


Observatory Development Strategy and Program

Hizami Sabil^{1*}, Alfath Khair Harefa²

^{1,2} Universitas Muhammadiyah Sumatera Utara

Email: 12hizam21@gmail.com

Article Info	ABSTRACT
<p>Article History Received 07-11-2023 Revision 16-12-2023 Accepted 20-01-2024</p> <p>Keywords: observatory, astronomy, research</p>	<p>Observatories are the main means of observing and studying celestial objects. The function of the observatory is seen in three ways, namely as a center for sky studies, scientific institutions, and a means of determining the time of worship. To exist and develop an observatory in the modern era entrusts the existence of planned strategies and programs. The strategy in question is mastery of astronomy, mastery of religious aspects (jurisprudence), mastery of astronomical history, mastery of observatory philosophy, and the availability of observation areas and representative practicum rooms. Meanwhile, the work program in an observatory includes three things, namely: (1) research programs (observations) of celestial objects, (2) astronomy education programs for the community, and (3) community service programs related to astronomy.</p> <p style="text-align: right;">This is an open-access article under the CC-BY-SA license.</p> <div style="text-align: right;">  </div>

I. Introduction

In modern practice, observatories are the main means of observing and studying celestial bodies. In the context of universities, the means of studying and researching celestial bodies were initially more popular with the term Falak Science Laboratory but now switched to the term observatory. In its development, the establishment of this observatory institution continues to mushroom in Indonesia, especially in the Higher Education environment.

In practice, both in classical and modern times, observatories are synonymous with various astronomical instruments, in addition to the location of special and strategic places. In the modern context, the observatory can be declared as both a heritage and a very valuable contribution to Islamic civilization. Seyyed Hosein Nasr in his work entitled "Islam, Science, and Civilization", states that the observatory as a scientific institution is an original

contribution to Islamic civilization. In this institution, the study and development of astronomy and related sciences took place vigorously in the Middle Ages [1].

The existence of observatories in the modern era is part of an effort to reprise the majesty of Islamic civilization, especially in the tradition of scientific research on the heavens and universe, then also a form of response and appreciation to the development of science, science, technology, and civilization.

Terminology and Origins of Observatories

Indeed, the origins and practice of observation (which later became the observatory) have existed since pre-Islamic times, among others have existed and been practiced since the Greek era of Ptolemy, but only found its definitive practice and understanding in Islamic civilization, which was pioneered by Caliph Al-Ma'mun who funded scientific research and at the same time initiated the establishment of observatories in the Islamic world.

In Arabic, the observatory is called 'al-marshad' (plural 'al-marāshad'), while in English it is called 'observatory'. 'Al-Marshad' itself comes from the root word 'ar-rashd' or 'ra-shada'. In the language encyclopedia "Lisān al-'Arab" by Ibn Manzhur (d. 711 AH/1311 CE) it is mentioned that the word 'ar-rashd' means 'yarqub' or 'taraqub', i.e. guarding or watching. Meanwhile Ibn Faris (d. 395 AH/1005 CE) in "Maqāyīs al-Lughah" mentions that the word 'rashd' comes from one word namely rashd, which means "at-tahayyu' liriqbah shay' 'alā maslakihī" (preparing something to anticipate on the way). In addition, the word 'ar-rashd' can also mean "al-mulahazhah ad-daḡiqah" i.e. careful observation. The word 'al-marshad' means "mauqi' ar-rashd" or "maudhi' ar-rashd", i.e. a place of guarding or a place of watching. From this literary meaning, it can also be concluded that 'ar-rashd' means observation, while 'al-marshad' means observation place or observatory [2].

In classical Islamic intellectual treasures (turats), observatories or 'al-marshads' are also called 'ar-rashd' (observations), 'dār ar-rashd' (observation areas/villages) and 'bait ar-rashd' (observation houses). Thus from the meaning of this etymology can be drawn substance and the common thread of understanding the observatory (al-marshad), which is a place to observe or observe celestial objects carefully and thoroughly. As for terminology, observatories can be defined as a certain building and in certain locations where observations of celestial objects are carried out using certain astronomical instruments (especially telescopes), where these observations are recorded and documented [2].

