

Epistemology of Thomas S. Kuhn's Shifting Paradigm and Its Relevance to Islamic Science

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Manuscript received 17 Dec. 2019 revised 3 Jan. 2020 accepted 8 Feb. 2020 Date of publication 22 Mar. 2020
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Abstract

This article aims to explain the epistemology of Thomas S. Kuhn's concept of Shifting Paradigm (1922-1996), a postmodernist with its philosophical, physical, and historical expertise, and the relevance of his thinking in Islamic science. The research is a qualitative study using the epistemological point of view to analyze. Kuhn's view on the Shifting Paradigm is analyzed based on the important points in the epistemology: the source and substance of knowledge; the instrument of knowledge; how to acquire knowledge; the theory of truth; and the validation of the truth of knowledge. The study finds that, first, the source and substance of science is the history of science. Second, the instrument of knowledge is the paradigm of science. Third, knowledge is acquired from the shifting process from the pre paradigm, normal science, anomalies, crises, to a new paradigm. Fourth, normal science is the theory of the truth. Fifth, the anomaly becomes the validation of the truth. Kuhn's thinking of the Shifting Paradigm is relevant to Islamic science because it can be used as a method to explain the transformation of Islamic science. This paper is vital in discussing the relevance of Kuhn's thinking to Islamic science. Despite many significant numbers of text on Kuhn's thinking, researchers have not found a text that especially discusses on the epistemology of the Kuhn's conception of Shifting Paradigme and point out its relevance to the transformation of Islamic science.

Keyword: *Epistemology, shifting paradigm, Thomas S. Kuhn*

Abstrak

Penelitian ini bertujuan untuk menjelaskan epistemologi Shifting Paradigm Thomas S. Kuhn (1922–1996) tokoh postmodernisme bidang filsafat, fisika dan sejarah dan relevansi pemikirannya terhadap keilmuan Islam. Penelitian ini merupakan penelitian kualitatif yang menggunakan sudut pandang epistemologi dalam menganalisis. Pandangan Kuhn tentang Shifting Paradigm dianalisis berdasarkan poin-poin penting dalam epistemologi: sumber dan hakikat pengetahuan; instrumen pengetahuan; bagaimana cara memperoleh pengetahuan;

teori kebenaran; dan validasi kebenaran pengetahuan. Penelitian ini menemukan bahwa: Pertama, sumber dan hakikat ilmu pengetahuan adalah sejarah ilmu. Kedua, instrumen pengetahuan adalah paradigma ilmu. Ketiga, pengetahuan diperoleh dari proses pergeseran dari pra-paradigma, normal sains, anomali, krisis, dan paradigma baru. Keempat, normal sains sebagai teori kebenaran. Kelima, anomali menjadi validasi kebenaran. Pemikiran Kuhn tentang Shifting Paradigm relevan dalam keilmuan Islam karena dapat digunakan sebagai metode untuk menjelaskan transformasi keilmuan dalam Islam. Artikel ini dianggap penting untuk mendiskusikan relevansi pemikiran Kuhn dalam keilmuan Islam. Meskipun telah banyak teks-teks yang menjelaskan tentang pemikiran Kuhn, penulis belum menemukan sebuah teks yang secara khusus membahas tentang epistemologi Shifting Paradigm milik Kuhn dan menunjukkan relevansinya dengan transformasi keilmuan dalam Islam.

Kata Kunci: *Epistemologi, shifting paradigm, Thomas S. Kuhn.*

Introduction

The development of science became an important part of human life. Beyond pointing out that man has existed, the development of science is also a sign that man is using his intellect in creating new formulations in science. Development and attainment in science have also made human life easier to observe natural phenomena practically and contributing to the history of science theoretically (Syafii'ie, 2000).

A historical trail of the modernizing crisis in the field of science has led to the emergence of postmodernism that is rapidly becoming a talking point among scientists today. In a general sense, postmodernism gives the scientists new things that refresh them and release them from the shackles of modernistic formalism. It produced a new development in science itself. Furthermore, the development of science can result in the dissatisfaction that later scientists had with previous scientists, which made a positive development in science (Rif'i and Mud'is, 2010).

