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The Re-Digging of Old Scientific Heritage in the Islamic Civilization

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Abstract: The re-digging of old scientific heritage is part of the indigenization of science. In the context of the Islamic civilization, it was conducted after a scientific work from another civilization was translated into Arabic language. The contents of the translated work was re-dug and re-explored to obtain further information on the knowledge contained in the work. This article aims to legitimize the existence of re-digging activity of old scientific heritage in the Islamic civilization. This matter had to be cleared in order to prove that scholars of the Islamic civilization did utilize the works of other civilizations to build up their science. However, at the same time, it did not mean that the knowledge was accepted without question. On the contrary, it was studied and assessed as well as modified according to Islamic concepts before being absorbed as knowledge in the Islamic civilization. This study uses the qualitative methodology through instrument analysis by way of textual and contextual study of primary sources. Accordingly, the study finds that the aspect of re-digging of old scientific heritage did occur in the Islamic civilization. It was established that scholars of the Islamic civilization had taken the initiative to re-dig old scientific heritage from the civilizations nearest to them, that is, Hellenistic-Greece, India as well as Persia. The importance of this study is relevant because efforts to re-dig from the nearest civilizations are appropriate and should be undertaken by all civilizations in the world. Indeed, this matter has been proven to be fruitful by the Islamic civilization and the Western civilization. Further research can be conducted by re-digging old scientific heritage of the Western civilization to re-assess the knowledge developed by them, such as science, which was taken from the Islamic civilization.

Key words: Indigenization of science, Islamic science, Islamic civilization, re-digging of old scientific heritage, Greek, Indian and Persian civilizations.

INTRODUCTION

Re-digging of old scientific heritage is a part of the indigenization of science. What is meant by indigenization of science here is "a process of transfer of contemporary science from a different culture to another state or nation and simultaneously re-digging the old scientific heritage of the said culture or cultures nearest to the state or nation" (Mohamad Zain, 2004). In the context of the Islamic civilization, the re-digging of old scientific heritage is seen as a process whereby scholars who, intensively active in developing their civilization, take the initiative to re-dig old scientific heritage of the nations or civilizations nearest to them. We are more comfortable with the term "scholars intensively active in developing their civilization" as compared to the term "Muslim scholars". This is because Muslim scholars were not alone in developing science and technology within the Islamic civilization. In fact, they were assisted by non-Muslim scholars. In other words, Muslim scholars jointly with non-Muslim scholars developed science and technology within the Islamic civilization.

If Muslim scholars were represented by Abu 'Abd Allah Muhammad ibn Ibrahim al-Fazari, Abu Sahl al-Fadl ibn Nawbakht and Abu 'Uthman Sa'id ibn Ya'qub al-Dimishqi, then non-Muslim scholars were represented by Hunayn ibn Ishaq, Salmawayh ibn Bunan, 'Abd al-Masih Na'ima and Jurjis ibn Jibril ibn Bukhtiyashu' (Nasr, 1984). Most of the non-Muslim scholars who were involved in this matter were Christians. In fact, the contribution of the non-Muslim Christian Arabs in developing science and technology within the Islamic civilization was characterized by Sarton (1975) as immense. Sarton's expression that "…out of eight physicians whom I have selected as the most important, six were Christians…" affirms the roles of both parties, whether Muslims or non-Muslims, in developing science and technology within the Islamic civilization.

Going back to the discussion regarding the re-digging of old scientific heritage, we need to clarify here that such an effort should be appropriately seen as an approach to obtain a picture of the nature of the said knowledge

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from a civilizational perspective as well as its basic niche. At the same time, it was necessarily a mode to evaluate the compatibility of the core knowledge to Islamic thinking. If the knowledge was found to be not in line with Islamic thinking, then modification of the core of that knowledge was necessary. However if the theory or idea was doubtful, then the scholars active in building Islamic science would give their commentary. Eventually, the said scholars were able to come up with their own original work which was much more compatible physically, culturally and ideologically with the Islamic civilization.

Within the context of the Islamic civilization, re-digging of old scientific heritage involved the Hellenistic-Greece Indian and also Persian civilizations. All these civilizations contributed to the building of science in the Islamic civilization. By bringing up this matter, we attempt to prove that even though the Islamic civilization clearly has accepted part of the knowledge resource especially science, from other civilizations, the knowledge was not accepted wholly without question. In fact, what had occurred was that scholars of the Islamic civilization scrutinized such knowledge to examine its compatibility with Islamic thinking.