This definition is almost similar to the Big Indonesian Dictionary (KBBI) which defines an observatory as a building equipped with tools (telescopes, binoculars, and so on) for observation and scientific research about stars and so on.

II. Method

This research uses library research. In obtaining Research data, researchers collect, analyze, organize, and source from Articles, books, past research on the implementation of strategic management in the Observatory. Then the researcher concludes and presents the data Management Strategies for Improving the Observatory Quality.

III. Results and Discussion

The Role of Observatories

There are at least three central roles of observatories: sky assessment centers, scientific institutions, and means of determining worship[2]. Assessment and research of celestial bodies in an observatory on its way metamorphosed into a place of astronomy teaching and scientific discussion. It's just that in practice it requires special equipment [3].

Meanwhile, the observatory as a scientific institution is a social demand of the Muslim community both related to worship and daily activities. A major factor in the emergence of this institution was both an expression and appreciation of Greek and Hellenistic heritage [4]. In its early presence, the observatory was a model for a science organization, for which at least two factors triggered its emergence. First, the observatory – as a scientific institution – can reflect the nature of scientific research through organized natural observations. This became the basis for the development of scientific theories that continue to develop and have character. Second, the observatory as a social organization reflects the peculiarities of scientific institutions depicted in the collective practice and cooperation among Muslim astronomers [5]. These two factors influenced the advancement of astronomical knowledge in the Islamic world.

The role of the observatory as The means of determining the prayer times is because the important worship of Muslims (especially prayer and fasting) is closely related to the movement and phenomenon of these celestial bodies. The motion and phenomena of the moon and sun become the standard limits and times for beginning and allowing worship. Prayer times are determined based on solar phenomena. For this purpose, observing the sky became a must for Muslims [6]. Meanwhile, the determination of the beginning of the moon requires observation and calculation of the crescent. Similarly, determining the direction of Qibla, especially for someone who is far from the Kaaba and or Mecca, requires knowing the point (coordinates) he is located and the position point of the Kaaba. Through the study of the heavens and all phenomena, the objects provide information and formulations about the direction.

Development Strategy

▪ *Mastery of Astronomy*

Mastering the theoretical and practical basics of astronomy is a necessity for people working at an observatory. This is fundamental because observatories are the pinnacle of astronomical insight and practice. An observatory that does not have human resources who master astronomy both in theory and practice will cause the observatory to run not ideal. Mastery of astronomy is a demand and at the same time a challenge that must exist and be met.

The glitter of the night sky with its celestial bodies is a pleasure and challenge for astronomers working at the observatory. To photograph and examine celestial objects, of course, you need instruments to find and track celestial bodies, in this case, especially telescopes. While the technology of searching and tracking celestial bodies continues to develop along with the times, science, and technology. Therefore, the observatory crew must have the expertise and ability to operationalize these instruments, and at the same time be able to follow and adjust the development of telescope technology and its devices. Then at the same time also mastered astronomy from various aspects [7].

▪ *Mastery of Religious Aspects (Jurisprudence)*

The religious aspect referred to here is astronomical phenomena that occur in the sky but have a connection and even become a condition for the implementation of worship. For Muslims, for example, there is an importance in determining the schedule of the five daily prayers. As is known, the entry and end of prayer times are determined by the daily phenomena of the Sun. Another example, is related to the direction of Qibla, which is a legal requirement for prayer. Then the problem of determining the beginning of the month that never ends in Indonesia. Some of these things are related to celestial phenomena called the moon and sun and are the domain of astronomers, but at the same time, they are related to the needs of Muslims and related aspects of postulate (jurisprudence). Therefore, observatory crews must have and prepare qualifications to understand these aspects of worship to provide a scientific solution and not contradict the Sharia. In this context, astronomers working at observatories should not be selfish with only the principle of science and science alone [7].

- *Mastery of Astronomical History*

Mastery of the history of astronomy across time and time is important. Because achievement in science in any field does not exist in a vacuum, there is a factor that underlies it and precedes it, which is called history. In the context of astronomy, there are many treasures (history) that can be gleaned and at the same time must be understood from its long history. As is known, astronomy has existed and practiced since humans existed on Earth, even a theory says that astronomy has existed since the universe was formed. Thus it is understandable that astronomy has stopped at every civilization and nation that each has its peculiarities.