Thomas S. Kuhn (1922-1996) was one of the postmodernists of the United States with its philosophical, physical, and historical expertise; attempting to explain the shifting paradigm of science written in his book *The Structure of Scientific Revolutions* in 1962. In this book, he gave a very radical idea and contributed a great deal of thought and influence to post-positivism and postmodern epistemology with

his scientific paradigm pluralism. Kuhn in with his conception of the Shifting Paradigm is at least successful in explaining the course of the history of science (Zaprul Khan, 2016).

The context of the course of scientific history theorized by Kuhn or what is called the scientific revolution is for economics or natural science; Physics and astronomy. Then, what if it were used to see a paradigm shift in social science? Such a thing, of course, is complex and difficult. It because, economics or natural science is a sure thing, while social is relative. However, this could have been done because for Kuhn himself, scientific truth is tentative and relative, thus because of this science can evolve (Rif'i and Mud'is, 2010). By referring to the issue, this article will explain how the epistemology of Kuhn's Shifting Paradigm and how is this concept relevant to Islamic science.

Literature Review

Based on searches for literature relating to the subject of study in this article, we found some works of science that are similar to the study, among which are the following: *first*, a journal written by Fuad, etc., in 2015 entitled *Kebenaran Ilmiah Dalam Pemikiran Thomas S. Kuhn dan Karl R. Popper: Suatu Kajian Hermeneutika dan Kontribusinya Bagi Masa Depan Ilmu*, which compare the thoughts of Thomas S. Kuhn and Karl R. Popper about hermeneutics (Fuad & friends, 2015). *Second*, an article was written by Yeremias Jena in 2012 entitled *Thomas Kuhn tentang Perkembangan Sains dan Kritik Larry Laudan* which studied Larry Laudan's criticism of the scientific revolution of Kuhn (Jena, 2016). *Third*, an article entitled *Paradigm as a Central Concept in Thomas Kuhn's Thought*, written by Turkan Firinci Orman in 2016 which studied specifically the central concept of Kuhn's thinking, which is about paradigms (Orman, 2016). *Fourth*, the study in 2008 by Sonjoruri B. Trisakti under the title *Thomas Kuhn dan Tradisi-Inovasi Dalam Langkah Metodologis Riset Ilmiah* which intended to gain clarity about the methodology of scientific research in the sphere of philosophical discussion of the science as suggested by Kuhn (Trisakti, 2010). *Fifth*, journal written in 2018 by Afiq Almas, entitled *Sumbangan*

Paradigma Thomas S. Kuhn dalam Ilmu dan Pendidikan (Penerapan Metode Problem Based Learning dan Discovery Learning) that focuses on the learning model reduced and interpreted from Kuhn's conception of paradigm (Almas, 2018). *Sixth*, a journal written by Septi Damayanti and Hamka Mujahid Ma'ruf entitled *Epistemologi Santifik Thomas S. Kuhn Terhadap Munculnya Ilmu Pengetahuan Sosial* that published in 2018. The article explored the scientific revolution of Kuhn (Damayanti & Ma'ruf, 2018).

The study of Kuhn's thinking and its relevance to Islamic science has been observed, namely, the research done by Inayatul Ulya and Nushan Abid in 2015 called *Pemikiran Thomas S. Kuhn dan Relevansinya terhadap Keilmuan Islam*, but its focus is on studying the transforming Kuhn's thinking in an Islamic paradigm (Ulya & Abid, 2010). While the focus of this study is the epistemology of Kuhn's thinking and its relevance to Islamic science. So, the thing that distinguishes this study from previous research is the epistemological building of Thomas S. Kuhn's thinking. The above writings can be used as a preliminary study of Thomas S. Kuhn's thinking. Besides, it is expected to be a further review of the previous works with the effort to find relevance to the epistemology of Kuhn's conception about shifting paradigm.