The Necessity of Re-digging Old Scientific Heritage within the Islamic Civilization:

The re-digging of old scientific traditions necessitates a detailed examination of every part of translated textual content. The purpose was to obtain useful information on the development of scientific traditions in earlier civilizations in order to formulate the basis and guidelines toward upgrading the existing scientific traditions. Besides, scholars could at the same time screen scientific ideas whether theoretical or practical to avoid contradiction with their values and beliefs.

We put forward the example of Yuhanna bin Masawayh, a scholar of the Islamic civilization, who would not accept Galen's idea of using the human body to study and obtain information on the anatomy. Instead, he substituted a monkey for a human body. The use of a human body to study anatomy is suggested by Galen in his work entitled De Anatomicis Administrationibus Libri XV (Galen's Book of Anatomy). In the beginning, Yuhanna almost sacrificed his own son as a study sample but he was prevented at the nick of time by Khalifah al-Mu'tasim bi Allah, who at the same time gave Yuhanna several monkeys as substitute for the human body (Husayn, 2004). This clearly shows that not all ideas in scientific heritage from earlier civilizations were acceptable. On the contrary, theories incompatible with Islamic values and beliefs would be rejected.

We are of the view that there are three reasons for re-digging of old scientific heritage in the Islamic civilization. First, it is necessary to be done by the scholars of the Islamic civilization to uncover the true concept of a discipline of knowledge in a certain civilization. Each concept of knowledge from a different civilization which had been explored and understood would lead to a process of integration as well as assimilation. Integration of knowledge into a different civilization from the aspect of values, beliefs and culture would establish a firmer form of knowledge.

For example, re-exploring a work from the Indian civilization entitled Brahmasputasiddhanta and a work from the Hellenistic-Greece civilization entitled Megale Syntaxis Mathematike indirectly prepares all kinds of useful information concerning Indian and Greek astronomy. The information obtained would be examined in detail and, if necessary, would be subject to criticism so that its results could be fully utilized later. According to O'leary (1964) the work Brahmasputasiddhanta had been translated as well as explored as early as during the rule of Khalifah Abu Ja'far al-Mansur (754-755AD). However, the scholars of the Islamic civilization found it quite difficult to understand. This was because the said work did not contain complete information on the basics of geometry and astronomy. Moreover, the Arabic society then, lacked sufficient knowledge of the said aspects. This problem extended into the rule of Khalifah Harun al-Rashid (786-809AD). After the problem was brought to the attention of Khalifah Harun al-Rashid (786-809 AD) by Ja'far al-Barmak, His Majesty then ordered the translation of the work Elements/Stoixea produced by Euclid and the work Megale Syntaxis Mathematike written by Ptolemy. The translation and re-digging of the said two works had presented a useful revelation on the basics of geometry and astronomy to scholars of the Islamic civilization. As a result, they acquired sufficient basis to further develop their own scientific traditions, especially, in astronomy.

Second, re-digging of old scientific heritage was necessary to refute baseless accusations constantly hurled at the intellectual class of the Islamic civilization. Amongst the accusations as stated by Sezgin (1984) is that the scholars of the Islamic civilization had inherited the Hellenistic-Greece scientific traditions blindly. They merely accepted all ideas from the said civilization without any filtering or commentary. This allegation is actually not accurate based on the ground that the scholars of the Islamic civilization did not passively translate works of earlier civilizations (Harun, 1992), but instead had studied and examined in detail scientific facts and ideas acquired. A proof of this is in the criticism by Jabir ibn Hayyan of Galen on his classification of various kinds of medicine based on mere perception without research and meticulous observation. Such a criticism portrays scholars of Islamic civilization as being very critical as well as innovative and not mere 'copycats' as alleged.

The example brought up by Wan Hasan (1990) also supports the same matter. He asserts that the Islamic civilization did not unconditionally accept Greek knowledge. In fact, knowledge which was clearly in contradiction with Islam was rejected. For example, the theory which claims that atoms are permanently everlasting did not succeed in permeating the Islamic philosophy of knowledge. This is because in Islam, only Allah is eternal and everlasting.