Astronomy as it develops today, especially in the West, did not come suddenly. He was born with a long process and thanks to his contact with the previous treasures (Arab-Islamic). Therefore, it is wrong, as it is happening today, to believe that Western astronomy as developed today is a legacy of the Greek astronomical civilization by ignoring the role and contribution of the Arab (Islamic) civilization. If carefully traced through historical sources, it will appear that Arab civilization made a significant contribution to the development of Western astronomy, which began in Spain (Andalusia). Therefore, ignoring the contribution of Islamic civilization to the development of astronomy is a form of historical distortion, and this should not be allowed by an institution called an observatory [7].

- *Mastery of Observatory Philosophy*

Observatories as institutions that study the sky require people in them to have a holistic and philosophical perspective. This is due to the observatory's universal nature of combining the earth and the sky. Therefore, the thing that must be understood at least is the values and wisdom such as accuracy, cooperation, and coordination (deliberation). These three things are important and must be understood and animated by the entire crew of the observatory [7].

- *Observation Area and Practicum Room*

Observation areas or parks with a representative area are required for public observation. In addition, it is also needed as an astronomical practicum place for students, students, and the public in general. Astronomical moments that are routine (annual) are often celebrated by the public by displaying and exhibiting astronomical tools and other treats. Therefore, the existence of a large area (field) is an important need for an observatory.

Program

The observatory programs referred to here are observatories in the educational category, precisely observatories as being under or within the scope of universities. In the context of educational observatories, there are at least 3 (three) major programs that can be carried out and characterized, namely: (1) research programs (observations) of celestial bodies, (2) astronomy education programs to the community, and (3) community service programs related to astronomy.

Research programs or observations of celestial bodies are fundamental things of an observatory, whatever the pattern and category, observation is something that must exist and be done. Observation of celestial bodies is a common feature of an observatory. In practice, the studies (observations) of celestial bodies that can be done are very many, as many as the celestial bodies themselves. However, in the context of the university observatory, some things must be adjusted, namely related to administration, bureaucracy, and the vision and mission of higher education [8]. But in general, sky research that can be done includes hilal observation. As is known, this celestial body has significance in Islam because it is a sign and standard for the start of worship, which is related to fasting and holidays. Moreover, in the Indonesian context, the issue of determining the beginning of the month, which is a hilal problem, is still a discourse that has not ended to this day. Therefore, educational observatories in universities can conduct research and further academic studies on it from various aspects. This is certainly a real contribution to an observatory in college. In addition to hilal, other moon-related research is research on lunar craters, research on lunar phases, ijtimak (conjunction) research, and others.

Furthermore, no less important is the study of dawn and shafak to determine the definitive formula for Fajr and Isha times. As is also known, this issue (especially the determination of the time of Fajr) in the country lately is still dynamic and a debate. Therefore, an observatory in a college should play a role. Some observatories under universities have done this, for example, Bosscha Observatory in Bandung (West Java), Ahmad Dahlan Observatory (OAD) in Yogyakarta, then the Falak Observatory of the University of Muhammadiyah North Sumatra (OIF UMSU) in Medan [9]. These three observatories at least now have data and 'conclusions' about the number of dawn and shafak [10].

In addition to the two studies above (hilal and syafaq), of course, there are many more studies of celestial bodies that can be done, such as solar research, sunspots, transits and conjunctions of celestial bodies, eclipse research, and others.

Meanwhile, the astronomy education program is very important in the context of higher education. In reality, these related programs are numerous and very much in line with campus programs. In the context of observatories, an astronomy training program is the right thing to do. The training can be general, namely for students, for students, or the general public. Some of them include Qibla direction training, prayer times, eclipses, the beginning of the month, calendar conversion, and others. In addition, training on the introduction and use of astronomical instruments such as telescopes, theodolites, rubu mujayyab, astrolabe,

mizwala, and others. For advanced levels, it can be continued with astrophotography training, processing hilal images and celestial bodies, and others.

In its development again, in some campus observatories, sometimes planetarium facilities are available, thus astronomical education projects will run more easily and plan. Bosscha Observatory, for example, provides a planetarium (flat) or called a multimedia room that is very helpful for visitors to see a simulation of the universe. [Meanwhile, another university had a dome planetary as their soh.](#) Likewise, at the Falak Science Observatory of the University of Muhammadiyah North Sumatra (OIF UMSU), there is also a planetarium (flat) which is used as a means of [learning](#) the universe.