Method

This research is a qualitative study employing a philosophical approach. The philosophical approach in this case is devoted to analysis from the epistemological point of view. The material object discussed in this study is Thomas s. Kuhn's thinking about paradigm and its shift. As for the reason to select Kuhn as an object study is based on several reasons. First, because Kuhn was known as the philosopher who promoted the term paradigm in the postmodern era, so when we discuss about paradigm, it cannot be separated from Kuhn. Secondly, because of Kuhn's success in explaining the flow of the scientific revolution (Bagus, 2010).

In this case, Kuhn's view on the Shifting Paradigm contained in his work the *Structure of Scientific Revolutions* is analyzed based on the important points in the

epistemology. It includes i) the source and substance of knowledge, ii) the instrument of knowledge, iii) how to acquire knowledge, iv) the theory of truth, and v) the validation of the truth of knowledge. It does, of course, begin with an interpretation of primary data—the structure of scientific revolutions— and secondary—other related works on the Kuhn's thinking of Shifting Paradigm. Then the data is described by clear mapping, and then analyzed from the epistemological point of view as previously described. At the end, Kuhn's idea of shifting paradigm would explain its relevance to the development of Islamic science.

Findings and Discussion

A Brief Biography of Thomas S. Kuhn

Thomas Samuel Kuhn was born on July 18, 1922, in Cincinnati, Ohio, the United States, and died on June 17, 1996, in Cambridge, Massachusetts USA. Kuhn was born to Samuel L. Kuhn and Minette Stroock Kuhn, whose father was an industrial engineer. Kuhn finished his Ph.D. at Harvard in 1949. He then began his academic career as an assistant professor by teaching science history in 1948-1956. His love for books led him into the subject of science viewed from the historical aspect. Next, Kuhn's attention turned to the question of astronomical history, and in 1957 the first book of Kuhn was published entitled *The Copernican Revolution* (Trisakti, 2018). He also studied at the University of California at Berkeley (Ulya & Abid, 2010). In 1956 to take post-graduate in the Department of Philosophy.

While studying in Berkeley, Kuhn became acquainted with Ludwig Wittgenstein and Paul Feyerabend's works, eventually, in 1962, he published the second book *The Structure of Scientific Revolutions* (Trisakti, 2008). In 1964 Kuhn left Berkeley for Princeton University as M. Taylor Pyne Professor for philosophy and history of science. In 1970, a paper collection contained by Kuhn's work on the discussion between Kuhn and Popper, entitled *Criticism and The Growth of Knowledge* was published. In the same year, the second edition of *The Structure of Scientific Revolutions* and *Postscript* was published. In 1977 a collection of Thomas Kuhn's

writings on philosophy and history of science was published under the title *The Essential Tension*. In 1978 the book *Black-Body Theory and The Quantum Discontinuity* was published. In 1983 Kuhn earned a degree from Laurence S. Rockefeller Professor of Philosophy at MIT (Trisakti, 2008).

Background of Thomas S. Kuhn's thinking

The Structure of Scientific Revolutions is unquestionably Kuhn's most famous work, in which he comprehensively explained his idea of a scientific revolution occurring in the realm of science. One of Kuhn's objectives in writing the book was to defy the prevailing stereotypes of the way science changes. In the view of the common man and some scientists, scientific progress is cumulative, each stage of progress is built on the entire advance that had been made Zaprul Khan (2016), this is the view that Kuhn criticized and saying that science is not cumulative, but revolutionary.

Kuhn understands the history of science is not a linear and continued process, but a process that cannot be compared and leaped. The emergence of such scientific leaps begins with the anomalies into old science or old paradigms, which then unable to survive, or a paradigm shift (Yuana, 2010). In other words, it is the appearance of these new facts-which the old paradigm could not finish-that caused the shifting paradigm to occur.

