

The Contribution of Arabic to the Process of Scientific Advancement in the XIII-XVIII Century AD

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Abstrak

Penelitian ini mengkaji kontribusi bahasa Arab terhadap kemajuan ilmu pengetahuan pada abad XIII-XVIII Masehi. Era ini ditandai oleh penyebaran Islam yang memberikan pengaruh pada peradaban, termasuk penguasaan dan pengembangan ilmu pengetahuan. Namun, penelitian mengenai peran khusus bahasa Arab dalam transfer dan inovasi pengetahuan masih terbatas. Dengan pendekatan deskriptif kualitatif berbasis filologi, penelitian ini menganalisis sumber primer seperti Al-Qur'an dan Hadis, serta karya ilmiah dalam bahasa Arab, seperti A New Dictionary of Scientific and Technical Terms karya Ahmad Syafiq Al-Khatib. Hasil menunjukkan bahwa bahasa Arab berfungsi sebagai medium penting dalam penerjemahan, pengembangan, dan penyebaran ilmu di berbagai bidang, termasuk kedokteran, filsafat, matematika, dan geografi. Bahasa Arab mendukung interaksi antarperadaban dan mendorong transformasi intelektual Eropa selama Renaisans. Oleh karena itu, bahasa Arab tidak hanya memfasilitasi transfer ilmu tetapi juga memperkaya peradaban global dengan kontribusi intelektualnya.

Kata Kunci: Bahasa Arab, Abad XIII-XVIII Masehi, Perkembangan Ilmu Pengetahuan, Renaissance Eropa, Peradaban Islam

Abstract

This research examines the contribution of Arabic to the advancement of science in the XIII-XVIII centuries AD. This era was marked by the spread of Islam, which influenced civilization, including the mastery and development of science. However, research on the specific role of Arabic in knowledge transfer and innovation is still limited. Using a descriptive qualitative approach based on philology, this study analyzes primary sources such as The Holy Quran and hadith and scientific works in Arabic, such as Ahmad Syafiq Al-Khatib's A new Dictionary of Scientific and Technical Terms. Results show that Arabic served as an important medium in translating, developing and disseminating knowledge in various fields, including medicine, philosophy, mathematics and geography. Arabic supported the interaction between civilizations and drove Europe's intellectual transformation during the Renaissance. Therefore, Arabic facilitated the transfer of knowledge and enriched global civilization with its intellectual contributions.

Keywords: Arabic Language, XIII-XVIII Century, Development of Science, European Renaissance, Islamic Civilization

Introduction

Islam's relatively rapid development and spread have caused several significant movements and changes throughout the world (Suaedi, 2016). This occurred between the eighth and eighteenth centuries AD. This was proven both before and after the arrival of Islam. Several European countries discussed the progress of science before Islam came. Most Europeans were not allowed to learn to read and write by state authorities. Therefore, almost all ulama, scientists and academics are castrated so that there is no transfer of knowledge.

The Dark Ages in Europe were comparable to today's predicament. Things became more difficult as suffering intensified and misery engulfed European society. Asian and African societies have both experienced significant social developments. In contrast to India and Saudi Arabia, where rape, gambling, murder, and drinking are commonplace, majority rulers employ discrimination and oppression to siphon off the nation's wealth (Krasteva-McCauley, 2014). Christian and Jewish leaders were equally involved in this.

However, this has slowly changed since the arrival of Islam. Since Islam entered, there is no longer any Judaism or Christianity (Center, 2015). The reason is, that Allah has decreed, "All heavenly religions are declared null and void, and Islam is the only valid religion of Allah until the end of time." (Husin et al., 2020). Religion is a source of truth with two important goals: equality of all human rights and monotheism (Firestone, 2020). The progress of science has also been impacted.

Islam in European countries also contributed to modern civilization. Three things encourage its growth: making The Holy Quran the only source of moral guidance and benchmark for thinking, behaving and acting; requiring Muslims to seek the truth and obey His teachings; and staying away from a culture of ignorance (Safdie, 2023). In this way, significant changes occur, such as improvements and renewal in the development sector (Cabello, 2023). Apart from that, since the religious split into Catholicism and Protestantism and the Crusades, society has experienced a crisis of faith. In this time of crisis, Islam has become a loyal friend against secularism and communism (Haqparast & Salangi, 2024).

As in Africa and Asia, many conflicts and colonialism occurred. Because religion and science used to be opposites, one of the key players in the colonization process brought important information about life, especially the understanding that colonization depended on faith. Religion will also become outdated if there is ignorance. As a result, the community

began to balance science and religion (Tarusarira, 2020). These changes were experienced in Asia, Africa and the United States.

Based on the background that has been explained, Islam brought the development of science to various parts of the century. Of course, the environment and cultural norms use various approaches and techniques. This research will examine these trends to determine what changes occurred when Islam entered. This can be seen by looking at the contribution of Arabic to the advancement of science, which will then be further studied based on supporting materials.

This research was conducted to understand the strategic role of Arabic as a vehicle for developing and disseminating knowledge. Arabic is a means of communication and a medium that allows the transfer of knowledge across time and culture. By examining the history and influence of Arabic as a knowledge system, this study offers important insights into how this language supports global civilization. In the current era of globalization, a deep understanding of the Arabic language is highly relevant to strengthening cross-cultural dialogue, encouraging innovation, and preserving the world's intellectual heritage.

Research Method

The method used in this research is descriptive qualitative with a philological approach. This approach involves analyzing old texts or manuscripts to critique and interpret their content. Philological research focuses on understanding and interpreting historical facts to uncover insights into the development of science. Through this method, the mapping of scientific progress becomes clearer and contributes to contemporary discourse on knowledge and culture.

