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Observations on Islamic Astronomy Research and Publications in Indonesia (2015-2024)

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Abstract

This article investigates research and publications related to Islamic astronomy, with a focus on Indonesia—the country with the largest Muslim population globally. The study examines scholarly works from Google Scholar over the past nine years (2015-2024), using filters for "astronomi islam" and "Islamic astronomy" using Publish or Perish application. The most frequently researched topics include the Islamic calendar, the new moon, and the Qibla. Surprisingly, despite the growth of Islamic astronomy in Indonesia, the number of studies on these topics has not increased substantially. To advance research, consider exploring automation and robotic systems, creating DIY tools, and leveraging image processing technology, machine learning, and deep learning.

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A. Introduction

Astronomy, often regarded as the oldest scientific discipline, predates Islam. However, due to its significance in understanding crucial aspects of the Islamic faith, research in the field of Islamic astronomy becomes essential. Although the Arabic term 'falak' (الفلك) refers to the science of astronomy, it is closely associated with Islam as a religion.

In this study the realm of Islamic astronomy research and publications will be limited as it pertains to calendars, holidays, Qibla, prayer times, and eclipses. Indonesia, with the world's largest Muslim population, plays a crucial role in advancing global Islamic astronomy. This significance is underscored by the abundance of publications on Islamic astronomy, primarily originating from Indonesia[1]. However, when considering the overall volume of publications from Islamic and Muslim-majority countries, Turkey (Türkiye) and Iran lead the way[2]. Staying informed about the latest developments in Islamic astronomy research and publications in Indonesia is essential for devout worship, deepening our appreciation of Allah's greatness through scientific exploration, and conducting further research, particularly on topics relevant to Indonesia.

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Research and publications related to Islamic astronomy in Indonesia can be explored using bibliometric analysis[3]. This method involves analyzing publications such as books, journal articles, and internet pages. By employing bibliometric analysis, researchers can access the latest developments in a specific topic (state of the art), identify crucial information, explore research influences (including sources, authors, and topics), and discover new research opportunities.

Bibliometric analysis has been applied to various subjects. In the realm of Islamic astronomy, several studies have employed this method. For instance, research has explored publications from Islamic and Muslim-majority countries using the Scopus database from 1991 to 2023[2]. Additionally, the history of Islamic education has been analyzed from 1980 to 2023 using Scopus and R[1]. Furthermore, investigations into the intersection of "Science" and "Islam" were conducted from 1991 to 2013 using the Web of Science database and VOS Viewer[4]. Surprisingly, despite the country's technological advancements, there has been no comprehensive analysis of research and publications on Islamic astronomy in Indonesia. Addressing this gap is crucial for advancing knowledge in this field.

A. Methods

In this study, the Publish or Perish[5] tool was employed to conduct bibliometric research on Islamic astronomy publications authored by Indonesian scholars. The research focused on articles published in both Indonesian and English and indexed on Google Scholar[6]. By using keywords such as 'astronomi islam' and 'Islamic astronomy,' the study aimed to explore relevant literature. Additionally, the application allowed researchers to narrow down results based on metadata, including article titles, keywords, authors, and journal names, using journal indexing sources like Google Scholar and Scopus. The collected publications were then analyzed, with titles and keywords sorted based on their frequency of occurrence."

B. Results and Discussion

Over the past nine years, research related to 'Islamic astronomy' has prominently focused on several areas, including the new moon, Qibla, and prayer times. Analyzing 9,417 words extracted from 993 publication titles related to Islamic astronomy in Indonesia, we discovered interesting patterns. Specifically, 101 publications featured the term 'calendar,', 41

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mentioned ‘hilal’, ‘sabit’, or ‘crescent’, and 23 included words like ‘dawn’ or ‘shubuh’, also ‘subuh’. Surprisingly, ‘Qibla’ (and its variations: ‘kiblat’ or ‘qiblat’) appeared in only 11 titles, while the broader term ‘direction’ appeared in 52 titles. This trend poses both an unsurprising observation and a challenge for Islamic educational and research institutions: expanding the definition of Islamic astronomy.

During this period (2015-2024), several other topics received significant attention. These included variants of ‘fiqh’ (Islamic jurisprudence) in 29 publications, discussions about centuries[7] (16), observatories (8), fajr (8), and Islamic education (5). Notably, the Abbasids[8] (29) frequently surfaced in these discussions due to the intriguing history of Islamic astronomy during their era. Additionally, the topic of accuracy (14) emerged frequently, emphasizing the importance of precise timing for prayer calculations. Overall, all research in this field aligns with interpretations of the Quran (45). Among the various discussion topics, the calendar, followed by the new moon and the Qibla, consistently stood out as the most frequently addressed subjects.