In addition to the above several reasons, Kuhn's view of science and its development was a response to the rapidly growing neo-positivism in Vienna. This development is primarily in a group known as the Vienna Circle, a discussion group of scholars based at the University of Vienna, Austria. The group emphasized the importance of the process of verifying and experimental confirmation of the "scientific language" as the step and process of development of science, as well as the differentiating line between science and not science. Positivism sees the development of science is accumulative. That is, science continues to unfold as an accumulation of what has happened as a result of scientific research throughout its

history. Further, they also establish scientific and unscientific criteria by one theory or proposition through verification principles (Lubis, 2014).

Before Kuhn, views on science were dominated by philosophical ideas on the scientific method. One is the assumption of the positivists, which suggests that scientific changes should be progressive. Besides, the pathway of change must be cumulative, objective, nomologic, and linear. Scientific progress is also seen as adding new truths to the stock of old truths, or increasing estimates of truth theories, or at least correcting errors in the past (Orman, 2016). This was rejected by Kuhn, for he argued that science developed through the scientific revolution and the scientific revolution came about through a paradigm shift.

Besides, Kuhn's view was also a response to Karl Popper's thoughts. For Popper, the process of scientific development in him would have to probably error with a process called falsification and refutation. Falsification is an experimental process to examine a scientific theory. The Falsification of Popper is a theory that requires one science to be proved wrong, which can then eliminate it. It means the truth of the theory is accepted until it is discovered by another scientist. Kuhn denies this and he considers it's inappropriate. The development and particularly the change of science according to Kuhn never occurs based on empirical efforts through the process of unification of a theory or system, but rather through one very fundamental change or a scientific revolution (Lubis, 2014). While refutation is theoretical denial. These are the two views that Kuhn rejects: positive-objectivity thought, evolutionary process, accumulation, and elimination in the development of science.

Kuhn himself viewed science from a historical perspective. One thing Popper did, too. The difference is, Kuhn, explored larger subjects, such as what is the nature of science? Both in actual practice and concrete and empirical analysis. If Popper is using his science history as evidence to defend his opinions, Kuhn is using science history as the point of inquiry. For him, philosophy must teach the history of science, with the intent of understanding the true nature of science and

scientific activity Zaprul Khan (2016), it was then that Kuhn offered a solution centered on paradigm a scientific development tool, and revolution as a way of science to expand. Kuhn claims that a study of the history of natural sciences shows how a values-based selection process always happens. Scientists must not only choose which phenomena to study, but they must also select a theoretical approach to do the research (Zaprul Khan, 2016). Aristotle was, in a sense, the first Greek philosopher to build such a scientific point of view in the 2 B.C.E. Kuhn has certainly studied this early history concerning how the revolution came about in the postmodern world.

Thomas S. Kuhn's Conception of Shifting Paradigm

The scientific revolution is the drastic change that occurs in the stage of the scientific development or noncumulative development when the old paradigm is replaced entirely or in part by a conflicting new paradigm Kuhn (2012), or is different from before. The substitution of a scientific paradigm would result in a very basic distinction between the old paradigm and the new—which replaced it (Lubis, 2014). The new paradigm needs to discard the old paradigm not just the development of previous theories, but a new paradigm gives new ways of seeing the world, new ways of thinking, and new goals and methods in exploring the universe (Zaprul Khan, 2016). The scientific revolution of Kuhn illustrates that scientific truth will be discovered many times or its scientific form will be changed even from the same object. It is not continuous, improvisational, evolution or cumulative, but it also produces revolutions (Nurkhalis, 2012).

The scientific revolution began with the growth of awareness of the scientific community that the prevailing paradigm no longer functions adequately in the exploration of an aspect of nature, which previously pointed the way for such exploration (Kuhn, 2012). It means that there are new facts that have emerged that are then unable to complete the old paradigm. It is also the cause of a crisis that triggers a new passion for the scientific community to introduce new paradigms to meet the demand for sure answers about nature or science. The first scientific

change of science was "discoveries" or "anomalies." The anomaly is the recognition that nature has somehow exceeded the expectations set in motion by the paradigm that governs normal science (Mauskoph, 2012).