The data sources in this research are The Holy Quran and hadith, which are sources of reference for a problem and how the guidance of the Shari'a solves the problem. Then, secondary data in the form of literature on the development of Arabic knowledge, such as a book written by Ahmad Syafiq al-Khatib entitled *A New Dictionary of Scientific and Technical Terms* (معجم الإصطلاحات العلمية والفنية والهندسية) in 1982. The data obtained was then analyzed descriptively for review and exploration. Next, an in-depth periodization of the development of science in Islam was formulated and compiled.

Manuscript Description

This manuscript is from an individual's private collection, so the storage of this manuscript is different from the storage of manuscripts in museums or other large libraries.

The title of the manuscript is "A New Dictionary of Scientific and Technical Terms " by Ahmed Syafiq al-Khatib. The manuscript storage is placed at Librairie Du Liban, Riad Soth Square – Beirut with book location in Juz 3, floor 35. This manuscript was published on January 1, 1982, weighs 3.31 pounds and has 751 pages. This manuscript consists of 9 chapters, including: 1) A preface (مقدمة), 2) A table of contents (محتويات المعجم), 3) For clarification (الايضاحات), 4) Abbreviations used in this dictionary (اختصارات استعملت في هذا المعجم), 5) A dictionary of terms, technical and engineering (معجم المصطلحات العلمية والفنية (والهندسية), 6) Right-hand contents of the dictionary (ملاحق المعجم), 7) Summary of the most important council decisions related to the development of scientific terminology (موجز (بأهمالقرارات الجمعية المتعلقة بوضع المصطلحات العلمية), 8) On the development of scientific terminology and language development (حول وضع المصطلحات العلمية وتطور اللغة), and 9) Arabic and French references (المراجع العربية والافرنجية)

Result Research and Discussion

In Arabic, the word *lughoh* according to language, comes from the word *loga*, which means to speak (Umam, 1980) . Meanwhile, according to terms, many definitions are given to language, but they only explain part of the nature of language and its function. Language is "a system of symbols in the form of sounds used by certain groups of people to communicate and interact" (RI, 19880). Arabic is popular because it was defined by an Arabic linguistic expert named Ibn Jinny (died in 392 H) as follows:

اللغة هي أصوات يعبر بها كل قوم عم

" *Language is the sounds used by every people to express their desires .*"

According to Dr Mahmud Hijazy, this definition is very precise and, in essence, based on the elements of the definition of language according to recent experts because, from one aspect, this definition explains the sound form of language symbols whose function is to express desires (Hijazi, 1968).

The information provided in the form of sounds in this definition differentiates language from other symbols or signals, such as those expressed through flags, lights, or similar means, including language in written form. Language, at its core, consists of spoken and heard sounds. In its most developed form, writing is simply an effort to embody and transfer language into a visual form that can be seen or read. Thus, writing functions as a representative or extension of language.

Language can be defined as a structured system of communication that relies on a set of phonetic symbols and grammatical rules to convey meaning between individuals. This

definition acknowledges both its spoken and written dimensions while emphasizing the primacy of sound in its origin and function. Language's auditory and symbolic nature underscores its unique position as a tool for human connection and expression, bridging individuals and communities across diverse contexts.

The sounds that form the foundation of language are varied and distinct. How these sounds are pronounced differs based on speakers' cultural, geographic, and physiological characteristics. These differences, influenced by the distinct traits of nations and variations in voice, have resulted in thousands of unique languages worldwide (Zaidan, 1904) . The diversity of languages reflects the richness of human expression and highlights the adaptability of language as a fundamental element of human civilization.

العرب هو جميل منالناس سامي الاصل كان منشئوه شبه جزيرة العرب والنسبة إليه عربى ولغة عربية

" *Arabs are a group of people descended from Sam bin Nuh who were born on the Arabian Peninsula called Arabi, while their language is called Lughat Arabiyah .*"

From these explanations, one can understand that Arabic is the sounds or sentences Arabs speak to express or convey their wishes.

Apart from being a language of daily conversation and revelation or rules, Arabic can also be a language of modern science using special terms. Recently, many scholars have written in various branches of science using Arabic, such as Ahmad Syafiq al Khatib, he was born in Palestine in 1926, studied at the American University of Beirut, and became director of a language institute in Lebanon as a linguist. He has succeeded in compiling a dictionary of science and technology terms in English and Arabic, with the title *A New Dictionary of Scientific and Technical Terms* (معجم الإصطلاحات العلمية والفنية والهندسية) (Al-Khatib, 1982) .

This book contains terms for 49 science, art, and engineering branches and is equipped with various kinds of images. Ahmad Syafiq al-Khatib's efforts have been appreciated by various circles in the field of science because they can be used as evidence that Arabic can keep up with the times.

1. History of the Arabs in Mastering Science in the VIII-XIII Centuries AD

In the Middle Ages, the European world was often nicknamed the Dark Ages because the lives of the nations in Europe were greatly influenced by the coldness of the church, which was not open to Greek science and philosophy and was considered dangerous for the

Christian religion (Hamid, 2006). The closure of Greek scientific and philosophical institutions in Athens proved this. Greek philosophers were considered infidels and apostates from the Christian religion, and many of them even experienced quite severe torture and punishment because the power of the church at that time was also the power of government. This situation caused some of them to flee to Asia and settle in Syria, Iraq and other places where they could teach Greek science and philosophy (Florio, 2023) .

