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Socio-Political Aspects In The Development Of Astronomy In The Islamic World

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Abstract: ***In its glory day, astronomy developed so rapidly. Various achievements were produced, including spectacular works and discoveries. Astronomy has a great role in Islamic world especially in religious customs. This study aims at identifying the socio-political aspects in the development of astronomy in Islamic world. The data of the study were collected from books and journals which discuss about Islamic astronomy. The study found that among the important factors advancing astronomy in the Islamic world are the social and political aspects as practiced by kings or rulers at the time, namely in the form of appreciation and conducive scientific climate. In addition to these two aspects, there are still other aspects that cause Islamic civilization in the field of astronomy developed where they closely interrelated. The point is that the development of astronomy in the Islamic world took place dynamically, while the socio-political role of the ruler was very large and decisive.***

Keywords: astronomy, social-political, scientific tradition

I. INTRODUCTION

Celestial is a classical exact science that is always studied and researched by humans all the time. Calestial objects have been studied by humans since the ancient era until present time. The Maya, Aztecs and other prehepatic peoples of Mesoamerica are the example of the ancient tribes who studies celestial for many different purposes such as calendrical system, architectural alignments, scheduling of agricultural, and ritual activities (Sprajc, 2009). In the past astrology has been also used to determine time, seasons, and navigate the oceans (Rosenberg, Bladon, Russo, & Christensen, 2014). Astronomy has a great contribution on science, since it stimulates science in the ancient time and it provides basic sciences for today's scientific development (Fabian, 2010). Studying astronomy can motivate people to increase their curiosity and motivation to study science and to make abstract knowledge can be presented in tangible and explicable data (Trumper, 2006).

In Islam, Islamic astronomy is mainly used for religios customs, such as deciding the start of the Islamic month, the time for the five daily prayer, and direction of prayer (Fernini, 2011). In doing the astronomical calculation sun and moon movements are very important, the daily prayer for example is alligned with the place of the sun in the sky and the beginning of Islamic month, including Ramadhan, depends on the visibility of the moon (Hanapi & Hassan, 2015). In addition, the direction of *qiblah* is also determined by using astronomy knowldege (Man, et al., 2012). In the context of the past, astronomy is considered as a human need because it is related to the social life of the community, including determining the time, direction of travel, trade, and suitable planting (Karttunen, Kröger, Oja, Poutanen, & Donner, 2007).

Because of such needs, finally astronomy developed in the Islamic world and received attention from the kings or rulers who were in power. Even the Chinese Kingdom, during the Yuan and Ming Dinasty, also used Islamic astrology in order to calculate civil almanac, astronomical ephemerides, predict luni-solar eclipses and occultation of the moon and the five planets (Yunli, 2014). The main support given by the authorities at that time was in the form of socio-political support, where the academic climate, discussion, translation of pre-Islamic astronomical works, and others, received support from the authorities, both in the form of facilities, facilities,

and financial assistance. These factors are truly that led to Islamic civilization in the field of astronomy continues to develop with all its achievements and discoveries.

II. THEORITECIAL FRAMEWORK

ASTRONOMY SCIENCE IN ISLAM

Literally, astronomy (Arabic: ʻilm al-falak) comes from two words namely science (al-ʻilm) and celestial (al-falak). Knowledge means knowledge of something that is essential, while astronomy means orbit or circular celestial bodies. In the Qur'an this word is stated twice with the understanding of the orbit or trajectory, namely in the QS. Al-Anbiya '[21] verse 33 and in the QS. Yāsīn [36] verse 40. Carlo Nillino in his work 'Ilm al-Falak Tārīkhuhu' Inda al-'Arab fī al-Qurūn al-Wustha states that the word 'falak' contained in the Qur'an is not from Arabic, but comes from the Babylonian language 'Pulukku'. It is the study that aims at understanding the underpinning principles of planet, stars, and galaxies behavior (Ladan, 2015). Thus through this understanding, astronomy can be defined as the study of heavenly bodies.