Third, the re-digging of old scientific heritage required to be realized in abidance by Islamic teachings which seriously stress on the concepts of al-Tadabbur, al-'Ibar and al-Tibyan. The concept of al-Tadabbur is clearly stated in Surah al-Nisa' verse 82, Surah Muhammad verse 24, Surah al-Mu'minun verse 68 and Surah Sad verse 29. The concept of al-'Ibar is explicitly stated in Surah al-Hashr verse 2, Surah al-'Imran verse 13, Surah Yusuf verse 11, Surah al-Nahl verse 66, Surah al-Mu'minun verse 21, Surah al-Nur verse 44 and Surah al-Nazi'at verse 26. And the concept of al-Tibyan is stated in Surah al-Nisa' verse 94 and Surah al-Hujurat verse 6. These three concepts have the same objective, that is, to invite man to explore, study and investigate in the effort to discover the truth of a matter. The capability to explore and study knowledge was further enhanced by interaction with knowledge from other civilizations (Kirmani, 2004). This concept also affirms the accuracy of the second reason on why re-digging of old scientific heritage was necessary as explained in the aforesaid paragraphs.

Re-digging of Old Scientific Heritage from the Hellenistic-Greece Civilization:

Scholars of the Islamic civilization had conducted much re-digging of old scientific heritage from the Helleenistic-Greece civilization. It was intensively carried out by prominent scholars of comparable caliber whether amongst translators themselves or amongst the scientists. The re-digging was also not restricted to only one field. In fact, it encompassed various fields such as mathematics, astronomy, medicine, geography, botany, minerology, etc. However, in this article, we only focus only on a few fields, that is, mathematics, geography and also mechanical engineering.

In the field of mathematics, for example, amongst the Grecian works which were re-dug were Megale Syntaxis Mathemathike produced by Ptolemy, Elements written by Euclid, De Sphaera Et Cylindro produced by Archimedes, Conica by Appolonios and others. Even though there are many Grecian works on mathematics which were re-dug, we are only focusing discussion on two works, by Euclid dan by Appolonios. Euclid's work entitled Elements was re-dug by the prominent figure, that is, al-Khawarizmi. Through this process of re-digging, al-Khawarizmi found that Euclid's mathematical concept was based on numbers and deductive method. The said discovery had sparked an inspiration in him to introduce a new mathematical concept not tied to numbers only, that is, algebra.

The said concept is stated in detail in his famous work, namely, Kitab al-Jabr wa al-Muqabalah. al-Jabr, refers to the variation of a quantity from one side of an equation to the other, whilst al-Muqabalah means to simplify a resulting expression (by eliminating the same term on both sides of the equation) (Mohammad and Ali @ Mat Zin, 2006). The function of this new concept is to resolve problems of quadratic and linear equations by using a systematic and logical approach. This work was produced by al-Khawarizmi at the request of Khalifah al-Ma'mun, following the need for a simple method to be applied in resolving several problems of daily affairs such sale and purchase, land area measurement, calculation in property distribution of inheritance and wills. It was written in or about the year 825AD.

The said book contains chapters which cover topics such as calculation in operations of multiplication, addition, subtraction and division; equations, measurement work; problems of sale and purchase; currency divisions; weights and measures; measurement of even plane; area of circle and triangle, volume of pyramid and cone; wills and distribution of inheritance estate. Through this work, al-Khawarizmi had achieved a new branch of knowledge never before invented by mathematicians before him. He had also introduced new terms still in use today, which are, variable (x), square of variable (x^2) and constant(c).

Recognition of his work is not only given by scholars in South-East Asia which have received Islamic influence, but also by Western scholars, specifically in Europe. Mohamad Zain and Samian (1987) who represent mathematics scholars in South-East Asia, for example, assert that al-Khawarizmi's work on algebra cannot be considered as a small discovery, because without it, the set theory, advanced geometry, calculus and others would not have been discovered and developed with ease. The recognition of his great work by European scholars of the Middle Ages was evident in their toil to translate it into Latin. Its Latin translation by Robert of Chester, for example, had become an important basis in the development of mathematics amongst other European scholars such as Leonard of Pisa, Cardan, Tartaglia, Luca Picioli, Ferrari and others. In fact, study and investigation by the said European scholars had further developed algebra to a more advanced level (Tuqan, 1954).