In countries where there was freedom to study Greek science and philosophy, after entering the territory of the Islamic caliphate, Greek science and philosophy was inherited by Muslims (Sufriansyah & Afriansyah, 2024). This was motivated by the teachings of the Islamic religion, which states that according to Islamic law, seeking knowledge is obligatory, so Muslims studied Greek science and philosophy with seriousness and perseverance, mainly when this opportunity was obtained during the Abbasid caliphate. As a result of the church's non-open attitude and harsh actions towards Greek civilization, the Western world became devoid of Greek philosophical knowledge, except for the knowledge of AD religion. Fortunately, when the Western world was in such a state, Muslims in the east could maintain and develop Greek science and philosophy. In the era of the revival or renaissance of the Western world, Greek science and philosophy were taken over again from Muslims in Asia and parts of Europe (Mifta et al., 2024) .

The first Abbasid period, 132-232 H/750/847 AD, was a time of sowing seeds to grow knowledge. Books translated into Arabic are seeds sown to grow and develop (Hamid, 2006). Next came the second period of 232-332 H/844-946 AD, namely the period of growth, development and fruition until the time of reaping the fruit or, in other words, the period of composing and creating. After the translation century was over, the Muslims actively studied the science and philosophy that had been translated, so that in the third century A.D, the first Islamic philosopher was born, namely Abu Yusuf Ya'qub bin Ishaq al-Kindi in 796-873 AD (Halil et al. , 2024) .

The translation of books on science and philosophy during the Abbasid period was encouraged by several factors, including: (1) the state of defense and security of the government gradually became better during the time of the Abbasid caliphate, so the government became increasingly intense, stable and provided opportunities to start moving in the field of science, especially during the era of Caliph Harun al-Rashid and Caliph al-Ma'mun (2) the demands and challenges of the times at that time required the development of ways of thinking in such a way, so that they could produce religious thought that could

be accepted by the level of advanced thinking (Al -Khatib, 1982) . Therefore, philosophy and the science of *mantiq* (logic) are vital to logically explaining problems related to aqidah and religious teachings. In addition, the need to carry out religious obligations at certain times, such as prayer, fasting, Hajj and so on, is a driving factor for studying falaq or astronomy and (3) the Abbasid caliphs such as al-Ma'mun, Harun al-Rashid and al- Mansur paid great attention to philosophy and science. The Caliph as the highest leader in government always provided facilities, assistance and appreciation to translators who had succeeded in translating scientific books into Arabic (Umam, 1980).

In the Muslim environment, The Holy Quran encourages Muslims to study various branches of science. Islam has given rise to thought in various branches of science, and The Holy Quran has laid down the basic foundations or rules, such as philosophy, economics, medicine and etc (Wahab, 2014) . The basic principles or basic rules in The Holy Quran still have to be developed and detailed through various research, the results of these developments then need to be disseminated widely so that they can be understood and utilized by all people. This effort will be successful if it uses a communication tool that binds all Muslims, namely Arabic. With this reality, the Arabic language plays a vital role in the disseminating knowledge from outside the Islamic world and which is the result of Muslims' thoughts (Fadillah et al., 2024).

The historical trajectory of Greek science and philosophy, from suppression in medieval Europe to preservation and innovation in the Islamic world, underscores the pivotal role of Islamic civilization in the global intellectual tradition. The Abbasid era exemplifies how political stability, religious motivation, and the patronage of leaders can create an environment conducive to scientific and philosophical advancement. The Arabic language was central to this intellectual flourishing, which served as the medium for preserving external knowledge and fostering internal scholarly discourse

Arabic's role extends beyond mere communication; it symbolizes the unity and intellectual vibrancy of the Islamic world. As the lingua franca of science and scholarship during this era, Arabic preserved the knowledge of the past and paved the way for future intellectual endeavors. This historical narrative underscores the enduring relevance of language as a tool for cultural and intellectual exchange, providing valuable lessons for fostering global collaboration in contemporary times.

2. Phases of Translation of Books in Arabic

At the beginning of the Abbasid rule in Baghdad, the movement to translate books from other countries always received special attention from the caliphs, among them from Persia, in the form of books on astronomy, history, literature and music (Florio, 2023). From Greek in the form of books on philosophy, medicine, astronomy, music, technique and logic. From Hindi in the form of Hindi medical books, mathematics, astronomy and music. From rules in the form of books on astronomy, agriculture and plants. While from Egypt in the form of chemistry and physics books (Zaidan, 1904).

a. The Caliphate of al-Manshur Year 136 H

Caliph al-Manshur has devoted his energy and wealth to the interests of the translation, so much so that he gave a gift of 10,000 dinars to a man named Jirjis bin Bukhtisyu', for having translated books on medicine, music and technique, as well as on logic or logic. At this time appeared Abdullah Ibn al-Muqaffa' in 757 AD who was a Persian who was a Magian then converted to Islam, they also translated the literary book *Kalilah wa Dimnah*, written by a Hindi philosopher named Baidaba, from Sanskrit into Arabic. The book has now been translated into Indonesian into the story of Kalila and Damina (Hamid, 2006).

During this period, Abdullah Ibn al-Muqaffa' emerged as a prominent figure in 757 AD. Originally a Persian Magian who later converted to Islam, Ibn al-Muqaffa' made significant contributions to the cultural and intellectual life of the Islamic world through his translations. Among his most famous works is translating the literary classic *Kalilah wa Dimnah*, initially written in Sanskrit by the Indian philosopher Baidaba, into Arabic. This work not only introduced Arabic readers to the rich literary traditions of India but also became a cornerstone of Islamic literary heritage.