In its development, astronomy developed in the Islamic world through the influence of pre-Islamic civilizations such as Indian, Persian, Greek, and others (Ikbal, 2015). The islamic astronomy in the past is mainly used to determine calendar system, five prayer time, and for finding sacred direction of qibla (King, 1990). Abbasid Daula meritorious put astronomy in a strategic position. For astronomy is studied, studied, and seen in the perspective of the practical needs of worship and developed as a basic foundation for the development of science. Thus the Islamic civilization gave birth to many astronomy scholars with amazing works and inventions, say for example: Al-Battāni, Al-Buzjānī, Ibn Yunus, Ath-Thūsi, Al-Birūni, and others.

THE ROLE OF ASTRONOMY SCIENCE IN ISLAM

In reality, astronomy is an exact science in Islam that received great attention from Muslim scientists (Wahab, 2015). This is because of the very significant role and contribution of the astronomy. Broadly speaking, there are four roles of astronomy in Islam, namely: determining the beginning of the lunar month, determining prayer times, determining the direction of Qibla, and determining eclipses (both lunar eclipses and solar eclipses) (Ahmad, 1995).

In determining the beginning of the lunar month, beginning with the new moon, both using rukyat and reckoning . One lunar year is the time period needed around the earth for 12 revolutions with an average of one year 354 11/30 days. In contrast to the solar year that is the time needed by the earth to circle the sun (evolve) with an average of one year 365 1/4 days (Ruskanda, 1996). In this case astronomy (astronomy) is very accurate in calculating and estimating the appearance of the new moon with great care, this level of accuracy is more than enough for the technical needs of determining the beginning of the lunar month (Rashed, Moklof, & Hamza, 2018).

Furthermore, astronomy plays a role in determining the times of prayer (Niri, et al., 2012). Regarding the times of prayer, there are a number of verses of the Qur'an that explain this, among others: QS. An Nisa 'verse 103, and QS.Al-Isra' verse 78. Furthermore, the traditions of the Prophet also explain a lot about the times of this prayer (Shan'any, 1421 H/2000 M) in practice, prayer times have limits and conditions in practice.

As a result of the apparent movement of the sun 23.5 ° to the north and 23.5 ° to the south over a one-year period, these times shift from day to day. As a result, prayer times every day or at least within a few days also experience changes. In determining prayer times, the most important astronomical data is the position of the sun in horizon coordinates, especially the height or distance of the zenith, and the phenomena sought to relate to the position of the sun are dawn, sunrise, crossing meridians, sunsets, and dusk. In this case, the Science of Claestial (Astronomy) plays the role of interpreting the phenomena mentioned in the Qur'an and the hadith above and is applied in the form of mathematical formulas (Ismail & Atan, 2010). In determining the schedule / times of prayer, in general the community has agreed to accept astronomical data (read: calculations) as a reference.

Meanwhile, in determining the direction of Qibla, the Word of God states, "And wherever you come out (come), then turn your face to the Grand Mosque; Surely that provision is truly something that haq from your Lord. And Allah is never unmindful of what you do "(QS Al Baqarah: 149). The Qibla is the direction that Muslims go from all corners of the earth in prayer, with the location of the Ka'bah al-Syarifah in the city of Mecca al Mukarramah of the Kingdom of Saudi Arabia (Musa, 'Ilm al Falak bayna as Sa'il wa al Mujib, 2004 M). For Muslims, the direction to Mecca is seen from its position is very important, because therein lies the Kaaba which is the direction of the Muslim prayer mecca. Especially from Indonesia, the Kaaba is around 20º - 30º from the west counted to the north. This position can be determined in principle if we know the geographical position of the Kaaba (Latitude and Mecca Longitude) and the geographical position where we are (Latitude and Longitude region/city in Indonesia) (Abdel-Wahab, 2019).

Furthermore, at certain times, twice a year, the Sun is directly above Mecca (Kaaba). So if we at this time look to the Sun, and draw a straight line from the Sun, we will get the position in the Qibla direction without having to do any calculations at all, the moment occurred on May 28 at around 16:18 West Indonesia Time and July 16 around 16:27 West Indonesia Time.

