Kanz Philosophia:
A Journal for Islamic Philosophy and Mysticism

Volume 9 Number 2, December 2023 Pages 395–420

EPISTEMOLOGY METHODOLOGY OF IMRE LAKATOS'S SCIENTIFIC RESEARCH PROGRAM AND CONTRIBUTION TO ISLAMIC SCIENCE

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Article History: Received: 11 July 2023 Revised: 20 October 2023 Accepted: 25 October 2023

DOI: https://doi.org/10.20871/kpjipm.v9i2.296

Abstract: *This study aims to look at the contribution of Imre Lakatos' scientific research program to Islamic scholarship. This study focuses on the relevance between the scientific research program and the integration-interconnection paradigm initiated by Amin Abdullah. This research uses a qualitative approach with a library research method, tracing writings that have a connection with the theme raised in the books and relevant recent articles. The study results found that Imre Lakatos' scientific research program is the result of the development of its predecessors, Popper's falsification and Thomas Kuhn's scientific revolution. Scientific research has three important elements: 1) hard-core, which is the core of research that cannot be disturbed; 2) protective belt, which protects the hard core from being eliminated: and 3) a series of theories, which contains interrelated theories and will give birth to new theories. In Islamic scholarship, the same thing happens, except that in Islamic scholarship, no matter how complex the problem is, the hardcore can never be replaced, unlike the Lakatos research program that adapts to the context of the problem. One of the fruits of the Lakatos concept is the presence of the Integration-Interconnection paradigm initiated by Amin Abdullah at UIN Sunan Kalijaga to connect religious science with other sciences through research. Three criteria must be met so that the concept of integration-interconnection can be used in the scientific research paradigm: recognized by most of the scientific community, has become a characteristic in society, and has produced many works from the concept of integration-interconnection.*

Keywords: *Imre Lakatos, Islamic Science, Scientific Research.*

Abstrak: Penelitian ini bertujuan untuk melihat kontribusi program riset ilmiah Imre Lakatos terhadap keilmuan Islam. Dalam penelitian ini menitikberatkan relevansi antara program riset ilmiah dan paradigma integrasi-interkoneksi yang digagas oleh Amin Abdullah. Penelitian ini menggunakan pendekatan kualitatif dengan metode kepustakaan atau *library research* yakni menelusuri tulisan-tulisan yang memiliki keterkaitan dengan tema yang diangkat baik berupa buku maupun artikel-artikel terbaru yang relevan. Hasil dari penelitian ditemukan bahwa Program Riset Ilmiah Imre

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lakatos merupakan hasil dari pengembangan pendahulunya yakni Falsifikasi Popper dan Revolusi Ilmiah Thomas Kuhn. Riset Ilmiah ini memiliki tiga elemen penting: 1) *hard-core*, merupakan inti dari sebuah riset yang tidak bisa diganggu; 2) *protective-belt,* yang berusaha untuk melindungi *hard-core* supaya tidak tereliminasi: dan 3) *a series of theory*, yang memuat teori yang saling berkaitan dan akan melahirkan teori yang baru. Dalam keilmuan Islam juga berlaku peristiwa serupa, bedanya dalam keilmuan Islam sekompleks apa pun permasalahannya, *hard-core* tidak akan pernah bisa tergantikan. Berbeda dengan program riset Lakatos yang menyesuaikan dengan konteks permasalahan. Salah satu buah dari konsep Lakatos adalah hadirnya paradigma Integrasi-Interkoneksi yang digagas oleh Amin Abdullah di UIN Sunan Kalijaga yang ingin menghubungkan ilmu agama dengan ilmu-ilmu lainnya melalui riset. Ada tiga kriteria yang harus dipenuhi agar konsep integrasi-interkoneksi bisa digunakan dalam paradigma riset ilmiah: diakui oleh sebagian besar masyarakat ilmiah, sudah menjadi ciri khas di masyarakat, dan sudah menghasilkan banyak karya dari konsep integrasi-interkoneksi.