In addition to *Kalilah wa Dimnah*, Ibn al-Muqaffa' translated several other important texts, further enriching the intellectual landscape of his time. These included *Khoday Nāmā* (The History of Kings of Persia), a significant work detailing Persian, Indian, and Arabic traditions. His translations were instrumental in preserving and disseminating the knowledge of pre-Islamic civilizations, blending them with Islamic thought and making them accessible to a broader audience (Hamid, 2006).

b. The Caliphate of Harun al-Rashid in 193 H

At this time, the translation is directed to new books and prioritizing proofreading or correction and repeating the translation done at the time of al-Mansur, because the translation results had errors. Among the translators at this time is Yahya bin Maswih in the field of

medicine, and also his students named Hunain bin Ishaq and Abu Yahya bin Natriq (Sufriansyah & Afriansyah, 2024). In Baghdad, Harun al-Rasyid also opened the Baitu Hikmah University, complete with a library and a translation agency. The officers were spread everywhere to find scientific books in any field to fill the library. If foreign language scientific books (non-Arabic) were found, the book was immediately submitted to the translation agency to be translated into Arabic. The Arabic-language book was used as literature in the university. So, those who studied foreign languages at that time were only fans, while students as a whole used reference books in Arabic, for example, the book *Republic* written by Plato in Greek translated into the book *al-Jumhuriyah* in Arabic (Mifta et al. , 2024).

Some of the significant works translated during this time include *Categories* (Kitab al-Maqlat), *On Interpretation* (Kitab al-Jadal) by Aristotle. Ptolemy's *The Almagest* (Kitab al-Majisti), an influential astronomical text, was another major translation. Plato's *The Republic*, translated as *al-Jumhuriyah*, also contributed to the corpus of Arabic literature. In medicine, Galen translated various texts, laying the foundation for Islamic advancements in the field. Euclid's *Elements*, a cornerstone of geometry, was translated and commented upon by scholars like al-Hajjaj and later refined by Hunain bin Ishaq. Additionally, portions of Plotinus's *The Enneads* were adapted into Arabic under *The Theology of Aristotle*.

Bayt al-Hikmah in Baghdad was a hub of intellectual activity, combining a library, translation bureau, and research institute. It facilitated the discovery and preservation of ancient knowledge, particularly from Greek, Persian, Indian, and other traditions. The translation agency actively sought scientific and philosophical texts, which were then translated into Arabic and made available to students and scholars. This ensured that Arabic became the dominant scholarly language of the Islamic world, even as it absorbed knowledge from diverse cultures.

In 193 H (809 CE), during the caliphate of Harun al-Rashid, the Islamic Golden Age reached a remarkable zenith of cultural and intellectual development. Harun al-Rashid, the fifth Abbasid caliph, established Baghdad as a global hub of knowledge, arts, and sciences. Central to his legacy was establishing and enhancing the Bayt al-Hikmah (House of Wisdom), which served as a library, translation centre, and research institute. Scholars such as Yahya bin Maswih, Hunain bin Ishaq, and Abu Yahya bin Natriq played a pivotal role in translating and refining essential works from Greek, Persian, and Indian traditions into Arabic. Key texts, including Aristotle's *Categories* and *On Interpretation*, Ptolemy's

Almagest, and Galen's medical treatises, were translated and studied, laying the groundwork for advancements in medicine, astronomy, and philosophy. Harun al-Rashid's reign was marked by intellectual flourishing and effective governance, economic prosperity, and military strength, which provided a stable environment for scholarship to thrive. Despite facing internal divisions and external threats, his leadership fostered an enduring legacy of learning and innovation that influenced the Islamic world and Europe for centuries.

3. The Caliphate of Ma'mun Year 198-300 H

The translation movement during the Abbasid era receive significant attention from the caliphs, as evidenced by various efforts to acquire and translate knowledge. Translators were often sent to regions like Rome to obtain scientific and philosophical books, which were then translated into Arabic (Hamid, 2006). To ensure the quality of these translations, caliphs such as al-Ma'mun would convene weekly gatherings of scholars and Arabic linguists to refine and improve both new and existing translations. In one notable instance, al-Ma'mun demonstrated his commitment by rewarding Hunain bin Ishaq with an amount of gold equivalent to the weight of the book he translated into Arabic (Florio, 2023).

A crucial and unique factor in the progress of the translation movement during al-Ma'mun's reign was his personal inclination towards philosophy. Unlike other Abbasid caliphs who were merely patrons of philosophical works, al-Ma'mun was a philosopher in the truest sense and an ardent supporter of the Mu'tazila school of thought. The Mu'tazila, with its emphasis on rationalism, played a pivotal role in introducing Greek philosophy to the Islamic world. This alignment between al-Ma'mun's intellectual pursuits and the principles of the Mu'tazila significantly influenced the translation movement. Al-Ma'mun's philosophical inclinations not only ensured the acquisition of texts but also created a receptive environment for the integration of Greek philosophical ideas into Islamic intellectual traditions, making this defining feature of his reign and the era's scholarly achievements.

Arabic is a language that has contributed more or less to science development worldwide. It is proven that in the 13th century AD, many scientists, writers and philosophers studied this book. They not only translate but also interpret the contents of the book. This event is one of the relationships between Arabic and science. Arabic has a function as a tool used to generate thoughts and ideas. Apart from that, it is also a communication tool to convey everything. There is some knowledge that comes from The

Holy Quran. The following is an example of science whose development is supported by the contents of The Holy Quran.