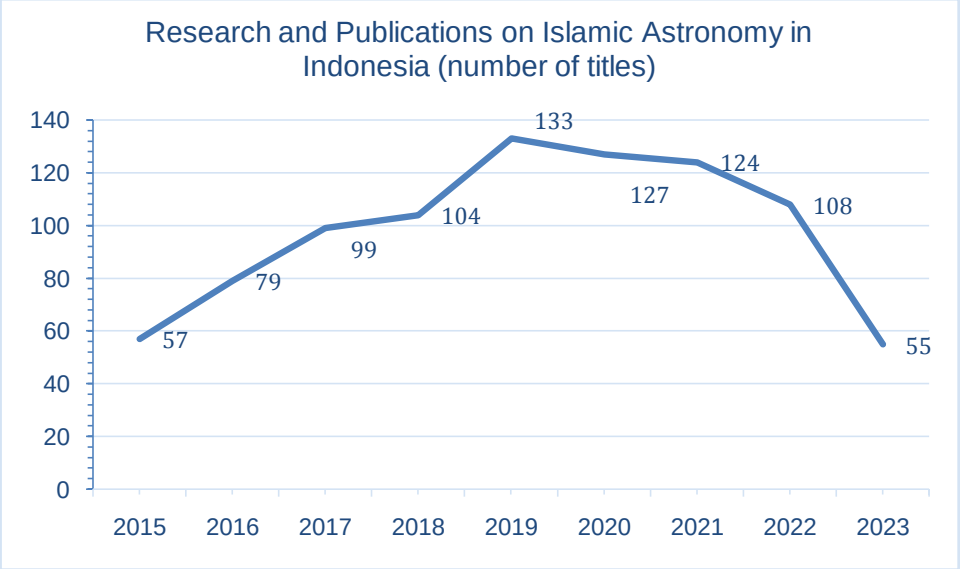

Figure 1. Research and Publications on Islamic Astronomy in Indonesia (number of titles) (2015-2023)

Since its peak in 2019 (as depicted in Figure 1), there has been a decline in publications related to Islamic astronomy in Indonesia. Al Husaeni and Al Husaeni[4] previously noted a decrease in Scopus publications on Islamic and scientific topics. Despite an increase in specialized journals and conferences dedicated to Islamic astronomy (such as ‘Al-Hilal: Journal of Islamic Astronomy’ [9], published twice a year since 2019, and ‘Al-

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Hisab: Journal of Islamic Astronomy' [10] published quarterly since 2023), as well as the establishment of observatories at Islamic universities, the overall trend remains downward. The decline may be linked to a shift in research focus away from this field as observatories mature, even though Islamic astronomy was previously a prominent topic during their early years. Additionally, the absence of publication in journals indexed by Google Scholar or Scopus may contribute to this decline.

Topic analysis reveals emerging trends that can inform future Islamic astronomy research. Notably, increased automation is a key development, including the use of robotic telescopes for automatic hilal[11] and dawn[12] observations. Previously, such observations were limited to researchers from the Bosscha Observatory[13] with their long astronomical research history.

The use of software or applications to enhance worship through astronomical information has become commonplace, thanks to widespread computer and mobile phone ownership. Notable software includes Stellarium[14] and Google Earth[15], while specific applications like Qibla Finder[16] and the Quran Application from the Ministry of Religion (Qur'an Kemenag[17], [18]) are also frequently used.

Another notable trend in the field is DIY (do-it-yourself) instruments due to the increasing use of accessible and affordable electronic modules. Technological advancements, such as the emergence of Arduino (used in telescopic focus control systems[19]) and Raspberry Pi (in dawn observations[20]), have empowered astronomers and practitioners to create their own tools. This shift is particularly significant because many imported tools and instruments tend to be expensive.

Since 2015, the adoption of virtual reality (VR)[21] and augmented reality (AR)[22], [23] as additional educational tools has gained popularity. These technologies can significantly enhance planetarium experiences, aiding in training for observing the new moon, determining the Qibla direction[21], and expanding knowledge of other astronomical sciences[22][24].

Another application of technology in the field of Islamic astronomy involves image processing, particularly for observing the new moon. Researchers like Damanhuri et al.[25] and Utama et al.[26] have explored this area. Additionally, machine learning, especially deep learning, has gained prominence across various domains. Although deep learning was initiated in the 1960s, its widespread adoption only began around the end of 2022. While there are limited publications on Indonesian Islamic astronomy that specifically utilize deep

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learning[27], machine learning and image processing techniques have been employed for tasks such as observing the crescent moon[28] and determining prayer times based on sky brightness data[29].

Conclusion

Based on a bibliometric study covering the period from 2015 to 2024, the author found that research and publications related to Islamic astronomy in Indonesia did not consistently increase each year, despite the overall development of Islamic astronomy in the country. Notably, scholars frequently explored topics related to the calendar, followed by investigations into the new moon and the Qibla. Additionally, potential research avenues within this field include DIY instrument creation and the application of technologies like robotics, virtual reality, and machine learning, including deep learning.

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