The old paradigm that was "kicked out" by this new paradigm called the scientific revolution. Based on the theory, Kuhn assumed that science was just a social process and consensus of scientific communities. In other words, scientific truth is relative and depends largely on the social factor that is the scientific community. Science cannot give an objective and one objective truth. He only gives tentative truth (Lubis, 2014). Kuhn did not see the claim of knowledge objectivity from the development of knowledge itself. According to him, the claim of objectivity in both knowledge and science comes not only from within and its discipline, but from a broader framework, or a broad social framework. That is, Kuhn saw the claim of scientific objectivity itself in the development of knowledge as the gathering of human beings within society (Watloly, 2013).

As for the paradigm, for Kuhn, was a basic view of the subject of science. Defining something that should be examined and discussed, what questions to ponder, how to formulate the question, and what rules to follow in interpreting the answer. The paradigm is also defined as the largest consensus in the scientific world that serves to distinguish one community from another. Paradigms are closely related to the defensive, scientific copies, theories, methods, and instruments included (Lubis, 2014). The scientific truth for Kuhn is tentative and relative to what appears when normal science experiences anomalies and culminates into a crisis that results in a new revolution and the emergence of a new paradigm, then a new science, and so on (Fuad & friends, 2010).

The shift of study on history to the structure of scientific practice and scientific ideas has largely resulted in the abandoning of the old paradigm, and the presence of the new paradigm is judged as a relevant category to the current scientific world. The new paradigm experienced a revolution that served as a historical interpretation (Nye, 2012). Kuhn's paradigm theory indicates that transformation

Syafi'ie (2000) has taken place in the field of physics and astronomy. For thousands of years, European scholars have used the natural philosophy Aristotle and Ptolemy as a model or pattern to explain natural phenomena.

For example, the earth is believed to be the center of the universe (the theory of geocentric), and the sun and the planets orbit around it. Aristotle's model or scheme began to be questionable and abandoned after the advent of a new astronomical system (a new paradigm) from Copernicus that claimed that the earth was not the center of the universe. The earth and the planets in fact orbit around the sun (the heliocentric theory). Galileo Galilei and Newton were two major proponents of the theory of Copernicus. These two physicists have offered a new model, pattern, or scheme for seeing and explaining the natural phenomena. So, the shift from a paradigm of Aristotelian to a paradigm of Copernicusian, Galilean, and Newtonian has occurred (Lubis, 2014).

In summary, the development of science according to Kuhn can be explained to several phases as follows: *first*, the pre-paradigm phase. The phase when the different kinds of thinking have emerged, it competing and eliminating each other, has different conceptions about basic matters of scientific discipline and what criteria to use to evaluate theories. It is the first stage in the formation of science. At this stage, the development of science has no set of established methods, theories, concepts, or paradigms. Scientists still do not have a conceptual agreement regarding an object that they consider. Each of them formulated a research object with a different formulation. This pre-paradigm phase can be seen from the classical era to the end of the 17th century when, generally, there was no acceptable distinctive view, for example, of the nature of light. Then there emerged a figure, for example, who presented the most effective argument that led to the conclusion of the theory becoming a paradigm, although the agreed-upon paradigm could not fully explain the object under consideration. So, in this pre-paradigm stage, scientists have not agreed on a particular method that will be used as a pattern or official reference to research. At this stage, many scientists give their theory and try

to point out that it is the theory and therefore deserves an official grip on the discipline of science. This is what is known as the paradigmatic war. There's a competition here to show whose theory is the best. From this came a paradigm and normal science (Zaprul Khan, 2016).

Second, the forming phase of paradigm and normal science. A paradigm is a central concept in Kuhn's thinking. In many kinds of literature, it is said that Kuhn himself did not have a clear and consistent definition of the paradigm, so in much of his explanation often the context and meaning of his explanation are changed (Zubaedi & friends, 2007). A paradigm agreed upon by the scientific community, because of its advantages in solving scientific problems, would be the foundation for the appearance of normal science. The normal science consists of only one paradigm, for if it is composed of many, it will be overlapping and will not be the normal science again (Zaprul Khan, 2016).