4. Medical science

Since the beginning of the Abbasid reign, medical science developed rapidly, so many doctors emerged. In 923 AD, al-Razi wrote the al-Hawi book, a collection of various health problems written by the Greeks, Persians and Indians, and the results of al-Razi's thoughts. (Sidra et al., 2021) . His other book is al-Mansury which discusses various medicines, poisons and surgery, then in 1073 AD, Ibn Sina also wrote about medicine with the titles al-Qanun Fit-Tibbi, al-Dutur Fit-Tibbi, and Asrarul Hikmah. Also, Ali bin Abbas al-Majusi (died in 384 H.) wrote a medical book entitled Kami/us-Sina'at.

Furthermore, al-Kindi (185-252 H/801-865 AD) was also known as a medical expert (Busari, 2014). His full name is Abu Yusuf Ya'qub Ibnu Ishaq al-Subbah, Ibnu Umran Ibnu al-Asa'at, Ibnu Qais, al-Kindi. He was born in Kufa in 185 H, his father was an Amir or ruler in that city. Al-Kindi had expertise in various branches of science, including philosophy, medicine, logic, mathematics, geometry and astronomy, he was even chosen by the caliph al-Ma'mun as a translator at the palace.

The progress achieved by Muslim scholars in medical science is also not small. Attention to this area arose when Caliph al-Mansur asked for help from Jirjis bin Bukhtisyu', a famous doctor in Yundisabur. Because of the success of his treatment, he moved the center of medical books. He had them translated into Arabic, initially by Ibnul Muqaffa', then by Hunain bin Ishaq and other translators under his leadership.

The first famous doctor was Ali bin Saha's son, Raban al-Tabari, who, in 850 AD, wrote the book Firdaus al-Hikmah. Arabic books are the oldest books in medical science. According to Seyyed Hossein Nasr in his book *Science and Civilization in Islam*, this book contains 360 chapters summarizing various branches of medical science, especially regarding pathology, pharmacology, and dietary problems.

The most outstanding physician of the Islamic world was Abu Bakr Muhammad bin Zakaria—Al-Razi (865-925 AD), known to Europeans as Rhazes (Sattar, 2021) . Baghdad already had a hospital, and he was the head. His works number are more than one hundred, and one of them is entitled Book-Tibbi al-Mansuri, which consists of ten volumes and was translated into Latin in the 15th century with the title Liber al-Mansoris. His most famous essay is the Book al-Hawi, a twenty-five-volume encyclopedia of medical science. The book was translated into Latin as *Continens* by Faraj and Salim, a Jewish doctor. This

encyclopedia was printed many times, and in 1452, the fifth edition appeared in Venice (Lazzeri & Rossi, 2019). This book was widely used in Europe along with Ibn Sina's encyclopedia entitled *al-Qanun Fit-Tibbi* between the 12th and 17th centuries, when Rhazes and Avicenna were valued more than Hippocrates and Galinos, al-Razi also wrote a book about measles with the title *al-Judri wal -Hisbah*.

5. Astronomy

During al-Ma'mun's time, the science of astronomy received significant attention from the caliph. Al-Ma'mun ordered scholars to focus on advancing this field, and one such scholar, Ibrahim bin Habib al-Ghazawi, was tasked with compiling a book that discussed the exact calculations related to astrology. Al-Ghazawi completed the work, which came to be known as *Zij*. However, contrary to what the author previously mentioned, the most important astronomers of this period were actually from the Iranian family known as the Banu al-Munajjim. This family contributed substantially to the development of astronomical science during the Abbasid period. Therefore, the previous information provided on the subject can be reconsidered. It is more accurate to highlight the key role of the Banu al-Munajjim, whose scholarly contributions were pivotal in shaping the progress of astronomy during al-Ma'mun's reign. A more comprehensive understanding of this period would focus on the achievements of the Banu al-Munajjim, who were instrumental in advancing astronomical knowledge, and the *Zij* compilations that arose during their time.

6. Philosophy

The Arabs became familiar with philosophy after engaging with the intellectual traditions of the Greeks, Persians, and Indians during the caliphs harun al-rashid and al-ma'mun. Initially, Muslims studied philosophy, particularly from Greek sources, to defend Islamic law (Sharia) from critiques posed by other religious traditions. Among the prominent philosophers of this period was Al-Kindi, known as the "Philosopher of the Arabs," who wrote works such as *On First Philosophy and Theology*, exploring the compatibility of Greek philosophy with Islamic thought. Al-Farabi, another key figure, contributed significantly to political philosophy with his works, such as *Al-Madina al-Fadila (The Virtuous City)*, where he discussed the ideal society. Avicenna (Ibn Sina), one of the most influential Islamic philosophers, wrote *The Book of Healing (Kitab al-Shifa)* and *The Canon of Medicine (Al-Qanun fi al-Tibb)*, which merged Greek philosophical thought with Islamic teachings, especially in the fields of metaphysics and medicine. Additionally, al-Razi (Rhazes), a Persian philosopher and physician, made important contributions to medicine and

philosophical reasoning into medical practice. These philosophers and others played a central role in preserving and advancing Greek philosophical ideas, adapting them to the Islamic worldview, and using them to support Islamic law and theology during the caliphates of Harun al-rashid and al-Ma'mun.