Furthermore, astronomy also plays a role in determining when and where the eclipse falls, be it a solar eclipse or a lunar eclipse. In Islam itself there is a sunnah worship called eclipse circumcision prayer, where the prayer prayer has a high priority. So in this case astronomy plays a role in determining when and where the eclipse event occurs.

III. METHOD

This study is a qualitative study that follow a review or a library research model. This study aims at explaining the

socio-political aspects in the development of astronomy in Islamic world. The data of the study were collected from the books and journals about Islamic astronomy. The collected data were analyzed using content analysis technique.

IV. FINDING AND DISCUSSION

SOCIAL AND POLITICAL ASPECTS OF THE ADVANCEMENT OF ASTRONOMY IN MUSLIM

History records, advances in science and technology in the Islamic world cannot be separated from the role of the king (sultan) who is in power. In the context of astronomy (astronomy) progress and development, the ruling kings often provide support to their scientists and pay attention to related educational institutions.

In the Islamic world, astronomy or astronomy has developed into other studies such as shipping, agriculture, military, mapping, and others. No half-hearted, the Caliph Al-Mansur for example, he spent large state funds in order to develop astronomy studies and other studies at the time. During this period astronomy studies also developed scientifically with various improvements and new breakthroughs. Specifically in the interests of worship, Muslim astronomers have performed scientific calculations of prayer times, Qibla direction, rukyatul hilal, calculation and forecast of seasons, and others (Maskufa, 2017). Development and academic climate in such a way is undeniably the service and contribution of the authorities at that time. And in reality the decisions and wisdom of the 'politics' of the authorities at that time had a significant influence on the development of astronomy.

In addition to the large allocation of funds from the state, traditions and movements of translating pre-Islamic scientific literature into Arabic also have a large role in the progress of astronomy in the Islamic world (Khalidi & Dajani, 2015). Since the time of the Umayyad Daula, especially in the time of the Khalifah Khalid bin Yazid, there has been a flurry of movements for the translation of foreign astronomy literature into Arabic (Rababah, 2015).. One of the pre-Islamic astronomy texts translated into Arabic is a book titled *"Miftāḥ an-Nujūm"* ascribed to Hermes the Great. Next follows the book titled *"Sindhind"* of 154/771 translated by Ibrahim al-Fazzāri (d. ± 180/796), followed by "*Almagest*" by Ptolemy translated by Yahya bin Khālid al Barmakī and perfected by Al-Hajjāj bin Maṭar and Sābit bin Qurrah (d. 288/901), and other works.

The whole translation was funded by the king (state), not even the wages paid to the translators when the amount was very large. In addition, in practice the kings or the royal family also often invite qualified Muslim scientists to the palace for discussion and dialogue on scientific issues. Apparently, this kind of tradition is something that was prevalent at the time. No doubt this is very encouraging and developing the study of astronomy in the Islamic world.

It's just worth noting, the progress of astronomy in the Islamic world is not merely due to socio-political factors alone, but there are other factors that influence each other. Among these factors are: (1) the geographical location of Mecca and the Kaaba, (2) the demands of branches of Islamic law, (3) the strategic principles of the Koran, (4) the topography of the earth and the Arabian peninsula, (4) Appreciation of the ruler (king), (6) Tradition of translating philosophical texts and natural sciences, (7) Traditions of correction and commentary, and (8) Dynamism and cosmopolitanism of tradition, scientific (Butar-Butar, 2016). According to Butar-butar (2016), these eight factors are all interrelated, and many of them are supported by the king (state) both socially and politically .

