power that must be maintained. Therefore, the exploitation of technology that damages the ecological balance is seen as a form of ethical and spiritual deviation in the development of modern civilization.

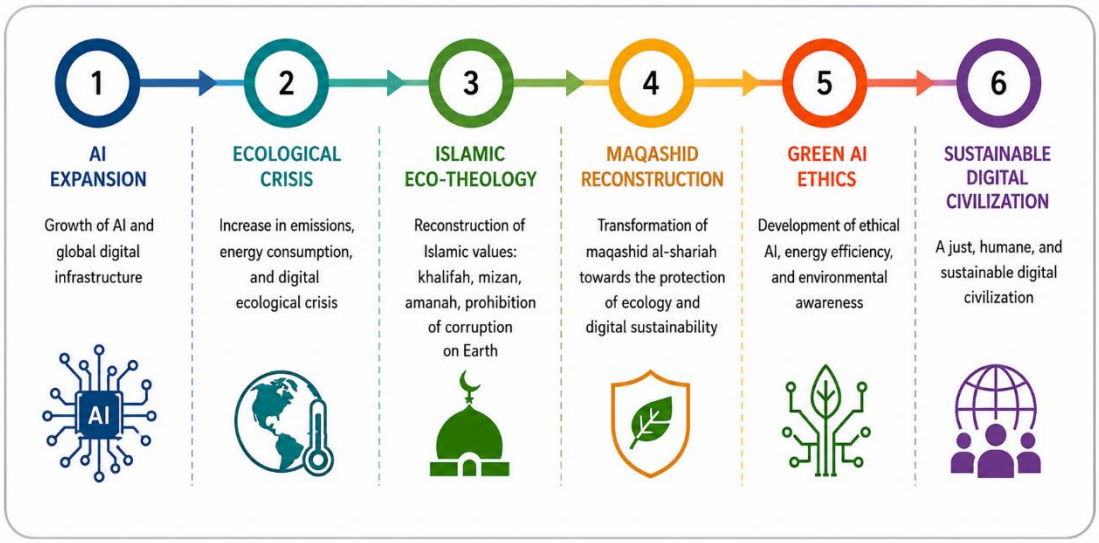

Figure 3. Novelty and theoretical contributions of articles

Islamic Technology Ethics Model for the Future Digital Civilization

The results of this study produce a conceptual model of Islamic technological ethics consisting of four main principles, namely *Spiritual Ecology*, *responsible AI*, *Ethical sustainability*, and *Digital Environmental Justice* [45]. These four principles form an ethical framework that places technology as part of human moral responsibility for the sustainability of global life [46].

Table 2. Islamic Technology Ethics Model for Digital Civilization

Principle	Orientation	Purpose
Spiritual Ecology	Divine consciousness	Harmony between man and nature
Responsible AI	Technology responsibility	Ethical and inclusive AI
Ethical Sustainability	Ecological sustainability	Digital emission reduction
Digital Environmental Justice	Environmental justice	Distribution of technological impact

Principle *Spiritual Ecology* emphasizing that man's relationship with technology must be built on spiritual awareness and divine responsibility. Technology should not be separated from the moral dimension and transcendental values. Meanwhile, the concept *responsible AI* demand the

development of AI that considers social and ecological impacts simultaneously [8].

Principle *Ethical sustainability* emphasizing the importance of sustainable technological development that does not damage the balance of nature. In this context, energy efficiency, digital carbon emission reduction, and the use of environmentally friendly resources are integral to Islamic technological ethics [47]. The concept *Digital Environmental Justice* highlighting the importance of global ecological justice in the distribution of benefits and impacts of the digital industry.

This research confirms that Islam is not a religion that rejects technological developments [48]. On the contrary, Islam encourages the use of science and innovation as long as it remains within the corridor of ethics, humanity, and ecological sustainability [49]. As such, AI should be geared not only to accelerate digital modernization, but also to build a more just, humane, and sustainable civilization [50].

Conclusion

The development of artificial intelligence (*Artificial Intelligence*/AI) in the contemporary digital civilization has been proven to produce serious ecological impacts through increased data center energy consumption, industrial water use, and digital carbon emissions on a global scale. This research shows the study confirms that contemporary AI development carries substantial ecological consequences that require ethical and sustainable governance because it thrives in a digital capitalism structure that emphasizes economic efficiency over environmental responsibility. In this context, the digital crisis not only represents a technological problem, but also reflects the moral crisis of modern humans due to the exploitation of natural resources that go beyond the principle of ecological balance. Islamic ecotheology offers an alternative ethical paradigm through the concept of *Khilafah Fil Ardh*, *Mizan*, ecological trusts, and prohibitions on doing *Fasad Fil Ardh* as explained in QS. al-A'raf: 56 and QS. ar-Rum: 41. This study confirms that maqashid al-shariah, especially environmental protection (*Hifz al-Bi'ah*), can be used as a conceptual foundation in building *sustainable AI ethics* Through the Paradigm *Green Artificial Intelligence Ethics in Islamic Perspective* that integrates technological innovation with ecological sustainability and Islamic spirituality. Theoretically, this article expands the study of Islam and AI through the development of the concept of Islamic digital ecotheology, while practically this research provides recommendations for sustainable AI ethics as well as a

normative basis for the development of environmentally friendly technology policies in the future.

Author Contributions

The author is the sole contributor who is fully responsible for the entire research process, starting from the conceptualization of the topic, data collection, data analysis, development of theoretical frameworks, interpretation of research results, to writing and editing article manuscripts. The entire process of research and article preparation is carried out independently by the author.

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Conflict of Interest

The author states the research and writing of this article was carried out without any conflict of interest, whether financial, institutional, or personal, which may affect the objectivity, analysis, and results of the research. The author also emphasized the entire research process is carried out independently based on the principles of academic integrity and scientific ethics.

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