7. Count

Muslim scholars who are experts in this field of science are:

a. Thabit bin Qurra al-Harrani (221-288 H / 836-901 AD)

Thabit bin Qurra was a renowned mathematician, astronomer, and translator during the Abbasid period. He made significant contributions to geometry, astronomy, and mechanics. Among his notable works are *Kitab fi Hisab al-Ahilla* (Book on the Calculation of the Moon Phases) and *Istikhraj al-Masa'il al-Handasiyyah* (Derivation of Geometrical Problems). He also translated and preserved several Greek works into Arabic, ensuring the survival of classical knowledge. His innovations in geometry and his studies on the movement of celestial bodies influenced later Islamic and European scholars.

b. Sinan bin Thabit (d. 331 H / 943 AD)

Sinan bin Thabit, the son of Thabit bin Qurra, was an accomplished mathematician and engineer. He played a pivotal role in applying mathematical principles to engineering and architecture. Although fewer records of his independent works exist compared to his father, Sinan's expertise was widely respected, and he is remembered for his practical contributions to Islamic science and engineering projects of the time.

c. Abu al-Wafa' Muhammad bin Muhammad al-Buzjani (328-388 H / 940-998 AD)

Abu al-Wafa' was a leading mathematician and astronomer whose innovations in trigonometry and geometry were groundbreaking. His work, *Kitab fi Ma Yahtaj Ilayh al-Kuttab wa al-Ummal min 'Ilm al-Hisab* (The Book on What is Necessary from Arithmetic for Writers and Scribes), provided practical mathematical solutions for scribes and administrators. He introduced new trigonometric concepts, including the tangent function, and made significant advancements in solving spherical triangles, which were essential for astronomy.

d. Muhammad ibn Musa al-Khwarizmi (780-850 AD)

Known as the "Father of Algebra," Muhammad ibn Musa al-Khwarizmi revolutionized mathematics with his seminal work *Kitab al-Mukhtasar fi Hisab al-Jabr wa al-Muqabala* (The Compendious Book on Calculation by Completion and Balancing). This book

introduced the systematic approach to solving linear and quadratic equations, giving rise to the term “algebra.” Al-Khwarizmi’s contributions also extended to astronomy and geography, as seen in his accurate calculations of the Earth’s circumference and mapmaking efforts.

e. Abu Ali al-Hasan ibn al-Haytham (Alhazen, 965-1040 AD)

Alhazen was a brilliant polymath known for his groundbreaking work in optics, physics, and mathematics. His most famous book, *Kitab al-Manazir* (The Book of Optics), laid the foundation for modern optics by explaining theories of light, vision, and reflection. He also contributed to geometry and engineering, with works like *Tashil al-Majishti* (The Simplification of the Almagest), a commentary on Ptolemy’s work. His methods of experimentation and systematic inquiry influenced the scientific method.

f. Al-Biruni (973-1048 AD)

Al-Biruni was a versatile scholar whose contributions spanned astronomy, geography, and mathematics. His work *Kitab Tahdid Nihayat al-Makin* (The Determination of the Coordinates of Places) was a remarkable achievement in geodesy, combining mathematical calculations with astronomical observations. Al-Biruni also advanced trigonometry by refining sine and cosine functions and applying them to practical problems. His curiosity and thorough approach earned him a lasting reputation as one of the greatest minds of the Islamic Golden Age.

g. Al-Qarni

Although little is definitively known about Al-Qarni, he is recognized for his contributions to Islamic inheritance law (*Faraid*) and arithmetic, particularly in developing tools for dividing estates (*al-Qismah*). His works focused on practical applications of mathematics in legal and administrative contexts. While specific titles of his books remain uncertain, his influence in advancing the understanding of inheritance distribution remain significant.

From al-Khwarizmi, Europeans learned Arabic numerals, algebra, and the most defensible astronomical tables, which the Englishman Adelard of Bath then translated into Spanish.

Other famous names in mathematics are al-Mahani, who developed algebra, and Abu Saha 'al-Quhi, who wrote additional books besides Archimedes' book (Florio, 2023). Umar al-Khayyam and Nasir al-Din al-Tusi are famous in Astronomy (Cimak, 2021). At that time, astronomy and mathematics were branches of science. The separation between the two

occurred later. Some Islamic philosophers have names in mathematics, such as al-Kindi, who wrote several treatises in this field, and Ibn Sina, who created a mathematical theory about music.

8. Chemistry

The father of chemistry in Islam was Jabir bin Hayyan (721-815 AD), known in Europe as Geber (Barral, 2021). Among his essays in the field of chemistry are the book *al-Tajmi'*, which discusses concentration, and the book *al-Zi' baq al-Syarqi*, which discusses mercury. Chemistry at that time was based on Greek theory, which stated that all metals were essentially one, and *ernas* was the purest metal. This theory is based on the emergence of experiments to find pure metals. Although not achieving the goal, Jabir's experiments improved the methods of evaporation, filtering, sublimation (evaporation and then condensation), liquids, distillation, and crystallization. He discovered how to make various chemicals, such as Cinnabar and arsenic oxide. Next, he learned about how to obtain alum, alkali, saltpeter, ammonia, etc., in pure form. Apart from Jabir, al-Razi was also a famous chemist. Before becoming a doctor, he discussed a lot in the field of chemistry. Other names known in the field of chemistry are al-Tugra'i, who lived in the XII century AD, and Abu al-Qasim al-Traqi, in the XIII century AD.

9. Geography

Geography in the hands of Islamic scholars experienced significant development, combining knowledge of mathematics, geography, and astronomy. According to risler, Muslims applied mathematical principles to measure geographical distances, such as determining the earth's circumference by taking the sun's position at Palmyra and Sinjar on the north side of the Euphrates River. Their calculations yielded fifty-six and two-thirds Arabian miles, an impressive result, as the difference from the actual distance was only eight hundred and seventy meters.