Financial security and political support from the authorities are important factors for the progress and development of a research project. Since research for developing something new cost a lot of money, financial support is really needed (Hall, 2002). The government financial support in research will give a large impact on the researchers' productivity (Jacob & Lefgren, 2011). Besides financial support, special training also has a greate contribution to scientific productivity (Jacob & Lefgren, 2011). Although not always identical, in general a great goal will always be parallel with the large costs allocated by the authorities. The Abbasid caliphs were known to be very supportive of scientific activities, including by establishing madrassas, libraries, and scientific assemblies. The library is a symbol of the progress of science, where the kings and rich people competed in building it. Nearly all mosques have large libraries that are used as a place for meetings and discussions of various scholars. At that time the libraries are the media of dissimenation of knowledge and religion (Surtikanti, 2018). The library tradition also spreads to other Islamic worlds. The library "al-'Aziz bi Allah al-Fathimy" in Cairo, for example, contains one million more literatures. *"Dār al-Hikmah"* (House of Wisdom), which is also located in Cairo, consists of one hundred thousand volumes of books, including mathematical and astronomical texts. "Dār al-Kutub" (House of Books) in Cordova contains four hundred thousand volumes with only 44 catalogs.

While the nobility of the role not less with a lot to contribute to the progress of science. Their motivation is none other than the love of science and in order to decorate their assemblies with scholars. Caliph al-Ma'mun (d. 218/833) once gave Hunain bin Ishaq a reward worth of gold scales in every work he translated. Sultan Mas'ud al-Ghaznawi once sent for al-Biruni (d. 440/1048) three camels filled with silver in return for the fruits of his work *"al-Qānūn al-Mas'ūdy"* (The Mas'ud Law), although al-Biruni did not receive the prize (Basya, 1429/2008).

While the Caliph al-Mansur (d. 158/775), he promoted studies and research in the field of astronomy. The Caliph without hesitation spent large state funds for the development of astronomical studies at the time. The funds spent are used for activities related to astronomical discussions and observations. During the Abbasid period astronomy studies also found a mature character (Musa, Tārīkh 'Ilm al-Falak Mundzu Qadam al-'Ushūr wa Hattā al-'Ashr al-Hādhir, 1984).

History records, the progress of astronomy at the time of the Abbasids was extraordinary, even he was the best in the history of Islamic civilization. In this era the study of astronomy was not only seen and studied in the perspective of the practical importance of worship, but also developed for the

benefit of other sciences, such as shipping, agriculture, military, mapping, and others. In addition to the established observation tradition, in this era there has also been a growing tradition of translating and criticizing non-Arabic astronomical works, besides the birth of original works by Muslim astronomers. In addition, the attention of these rulers was also marked by the real role of the caliph. He presented many astronomers from various ethnicities, and he also often consulted with these astronomers. The city of Baghdad itself, which was founded in 762 AD, was at that time a center of world science and civilization for several centuries. Even the construction and arrangement of the city was designed by many astrologers and astronomers who were not only from the Arabs (Islam), but also from the Jews, Persians and Indians (Nakosteen, 2003).

During the time of al-Ma'mun astronomical observation activities were rife, and as an access to the establishment of astronomical observatories in the cities of Baghdad and Jundisapur. The establishment of this observatory makes astronomical studies increasingly grow and spread throughout the Arab world. Here, the role and contribution of the authorities is the key to the glory of astronomical studies in Islamic civilization.

In addition, the tradition of translating scientific texts also influenced the development of astronomy in Islamic civilization. Language is a medium of human expression and communication through which the ideas and ideas of a person or group of people can be conveyed. In the early Arab context, Arabs and non-Arabs were separated from each other. This separation eventually gave birth to cultural and linguistic differences. In the scientific context, language and communication difficulties are the cause of the undevelopment of a civilization. It is in this context that it is important to translate non-Arabic texts into Arabic that aims to explore and bring to life the long-buried Arab philosophical and scientific reasoning (Akan, Karim, & Chowdhury, 2019).

In reality, translation activities are a powerful way to understand the outside world to be absorbed and developed in Islamic civilization. Translating, in fact again is one of the few media available for Muslims to get to know the treasury of pre-Islamic science or what is known as the 'early sciences' *(‘ulūm al-awā’il)*. Khalid bin Yazid (d. 85/704) - one of the caliphs of the Muawiyah era - was the one who spearheaded the translation movement of scientific literature from foreign languages into Arabic. Translations and initial transfers were made from the Greek and Syrian treasures. The caliph was indeed known to have an interest in science, especially chemistry (Butar-Butar, 2016).