Astronomy education programs can also be carried out through routine or annual astronomical moments, such as International Observe the Moon Night (InOMN), Astronomy Day, Rasdul Kibla, and other astronomical moments. Providing facilities and explanations for these moments is a good way of educating the community. For these moments, it seems to have been common by campuses in Indonesia, however, they do not yet have observatory facilities.

As for the community service program, it is also a program that is no less important than the previous two programs. However, it seems that each university is different in its service application, according to the locality and culture of each university. However, astronomical devotion in general is the measurement of the direction of Qibla and enlightenment to the public regarding astronomical moments or phenomena that occur. At the Falak Science Observatory of the University of Muhammadiyah North Sumatra, for example, the Qibla direction measurement and accuracy program is a service program that is quite instinctive and is a community need. Until now, the OIF UMSU team has measured and accurate the direction of Qibla in more than a hundred places which include mosques, prayer rooms, fields, offices, and others. Even in practice, this observatory collaborates with the local Ministry of Religious Affairs, where the minutes of the Qibla direction measurement results are penetrated to the Regional Office of the Ministry of Religious Affairs of North Sumatra Province and then forwarded to the center [7].

IV. Conclusion

Through the description above, it can be concluded that the observatory is a very valuable heritage of Humanity especially Islamic civilization. In its journey, the observatory has a very significant function or role in human life. In the modern context, the observatories exist as barometers and standards to assess the sky which is indicated by some strategies and programs that must be contained in it, all of which are useful and/or used for the benefit of society, especially Muslims.

References

- [1] S. H. Nasr, *Science And Civilization in Islam*, 1st ed. Chicago: ABC International Group, Inc., 2001.
- [2] A. J. Rakhmadi, *Observatorium: Sejarah dan Fungsinya di Peradaban Islam*. Medan: UMSU Press, 2014.
- [3] H. Asari, *Menyingkap zaman keemasan Islam : kajian atas lembaga-lembaga pendidikan*, 3rd

- ed. Bandung: Ciptapustaka Media, 2007.
- [4] A. Sayili, *al-Marāshad al-Falakiyyah fī al-‘Ālam al-Islāmy*, 1st ed. Kuwait: Mu’assasah al-Kuwait li at-Taqaddum al-‘Ilmy, 1995.
- [5] A. Al-Qadiri, *Mu’assasah ‘Ilm al-Falak al-‘Araby Dirāsah fī at-Tārīkh as-Susiyūlūjiy li ‘Ilm al-Falak al-‘Araby fī al-Qarnain ar-Rābi’ wa al-Khāmis al-Hijriyain*. Damaskus: Wizārah ats-Tsaqāfah, 2009.
- [6] A. J. Rakhmadi *et al.*, “Uji Akurasi Perhitungan Waktu Ashar menggunakan i Rubu ‘ Al-Mujayyab,” vol. 20, pp. 99–113, 2022.
- [7] A. J. Rakhmadi, *Observatorium : peran dan keberadaannya di Indonesia*, 1st ed. Yogyakarta: Bildung, 2020.
- [8] C. Kunjaya, Melany, A. A. Sukmaraga, and T. Arsono, “Possibility of astronomical phenomena to be used to support tourism industry,” *J. Phys. Conf. Ser.*, vol. 1231, no. 1, 2019, doi: 10.1088/1742-6596/1231/1/012025.
- [9] A. J. Rakhmadi and M. Hidayat, “the Falak Science Observatory of University of Muhammadiyah North Sumatra (Oif Umsu) and the Contribution in Fajr Time Research,” vol. 2, pp. 851–858, 2021.
- [10] A. J. Rakhmadi, H. R. Setiawan, and A. Y. Raisal, “Pengukuran Tingkat Polusi Cahaya dan Awal Waktu Subuh di OIF UMSU dengan Menggunakan Sky Quality Meter,” *Titian Ilmu J. Ilm. Multi Sci.*, vol. 12, no. 2, pp. 58–65, 2020, doi: 10.30599/jti.v12i2.667.