In the 9th century AD, Ptolemy's *Geography* was translated into Arabic, serving as a foundational text for many Muslim scholars who advanced the earth sciences during the Islamic Golden Age. For instance, al-Khwarizmi, renowned for his contributions to mathematics, wrote *Suratu al-Ardi*, a book that included a map of the Islamic world. Another notable geographer, Ibn Khurdazbih, authored *al-Masalik wal-Mamalik* in the 9th century AD, a work praised for its topographical and historical content. Ibn Wadih al-Ya'qubi contributed to geography and economics with his book *Kitabul Buldan*, which explained topography and the economics systems of various regions.

Abu al-Hasan al-Mas'udi, a 10th-century scholar, authored *Muruj al-Zahab wa Ma'adin al-Jawhar* (The Meadows of Gold and Mines of Gems), a comprehensive work covering history, geology, and geography. Additionally, Yaqut Ibn Abdillah al-Hamawi, who lived in the 13th century AD, emerged as the greatest Islamic geographer of his time, known for his monumental geographical dictionary *Mu'jam al-Buldan*.

Among the notable contributions to Islamic geography, Ibn Faqih al-Hamadani holds a significant place with his work *Kitab al-Buldan* (also referred to as *al-Akhbar al-Buldan*). This text provides a comprehensive account of cities and regions, including detailed descriptions of their geography, history, and cultural significance. Incorporating the work of Ibn Faqih al-Hamadani into the discussion highlights the depth and diversity of Islamic geographical scholarship. His contributions, alongside those of other prominent figures, illustrate the systematic approach Muslim scholars took in advancing the study of geography, integrating it with disciplines such as mathematics, astronomy, and history to create a robust framework for understanding the physical and cultural dimension of the world.

10. History

Abdullah Muhammad, bin Sa'ad Mani'uz-Zahri, also wrote the book *al-Tabaqatul-Kubra* and Ibn Nadim, Abu Faraj Muhammad bin Ishaq bin Ya'qub al-Nadim compiled a book called *al-Fihrisah*-likewise *Maskawaih* with his book *Tajarubul Umam* (Editorial, 2023). The famous historian before al-Mas'udi was Ibnu Wadih al-Ya'qubi who left his book entitled *Tarikh*, then Ibnu Ja'far Muhammad Ibnu Jarir al-Tabari (838-923 AD) with his book *Tarikhur-Rusuli wal – muluki*.

Its history begins from the creation of nature until the year 302 H or 915 AD. He obtained the materials for making his book from history books written by earlier Islamic historians, from the information he obtained while travelling to various countries, from his teachers and so on.

Al-Mas'udi was different from previous historians, he wrote history not chronologically but according to the classification of dynasties and nations. From Baghdad, he travelled around the Arab world, visiting Asia and Zanzibar. The history he wrote included Indian, Persian, Roman and Jewish history. The greatest historian in Islam was 'Abdurrahman Tun Khalun (1332-1406 AD), who wrote history by linking its development to local geographic and weather conditions and the moral and spiritual strength of the nation concerned.

11. Animal and Plant Sciences

In the natural sciences, scholars also wrote about zoology, plant science, anthropology and geology. Regarding zoology, al-Jahiz, al-Mu'tazi figure who lived in the ninth century AD, wrote a book entitled *Kitabul. Animals* that greatly influenced the subsequent development of animal science. Ikhwan al-Safa' also talked about animals by writing an essay entitled "The Difference Between Humans and Animals". Another famous writer in zoology is Abu Yahya al-Quzwini, who wrote a book about "The Miracle of Creation".

Al-Tamani, al- Biruni and Ibn Sina wrote about the nature of plants. Then, in Spain, new writers named Abu Ubaid al-Bakri and Ibn Hajjaj appeared, who paid much attention to the science of plants. Ibn al' Awwam, also in Spain, wrote a book on agriculture, and Ibn Wahshiah also wrote a book on agriculture. This description shows that Muslim scholars controlled many branches of general knowledge before the thirteenth century AD, and then science developed along with modern technology.

12. Religious Science

Religious knowledge includes interpretation, hadith, jurisprudence, and the science of penmanship. During the reign of the Umayyads, the first attempt to interpret The Holy Quran was made by Abdullah bin Abbas. During the time of the Abbasids' time, interpreters continued it, including al-Zamakhshari with his work *Kitab al-Kasysyaf* and al-Niqas al-Mausuki with his work on the book *Syifaus-Sudur-Ibrahim al-Sa'labi* with his work on *al-Kasyfu wal-Bayanu*, and others. The collection and bookkeeping of the Prophet's hadith began during the reign of Umar bin Abdul Aziz (the Umayyad Caliph), and among the famous hadith scholars at that time were Imam Malik bin Anas (died in 197 I-1), Ibnu Dawud al-Tayalisi (died 203 H) and Imam ibn Hanbal (died 241 H) (Safrudin Halimy Kamaluddin, 2021). The hadith books produced are *Jami'us-Shagir* by Imam Bukhari, *Sahih Muslim*, *Musnad Ibnu Majah*, *Sunan Abi Dawud*, *Kitab Jami'us Sahih* by Abi Isa al-Turmuzi. Book *Sunan* by Abu Abdur Rahman al-Nasa'I and book *Sunnah Masabihus* by Bagawi and *Jami'ul Usu'* by Bahzari. However, in the early days of Islam, disagreements about fiqh problems, both regarding worship and mu'amalah, always returned to The Holy Quran and hadith, especially when the Prophet Muhammad SAW was still alive. All matters related to religion were handled directly by the Prophet himself. Then, it was continued by the companions and caliphs of the Bani Umayyah, but after stepping on the Abbasid Dynasty, some ijthihad experts specializing in Fiqh appeared. Among them are Abu Hanifah in Iraq (died 150 AH), Malik bin Anas in Hijaz (died 197 AH), Muhammad bin Idris al-Syafi'I in Egypt (died 240

AH), and Ahmad Ibnu Hanbal in Najed, Bahrain. And Syria (d. 241 H). They are famous for their madhhab which is called Madhhab Empat (Modongal, 2023) .