In his book *The Structure of Scientific Revolutions*, it is explained that normal science means research solidly based on one or more scientific achievements past, ones that certain scientific communities at one time claim to be the foundation for further practice (Kuhn, 2012). This phase shows, where one stream of thought or theory arose in the pre-paradigm dominates disciplined theories or other sciences (Jena, 2012). *Third*, the emergence phase of anomalies and crisis, both scientific practice and disciplinary matrix can no longer be relied upon in solving the new issues. Scientists began to question the accepted paradigm over time. Here we have a serious competition because the winner determines whether a paradigm will work (Jena, 2012). Kuhn says history proves that there is no one perfect paradigm that answers all scientific problems. Scientific problems that cannot be solved by a paradigm called an anomaly. Thus, the anomaly arose because the old paradigm had lost the ability to answer the scientific problems that arose Zaprul Khan (2016), and this resulted the emergence of the fourth phase, crisis.

Quite simply, the crisis is a cumulation of unfinished anomalies. This is due to an increasing number of problems that paradigms cannot solve. The crisis is also a

phase in which the normal old science (old normal science) based on the old paradigm has trouble solving the new scientific problem (Zaprul Khan, 2016). To overcome the crisis, there was a revolution in the scientific world. By practicing a paradigm war on new concepts from science experts, a new paradigm that would later emerge the new-normal science could form.

Fifth, the emerging phase of a new paradigm, during the competition, one of schools or streams of thought emerged and could address the problem, able to generalize and promise a better research future (Jena, 2012). In the history of science, an old paradigm is abandoned not because it is less scientific than it is new but because it is no longer considered fit to solve a problem. New paradigms give new ways to see the world, new ways to think, and new purposes and methods to explore the universe. A new paradigm needs to discard the old paradigm, not just a development of previous theories. Consequently, the scientific revolution twilight the rejection of the old paradigm, not just the addition to the new one. A process from the old-normal science to the emergence of a new-normal science, and then followed a more recent normal science, and so on, Kuhn understood it as a never-ending process, and this led to scientific development. Kuhn also adds that the change from the old paradigm to the new paradigm or from the old-normal science to the new-normal science occurs radically, one killed to the other (Zaprul Khan, 2016).

An old paradigm has already intolerable then replaced by a new paradigm different from the previous one (incommensurable). In the sense that there is no more conformity in the old paradigm of facing or solving new problems faced. The old is replaced by the new, this is what Kuhn calls the scientific revolutions. It needs to be noted also that with the consequences above, each paradigm is ultimately very subjective depends on groups that consider a theory to be a paradigm. So each theory that results depends greatly on the group's perspective (Zaprul Khan, 2016).