Globally, historiography and periodization of translations in Islamic civilization have been discussed by several scholars (see Hirschler & Savant, 2014; Mårtensson, 2005) This historiography and periodization can be divided into several periods. The first period, starting from the era of al-Mansur (d. 158/775) in 136/753 and ending in the era of Harun al-Rashid in 193/809. Some popular translators in this era can be mentioned including Yahya bin Patrick (the era of al-Mansur), Georgius Gabriel (a doctor), Theodore, Salam al-Abrasy (Barmak era), Samuel Matran, Ibn Muqaffa '(d. 142 / 759 or 148/765), and Yuhanna bin Masawaih (a Syrian Christian of the Harun al-Rashid era). During this period books were generally translated mostly into medical, logic and geometric texts. These sciences are needed at that time in everyday life.

The second period, starting from the era of al-Ma'mun (d. 218/833) 198/814 to 300/912. Some translators in this era include: al-Hajjaj bin Yusuf Mathar, Qustha bin Luqa (d. 300/912), Hunain bin Ishaq (d. 260/874 or 263/877), Esteban bin Basel, Musa bin Khalid, Yahya ibn Harun, Ishaq ibn Hunain (d. 298/910), Thabit ibn Qurrah (d. 288/901), Hubaisy ibn al-Hasan (known as 'Hubaisy al-A'yam', son of Hunain's sister, died in the year 300/912), Ayyub (more popular with 'al-Abrasy'), Isa bin Yahya (Hunain's student in the field of translation), Abu Uthman Sa'id bin Ya'qub (translator of Ali bin Isa, one of the ministers of al-Ma ' mun), and Ibn Shilat (d. 529/1134). In this period the Greek astronomy text Almagest was translated by Ptolemy and the text "The Golden Verses" by Pythagoras. Likewise, the works of Galen, Plato and Aristotle have been translated.

The third period, from 300/912 to the middle of the 4/10 century. Some translators in this period include: Mata bin Yunus (he worked in the caliphate of ar-Radhi in Baghdad), Sinan bin Thabit (d. 360/971), Yahya bin 'Ady (d. 364/974), Isa bin Sargent, Ibn Zur'ah, and Hilal bin Hilal al-Himshi. It is noteworthy, the activity of translation in the last two periods is more intense than the first period, where translation is no longer limited to books of logic and medicine, but all branches of philosophy: the natural sciences, morality, and politics. During this period logic books and natural sciences were also translated by Aristotle and their comments by Iskandar and Yahya an-Nahwi. Besides books are also translated geometry books and other natural sciences. (an-Najjar, 1993)

Geographically, the Islamic power in Damascus was a place where Greek thought was flourishing. One of the efforts of the king was the encouragement of Greek scholars who settled in Egypt to do the translation of the Greek treasures (Myers, 2003). The king at that time gathered figures from various circles who had the ability of the Greek language and sufficient scientific background to translate Greek scientific texts, in addition to providing adequate facilities for these translators. The tradition of translation was continued by another Umawiyah king, Marwan. He once ordered the translation of a Syrian medical text by Aaron into Arabic (Abdullah, et al., 2002).

In the Umawiyah period, translation activities seemed to be slow, except after entering the Abbasid era (750-1258 AD) translation activities began to flourish and become established (Rababah, 2015). Caliph Harun al-Rasyid was noted to have gathered intellectuals in a halakah to develop the traditions of Greek and Indian science, including translating two of the most popular astronomical texts: Sindhind and Almagest. The first text was translated by Muhammad bin Ibrahim al-Fazzari (d. 159/777) and Ya'qub bin Thariq (2/8 century), the second by Hunain bin Ishaq (d. 260/874 or 263/877) and later in revision by Thabit bin Qurrah (d. 288/901). In addition to these two texts, the Persian astronomy table titled Zij Syah or Zij Syahryaran was also successfully translated into Arabic (Butar-Butar, 2016).