Apart from the work by Euclid, the work of Appolonius was also re-dug by scholars of the Islamic civilization. This effort was undertaken by the family of Banu Musa jointly with Thabit ibn Qurrah and Hilal ibn Hilal al-Himsi. Hogendijk (2006) stated that the family of Banu Musa was very interested in the field of geometry. In the beginning,

they were already in possession of Maqalah 1-7 of Appolonios's work. However, the manuscript was difficult to understand because the handwriting was not legible. Thus they looked for other more legible manuscripts which could be easily understood and translated. Such a manuscript was finally found in Syria (accompanied by Eustocius's commentary) by Ahmad (Fried and Unguru, 2001). Banu Musa then hired Hilal al-Himsi to translate Maqalah 1-4, whilst Thabit ibn Qurrah translated Maqalah 5-7. In the process of re-digging, they found that Appolonius's work was very useful, specifically as a model to develop a new theory regarding cylinder and plane section (Montgomery, 2006). However, his work was undidactic as it did not explain to the reader theorems used as proof for each presumption. Thus, in an effort to improvement, Ahmad had added in the text of his translation of Appolonius's work, the theorems which Appolonius had used earlier to support his arguments (Hogendijk, 1992).

In relation to this field, in the middle of the 9th Century AD, Banu Musa had produced an original work entitled Kitab Ma'rifah Misahat al-Ashkal. Based on the explanation of (Rosenfeld and Youschkevitch, 1996) in the Encyclopaedia of the History of Arabic Science concerning Kitab Ma'rifah Misahat al-Ashkal, it contains methods to calculate the circumscribed and inscribed areas of regular polygons. Likewise, it contains the method of finding the formula to calculate the area of a circle. According to them, the formula was obtained by the product of half of the diameter of a circle and half of the circumference. They proved that for each circle, the ratio of its diameter to its circumference is the same. The value of the said diameter ratio is greater than $3^{10}/_{71}$ and less than $3^{1}/_{7}$. Besides this, they also explained the theorem used by Archimedes dan Heron to calculate the area of a triangle by using its sides.

Besides that, Ptolemy's work entitled Geographia was also re-dug by scholars of the Islamic civilization. In the early stage, it was translated several times into Arabic language by translators of the 'Abbasid era including Thabit ibn Qurrah. This work contains several principles regarding the process of map-making such as the basic rules, methods of dividing areas, techniques of coordinate listing (longitude and latitude) and the main principles of preparing a map. Thus, Ayyubi (1985) gave his view that al-Khawarizmi had used the said work as a model for his original work, that is, Kitab Surat al-Ard (Book of the Image of the Earth). We believe that the writing of Kitab Surat al-Ard, was the result of re-digging of the said work by Ptolemy. This is proven by the existence of several of Ptolemy's influence in his work. For example, among the four maps produced together with his work such as maps of the Island of Ceylon, the Java Sea, the Azov Sea and the River Nile, the last two were in Ptolemy's work, Geographia (Bagrow and Skelton 1985). Apart from this, according to Ayyubi (1985), Ptolemy's influence can also be seen in his work from the aspect of dividing earth's surface area into seven (climate/iqlim) areas.

Kitab Surat al-Ard contained almost all the longitudes and latitudes for every area encompassing cities, mountains, rivers, islands and others based on their respective coordinates in a tabular schedule. It was also annexed to several maps including the first world map of the Islamic civilization in commemoration of Khalifah al-Ma'mun, that is, al-Surah al-Ma'muniyyah/Ma'munic map. This map was the result of al-Khawarizmi's work together with 70 other geographers, by order of Khalifah al-Ma'mun to draw a world map.

Unfortunately, the said map was lost. However, al-Mas'udi (d. 956 AD) managed to have a look at the said map. He considered it as the best map in comparison to Ptolemy's map and also Marinos's map (Bagrow and Skelton 1985). We cannot ascertain from which aspect the al-Ma'mun map was said to be better than the other two maps. Perhaps what is portrayed by Harley and Woodward (1992) regarding the map may shed some light. They explained that the al-Ma'mun map was very clear and complete. It showed the earth as a sphere in a complete universe. It also contained pictures of the land, seas, inhabited and totally uninhabited areas, areas where human settlements focused, towns, cities, etc. According to Ayyubi (1985), al-Ma'mun map had been re-drawn based on the description and data contained in Kitab Surat al-Ard. This worthy task was undertaken by Dr. S. Razia Jafri, that is, one of the staff of the Aligarh Islamic University, India. The 'born again' map together with an introduction written by Dr. Kamal Ayni and Prof. S. Maqbul Ahmad was printed and published by the Soviet Tajikistan Science Academy.