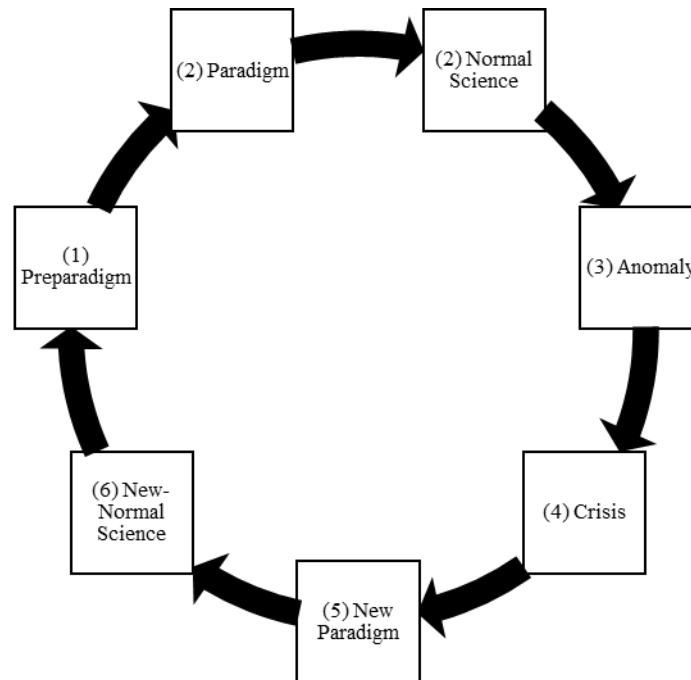


Fig 1. Scheme of Kuhn's Shifting Paradigm

According to F.R. Jevons in the book *The Holy Quran and The Sciences of Nature*, says that Kuhn's paradigm suggests more than just individual research that gives instructions for further work. It is a research tradition, a way of thinking that brings a set of assumptions and guides a group of scientists to approach natural phenomena. It also gives way to see the problem, and it determines certain techniques that are correct and various acceptable solutions (Ghulsyani, 1986). This means F.R. Jevons agrees with Kuhn, which states the implications of Kuhn's paradigm, which helps the developmental science process.

In the same book quoted the different views presented by Goldsmith. According to him, there is a flawed link in the paradigm of modern science with current physical or nonphysical effects. Modern science nowadays is nothing but an accumulation of half the truth, and this half-truth is that man tries to control the world, and as a result, brings the world to ruin (Ghulsyani, 1986).

Between the two opinions, the writer agrees with the two. The scientific revolution was the development of science. Scientific development brought new

knowledge to the world of science and have a good effect on the ease of life in the world. As for Goldsmith's opinion above, it could be due to the interest and manipulation of human beings in exploiting the development of science. Developments that should be of positive value turn into things that are not beneficial. However, the fault is not in its scientific change, but in humans who developed it. Fuller in his journal entitled *Thomas Kuhn: The Wrong Person At the Right Place at the Right Time* suggests that Kuhn's influence on science has made the history of science important and sidetrack the political discussion of the day. Although, the ending didn't have a happy ending, because Kuhn's conception of a paradigm as a social movement was then suppressed (Fuller, 2001).

Analysis of Epistemology of Shifting Paradigm

The central question of epistemology speaks of what can be known and how to get to the knowledge (Suhartono, 2011). For Kuhn, the social process determines the development of science. The old paradigm shift to a new paradigm is caused by the dynamic social processes and a new challenge of the era itself. The development of social processes has implications in the development of science. It because the development of science rests on social processes causes it to be relative. For Kuhn, the source and the nature of knowledge is the history of science, whereas the knowledge instruments are the paradigm of science. As for science and philosophy, Kuhn stated, it is to challenge the prevailing notions of how science changes.

In Kuhn's theory, the way to acquire knowledge is to take it from the current scientific paradigm (normal science) in a particular scientific community. When the paradigm was considered already incapable of solving the new scientific problem that caused the cumulation of anomalies or crisis, scientists would begin attempting to find new ways in solving the crisis. It is this the new way that will later replace the previous way and become a new paradigm that shifted the old paradigm. This new prevailing paradigm would become the new-normal science. Thus, new knowledge would emerge.

For example, in the 2nd-century, Aristotle, and Ptolemy discerned that the earth was the center of the solar system (geocentric). Increasing the social process of the theory began to be questioned because of the uncertainty and failure of the expected answer to the riddle of science. Later, scientists attempted to unravel the riddle of science, as social processes called for answers that were supposed to eliminate the uncertainties. In the Middle Ages between the 16th century, Copernicus and his supporters Galileo Galilei and Newton performed experiments and observations that produced new variations that the earth was not the center of the universe, the earth and the planets were orbiting around the sun.

As for the theory of truth, scientific statements are true if they go in line with an existing paradigm (normal science). Whereas the validity of truth of knowledge is an anomaly, as long as scientific anomaly does not arise then the theory of knowledge is validated as true.