13. Arts and Literature

During the Abbasid era, apart from movements in general science and religion, there were also artistic or writing activities in the field of literature. What is meant by literature or al-Adab is the arrangement of beautiful sentences that arise from the soul of the reader and can be felt by the listener, whether the sentence arrangement is in the form of poetry or prose (Munjin & Kusumawanti, 2021) .

The influence of Arabic is felt in southern Europe, especially in Sicily and Spain, because this place was once the center of Islamic culture and civilization, with the founding of universities in Cordova, Seville, Malaga, and Granada between the VII-XIII centuries. These students who studied in Spain eventually developed science throughout Europe after they succeeded in transferring Muslim ideas to the Western world, which ultimately became modern science.

To prove the contribution of Muslims through Arabic works in the process of scientific advancement in the West, the following statements or opinions from Western scientists are presented:

- 1) Dr Max Meyershof argued that "Islamic medicine and science in general, shone the light of Hellenism until its light faded. Then Islamic science became the moon in Europe's pitch-black night, bringing Europe into the Renaissance. For this reason, Islam is the cause of the great movement that is now taking place in Europe" (Hoesin, 1975) .He argued that Europeans had taken eye remedies from the Arabs and used them throughout the medieval period, retaining the names of eye remedies composed by Europeans, except in the early 18th century.
- 2) Diorant argued that "Christian patients preferred Muslim doctors to Christian doctors"during the Crusades (Thaha, 1983).
- 3) Part of science. Several doctors living in northern Italy have transcribed the contents of their books while still using Arabic terms. This is due to the high prestige of these books. Such terms include: Syrup (syarab), arter (thorthiir), Tared (thorohahu), Alambic (from ambiiq), Alcohol (from alkuhuul), Alkali (al-qaali), Borax (buuraq) and Elixir (al-iksiir) (Thaha, 1983) .
- 4) Hull argued: As soon as we think of Arab culture, we immediately think of the activities and efforts of the Arab people in the field of science, in which they have

played a universal and international role. They have succeeded in learning what is worth learning, and the results of their hard work are enjoyed by future generations (Thaha, 1983).

- 5) Brivo stated, "The Arabs deserve our respect, because they have taught all these things to the Europeans. In other words European science is indebted to the Arabs (Thaha, 1983) ”.
- 6) G. Lebon wrote, "It is the Arabs who gave us (European) civilization. They have been our teachers for six centuries".
- 7) Henry Treece argues that "While Muslims learned little from the West, Europe sucked almost all the arts and sciences from Syria, which were necessary to elevate the peasantry to modernity in the Middle Ages (Nasution, 1980) ”.
- 8) JC Risler, after explaining that Islam as a religion had no influence in the West, wrote on the contrary that "Islamic science and technique greatly influenced Western culture (Nasution, 1980) ”.
- 9) Rom Landau stated that "It was from the Arabs that Europe thought objectively and straightforwardly, learned tolerance and had a broad outlook. This is the foundation that guided the renaissance and brought progress to Western civilization (Nasution, 1980) ." He also said that "The progress of Western science would not have been possible if Western scientists continued to use Roman numerals".

These statements show that the efforts of Muslims to master and develop knowledge through writings in Arabic have received recognition from Western society. Likewise, the process of cultural progress and thought in Western civilization initially received many contributions from Islamic scholars, especially in the eighth to eighteenth centuries AD.

The success of Muslims' efforts at that time was partly due to the high position of reason in The Holy Quran and hadith and the strong urge to seek knowledge, as found in the two primary sources of Islamic teachings, then in the eighth and second sources. Science developed in Islam and all its branches in the ninth century AD. Likewise, the theories that emerged preceded similar theories in the West. Because they often forget about the existence of Islamic civilization in the past, Muslims living in the 21st century do not know that theories in Islam preceded several Western theories, so Muslims consider Western theories to be very modern.

This description provides an overview of the Arabic language's contribution to the development of science. This process can be fully realized if the agility and activeness of

Arabic speakers in the world of science receive the best possible attention, both through translation and research results.

Today's Arabic has borrowed many modern technological and scientific terms from the West into its vocabulary. With these borrowings, Arabic can still survive as the language of science, at least in Arabic-speaking countries. Today's Arabic may be too difficult to influence Jains in advancing modern science and technology.

Conclusion

This research confirms that the Arabic language had a major contribution to the development of science in the XIII-XVIII centuries AD. As the primary medium of translation and scholarship, Arabic enabled the transfer of knowledge from Greek, Persian and Indian civilizations to the Islamic world and subsequently to Europe. It played an important role in the intellectual progress of the world, especially during the Renaissance. However, this research is limited to analyzing specific literature and philological approaches, so further exploration of other manuscripts and eras is needed.

These findings suggest the importance of preserving Arabic as a scientific language to support the development of science. Further research using multidisciplinary approaches and modern technology is recommended to explore a wider range of historical documents. In addition, Arabic language education needs to be improved to strengthen its role in connecting the scientific heritage of the past with the needs of today's science.

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