The peak of translating activity actually occurs when standing and operating *Bait al-Hikmah* (House of Wisdom) which was built by al-Ma’mun. *Bait al-Hikmah* was a research and translation center which later developed into a large

academy. *Bait al-Hikmah* in the beginning was a simple library called *Khizānah al-Hikmah* (Khazanah Hikmah), which has been operating since the caliph Harun al-Rashid. Al-Ma'mun increased the activities of the institute by including teaching and translating projects of philosophical works and foreign knowledge from various languages (Nakosteen, 2003). Although it is not the only activity in it, but the translation activity seems to be the most dominant activity. Al-Ma'mun actively gathered the best translators of the time to work at this institution. Not only that, al-Ma'mun was also very enthusiastic about collecting classical works in various languages to be studied and translated into Arabic, so that they could be studied. Al-Ma'mun even succeeded in sending a group of messengers including Bait al-Hikmah staff in it to Byzantine territories to search for valuable manuscripts and bring them home to Baghdad, then to study material in Bait al-Hikmah (Makdisi, 1990).

For this achievement, the era of al-Ma'mun actually became a miniature of science in the history of Islamic intellectualism, especially in the transmission of foreign sciences into the Islamic treasury. Indeed, the initial stage of translation in the Abbasid era began in the time of al-Mansur, only reaching a maximum below al-Ma'mun which continued into the 4/10 century. The most active translators in the Bait al-Hikmah during Harun al-Rashid and al-Ma'mun were Abu Sahl Fadhl bin Nubekht and 'Alan asy-Syu'ubi, both Persians, and Yohanna bin Masawaih, a Syrian Christian (Nakosteen, 2003).

Another translator who came later but did not lose the role was Hunain bin Ishaq (d. 260/873), one of Masawaih's students. Hunain not only served as a translator, but also as one of the pioneers of scientific terminology in Arabic, which in his time was still in early development (Asari, 2013). Hunain translated many works by Plato, Aristotle, Galen, Apollonius and Archimedes which covered the fields of philosophy and various other sciences. Another translator was Qustha bin Luqa (d. 300/912) who not only did the translation but also revised the previous translations. Thus he not only enriched but also improved the quality of translations circulating in Arabic among Muslims (Qadir, 1990).

In the 7/13 century, Nashiruddin al-Thusi (d. 672/1273), director of the Maragha Observatory, Iran, translated many Greek texts into mathematics, geometry, astronomy and optics. According to Abbas Sulaiman, al-Thusi was a person who understood Greek sciences well and was able to represent Greek treasures well. Even the earlier Latin translations of the Greek treasures were guided by the re-copy (tahrīr) of al-Thusi, even more guided by the original Greek work where most of it was lost (Sulaiman, 2006).

In the modern context, Greek scientific works rewritten by al-Thusi were in fact the only source after the loss of the original Greek source to the medieval Western world. Therefore, al-Thusi played a major role in the advancement of European intellectuals. A copy of al-Thusi in the field of astronomy includes "Zhāhirāt al-Falak" by Euclid (d. 270 BC) consisting of 23 formulas, in other texts 25 formulas. Furthermore "al-Falak ash-Shaghīr" by Qustha bin Luqa (d. 239/854). In the field of geometry, among others, "Tahrīr Usul al-Handasah" which is also the work of Euclid (d. 270 BC). In the field of optics, al-Thusi translated the book "Tahrīr Kitāb al-Manāzhir" by Euclid (d. 270 BC) which had been captured by Ahmad Sa'id ad-Demerdash (King, 1990).

V. CONCLUSION

From the description above, it seems clear that the social and political climate greatly influences the development of science in the Islamic world. The scientific tradition (between translation) and the appreciation of the authorities are two important pillars in the progress of astronomy in the Islamic world. However, it should also be noted that the factors of the development of astronomy in the Islamic world were not merely due to the rise of scientific traditions and the socio-political role of the authorities at that time. There are still many other factors that are interrelated with one another, including: (1) the geographical location of Mecca and the Kaaba, (2) the demands of branches of Islamic law, (3) the strategic principles of the Koran, (4) Topography of the earth and the Arabian peninsula, (4) Appreciation of the ruler (king), (6) Tradition of translating philosophical texts and natural sciences, (7) Traditions of correction and commentary, and (8) Dynamism and cosmopolitanism of traditions of scientific spirit.

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