Scholars of the Islamic civilization also re-dug and explored old scientific heritage in the field of mechanical engineering. Nadarajan (2007) stated that re-digging of Philo's work entitled Pneumatica, Archimedes's Apropos (work on water clock) and Heron's Mechanica and Pneumatica had sparked the innovation and creativity of scholars of the Islamic civilization especially in the field of engineering. One of the scholars who had re-explored old scientific heritage was Banu Musa ibn Shakir (1979). The results of re-digging had attracted those in the field of engineering, especially pneumatic and aerostatic. Thus, Banu Musa ibn Shakir was able to produce his work entitled Kitab al-Hiyal (The Book of Ingenious Devices). Abdullah (2004) states that Kitab al-Hiyal was written in Baghdad in the year 850 AD. It discusses about 100 different devices such as jet light, gas mask, etc. It also contains theory and practical on aerostatics and hydrostatics as well as the use of automatic control and switch system.

Re-Digging of Old Scientific Heritage from the Indian Civilization:

The contribution of the Indian civilization in driving the scientific progress of the Islamic civilization was just as important. Amongst the scientific fields of the Indian civilization which had been re-dug are astronomy, mathematics and medicine.

In the fields of astronomy and mathematics, an Indian civilization work entitled Brahmasputasiddhanta was re-dug several times. Muhammad ibn Ibrahim al-Fazari was the person responsible for the first re-digging after he was ordered by Khalifah Abu Ja'far al-Mansur to translate it into Arabic language. According to Nallino (n.d.), during the re-digging, he had discovered methods of calculating planetary motion as well as several activities relating to astronomy. In consequence, he had produced a work entitled Zij al-Sindhind al-Kabir (Rosenfeld and Youschkevitch, 1996). This work contains the Zij to observe the motion of celestial objects. This work became the prime reference of that time in aspects relating to astronomy.

Brahmasputasiddhanta was next re-dug by al-Khawarizmi, at about the end of the 8th century AD. It occurred while he was writing an abstract concerning its contents by the order of Khalifah al-Ma'mun (Qasmi, 2006; Ayyubi, 1985). The effect of the re-digging had a great impact on the development of mathematics in the 'Abbasid era, especially in the field of arithmetics. According to Smith and Karpinski (2008), Brahmasputasiddhanta which was produced by Brahmagupta (d. 665 AD), had availed various useful information on the Indian knowledge relating to spheres, planets, arithmetics and several other branches of science. In consequence of the re-digging, the Hindi numerals and system of reckoning were discovered.

In the field of medicine, the Indian work entitled Caraka Samhita and Susruta Samhita were re-dug. Caraka Samhita was re-dug by 'Abd Allah ibn 'Ali in the 9th century AD. Susruta Samhita was re-dug by Mankah (Usaybi'ah, 1965; Levey, 1973). The Arabic versions for these two works were Sharik al-Hind and Kitab Susrud. Both these Arabic versions were re-dug by 'Ali ibn Rabban al-Tabari. We would like to clarify here in detail regarding Susruta Samhita (Kitab Susrud), that is, how re-digging of this work had been utilized by 'Ali ibn Rabban al-Tabari specifically to produce his own work Kitab Firdaws al-Hikmah.

We begin with the view of Levey (1973) which states that 'Ali ibn Rabban al-Tabari discussed food and medicine in his work Kitab Firdaws al-Hikmah which was quoted from Kitab Susrud. He mentioned that food enriches the life of man, whilst medicine may change the human body system to a particular condition or state. Bitter medicine may eliminate thick phlegm in the throat, sour medicine may clear the duct while sweet medicine nourishes the organs. Levey's view is supported by more recent studies by Pormann and Smith (2007) who assert that Kitab Susrud had been an important source in the writing of Kitab Firdaws al-Hikmah.

Re-Digging of Old Scientific Heritage from the Persian Civilization:

In the process of re-digging old scientific heritage of earlier civilizations, scholars of the Islamic civilization also re-dug great Persian works. For example, Kalilag u Dimnag was re-dug by 'Abd Allah ibn al-Muqaffa' and 'Abd Allah Ahwazi. This work is actually a collection of Indian mythical stories contained in the work entitled Panchatantra/Pancatantra. It was written by an Indian intellectual named Pandit Vishnu Sharma around the year 200 BC. It was originally written in Sanskrit, esspecially for the King, Raja Dabschlim. It contained moral values which were uncovered through animal stories on the prerequisite qualities to be a good head of state. The leading animal characters in the stories were two wolves by the names of Karataka and Damnaka.