The relevance of Thomas S. Kuhn's Concept of Shifting Paradigm to the Islamic Sciences

Kuhn's success in describing the course of the transformation of science in the field of natural science; Physics and astronomy can be used as a method of analysis to explain the transformation of Islamic science. The development of science in Islam which, from time to time, is dynamic, the Shifting Paradigm theory of Thomas S. Kuhn can be used to understand how the process of shifting paradigm occurs. For example; Islamic science in the field of tasawuf. As is known, tasawuf has a dynamic development, in concepts, understandings, and practices. With Kuhn's theory of Shifting Paradigm, the development of tasawuf is visible. As for the application, which is:

First, pre-paradigm. It is the first stage in the formation of science, where there is a wide succession of thought streams with no set of established methods, theories, concepts, or paradigms (Zaprul Khan, 2016). In the case of tasawuf, it may be said that pre-paradigm in this field is the emergence of the asceticism or *zuhud* as a social, moral, political, and economic criticism divided into four sects; Madinah,

Bashrah, Kufah, and Egypt, which occurred in the 1 and 2 centuries AH/7 and 8 CE (Hamali, 2007).

Second, the paradigm and normal science phase are when a paradigm agreed upon by the scientific community because of its efficacy in solving scientific problems, which would then serve as the foundation for the normal science emerged, which is the new thought or theory arising in pre-paradigm phase dominates other disciplines of theory or science (Zaprul Khan, 2016). At this phase, tasawuf as an established paradigm of science with theoretical concepts of soul, morals, and metaphysics, and the mainstream of the two faces of tasawuf; *Akhlaqi* and *falsafi* that occurred in the 3 and 4 AH/ 9 and 10 CE. Later, in the 5 / 11 AH., tasawuf *Sunni* that was spearheaded by Imam al-Gazali develop, and in the next century 6 and 7 AH/ 12 and 13 CE, tasawuf *falsafi* appeared to dominate again (Rifi & Mud'is, 2010).

Third, the anomaly phase, emerged because the old paradigm was no longer able to answer the scientific problems that arose (Zaprul Khan, 2016). At this stage, tasawuf has a decline because it is limited to comments or summary of its previous tasawuf books and just like a ritual away from the substance of tasawuf, which occurred in 8-13 AH / 14 -19 CE (Rifi & Mud'is, 2010).

Fourth, crisis phase; the cumulation of anomalies that cannot be unfinished (Zaprul Khan, 2016). In the case of tasawuf, in addition to the scientific construction of tasawuf has failed to develop, tasawuf is also faced with a crisis that is considered incompatible with modernization and tasawuf is considered to be the cause of the decline of Muslims, and it is heresy, and superstition (Rifi & Mud'is, 2010).

Fifth, the new paradigm phase, an old paradigm is abandoned not because it is less scientific than the new, but because it is deemed irrelevant to solving a problem (Zaprul Khan, 2016). This phase produces what is called neo-Sufism, the tasawuf spearheaded by Fazlur Rahman in 19 century who attempted to reinstall a positive attitude toward the world (Rahman, 2010).

Conclusion

From this research on the Epistemology of Kuhn's concept of Shifting Paradigm, we can conclude some important things. *First*, the source and essence of science—in Kuhn's concept—was the history of science. *Second*, the instrument of knowledge is the scientific paradigm. *Third*, the way to gain knowledge is starting from the pre-paradigm there arose normal science, there were anomalies and crisis, and then there was a new paradigm. *Fourth*, the theory of truth is normal science—in the sense that scientific statements are correct when they correspond to the prevailing paradigm (normal science). *Fifth*, validation of the truth of knowledge, is the discovery of anomalies, as long as scientific anomalies do not arise then the theory of knowledge is validated as correct. As for the relevance of this concept to Islamic science, it can be used as a method of analysis in describing the transformation of Islamic science, concerning the line of the scientific revolution of Kuhn. In this case, the concept can be used to describe the transformation of tasawuf. *First*, the pre-paradigm, the phase in which the tasawuf seed appears in the form of the life-form zuhud. *Second*, the paradigm and normal science, the phase in which tasawuf was established as a science. *Third*, the anomaly phase, the phase in which the tasawuf is regressing. *Fourth*, the crisis phase, where there are various anomalies in tasawuf science. *Fifth*, a new paradigm, a phase in which neo-Sufism emerged spearheaded by Fazlur Rahman.

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