During the reign of Khusraw/Kisra 1, a renowned minister by the name of Burzoe/Barzawayh had translated this work from Sanskrit into Pahlavi language, entitled Kalilag u Dimnag. 'Abd Allah ibn al-Muqaffa' and 'Abd Allah Ahwazi later translated it into Arabic language using the title Kalilah wa Dimnah (Litvinsky et al., 1996). This work later became the prime study resource on animals, as well as for the moral message in the behaviour of animals who share life in this world as creatures of Allah (Nasr 1976).

Persian scientific works in the field of astronomy such as Zij al-Shahriyar/Zij al-Shah/Zij Shahriyaran al-Shah (Royal Almanac) were also re-dug. In Pahlavi language Zij al-Shahriyar is pronounced as Zik-i Shatro-ayar. After translation into Arabic language by 'Ali ibn Ziyad al-Tamimi (known as Abu al-Hasan) in the 8th century AD, it became known as Zij al-Shahriyar/Zij al-Shah/Zij Shahriyaran al-Shah. Historically, Zij was compiled during the reign of Khusraw I Anushirvan (532-580 AD) and re-edited during the rule of Yazdajir III (632-651 AD), that is, the last Persian ruler (Litvinsky et al., 1996).

Re-digging of this work involved several scholars such as Masha' Allah, al-Khawarizmi, Abu Ma'shar and al-Biruni. According to Anawati (1970), in the beginning of the 9th century AD, Masha' Allah (d. 815 AD) had used the Zij as the basis for calculation in the field of astronomy. And in the middle of the 9th century AD, al-Khawarizmi had made a report on the periodical planetary motion based on quotations from the Zij al-Shahriyar. Further, in the same century, Abu Ma'shar (d. 886 AD) had compiled an astronomical schedule with the Zij as a guide. We believe that al-Biruni too had re-dug the said Zij based on the similarities found in his work Rasa'il al-Biruni. This book

contains four maqalah which discuss mathematics and astronomy. According to Kennedy (1956), al-Biruni had repeated in his book, a quotation from the said Zij on the calculation of the distance between Babylon and al-Qubba. Besides that, he also repeated the method of determining time during the day based on shadows. Thus, this fact proves that the old scientific heritage of the Persian civilization too played a role in the development of scientific traditions in the Islamic civilization, specifically in astronomy.

In the field of medicine, re-digging was done by Abu Bakr Ahmad ibn 'Ali ibn al-Wahshiyyah al-Kaldani (9th century AD) on the work of Yarbuqa al-Nabati al-Kasdani al-Fuqai. Unfortunately, we could not trace the title of the said work. Re-digging of this work also shows that the Persian civilization also contributed to the development of medicine in the Islamic civilization, particularly with regard to knowledge on poisons. Extending from this re-digging, Ibn al-Wahshiyyah had produced a book entitled Kitab al-Sumum wa al-Tiryaq (A. Anees and Harmaneh, 1983). Levey (1973) is of the view that the writing of this book is the result of translation of Yarbuqa's work and also Suhab Sat on poisons by Ibn al-Wahshiyyah. Amongst the discoveries obtained by Ibn al-Wahshiyyah from re-digging of old scientific heritage were: i) Not all poisonous herbs are useless, in fact, sometimes, they can be used as substance for therapy treatment, and ii) Poisons can be obtained from various sources such as plants, animals and even minerals.

Conclusion:

Scholars in the Islamic civilization, whether Muslim or non-Muslim, had taken the initiative to re-dig old scientific heritage from other civilizations in their efforts to build and develop Islamic science to an excellent level. These efforts have not been in vain when Islamic science reached its peak of glory in the 9th to 12th centuries AD. In the 12th century AD, Islamic science began to flow into Europe when original works contributed by scholars of the Islamic civilization began to be translated into European languages. We propose that a further study be done to re-evaluate the translations by European scholars from the aspect of accuracy of knowledge transferred. Further study of the original works produced by European scholars then, should also be done to assess the extent of their acceptance or modification of the knowledge taken from the Islamic civilization.

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