Kata-kata Kunci: *Imre Lakatos, Keilmuan Islam, Riset Ilmiah.*

Introduction

The complexity and development of science today seem to be experiencing a lot of turbulence. It is very difficult today to distinguish the truth of a science. Paradigms continue to emerge from various figures who criticize each other. The complexity of theories that continue to emerge needs to be tested to indicate whether or not the theory is scientific and to see that the theory does not stand alone. In the world of research, the methodology cannot be separated as part of it to fulfill human curiosity about the truth through data, whether symbolic or not. Humans can accommodate the facts that surround them, so it is often referred to as a scientific theory (Assya'bani 2020, 222).

This scientific theory then led to human civilization as it is today. Its rapid, tight, and dynamic development makes scientists compete to solve and even develop a theory. The tight competition in solving and discovering new theories then raises questions such as: how do scientists maintain the theory they found amid criticism that comes one after another? How then scientists find a new theory that criticizes the old theory? It does not even rule out the possibility that the old theory cannot be used anymore or doubt the truth then abandoned. So, it is necessary if scientists to understand the methods and steps that are appropriate in conducting scientific research.

The history of the development of science records many scientific figures who contributed their thoughts to finding the truth. One of those who gave his ideas regarding how to carry out research is Imre Lakatos. The presence of Imre Lakatos' thoughts is inseparable from his criticism of other scientists. Imre Lakotos in this case evaluates and refines the thoughts of two other scientists, namely Karl R. Popper and Thomas Kuhn. As we know, the two figures above are two of the scientists whose

thoughts have contributed to this day. Popper has the view that the theory is nothing but a creation of the human brain, it can be recognized if tested. Testing is done with a series of experiments and observations. If the theory is unable to survive, it cannot be used, meaning that Popper views that knowledge develops from errors and mistakes made by humans, so the term falsification arises. Meanwhile, Kuhn thinks that the development of science is a revolution. Kuhn began his thinking with the concept of a paradigm which was then followed by a scientific revolution (Mardiana, Ainin, and Iskandar 2022, 4356).

Popper's falsification and Thomas Kuh's scientific revolution sparked Imre Lakatos' thinking by combining the two ideas. The fruit of Imre Lakatos' thinking is known as the *methodology of scientific research programs*. It is used to test the validity of existing theories using three elements: the *hardcore*; the protective belt; and *a series of theories*. The logic of discovery is fundamental to Imre Lakatos' theory of scientific research (Mustansyir 2017, 255).

In the development of Islamic science, the study of scientific epistemology is still rarely touched by academics. The practical and pragmatic conditions of society have led Islamic science to be underdeveloped. It is important to explore the nature of science and the history of its development, which is one of the pillars in understanding the nature of science in Islam (Muslih 2020, 50).

In this regard, one of the professors of UIN Sunan Kalijaga, Amin Abdullah, initiated a new paradigm in Islamic science, namely integration-interconnection. This paradigm was born because the scientific integration that developed at UIN is still struggling at the normative philosophical level and has not touched the empirical implemented area (Lubis, Husti, and Mustofa 2023, 17). The interesting concept of this integration-interconnection paradigm is explained by a spider web scheme where the center is the Qur'an and Sunnah. The scheme has similarities with the scientific research method initiated by Imre Lakatos by placing *hardcore at* the center of his concept. Based on this, the author is interested in exploring the relationship or relevance between Imre Lakatos' scientific research method and Islamic scholarship, especially Amin Abdullah's integration-interconnection paradigm.

Biography of Imre Lakatos

There is not much literature on Lakatos' life history. Imre Lakatos was born in Debrecen, Hungary on November 9, 1922. Imre Lipschit is the original name of Imre Lakatos. The upheaval of the political situation and due to threats from the Nazis, Imre then changed his name again to soundlike a real Hungarian, namely Imre Molnar. During the Second World War, Imre was actively involved in the anti-Nazi resistance. At this time, he changed his name again to Imre Lakatos. The name Lakatos comes from

the Hungarian language which means "locksmith". His name that keeps changing is not without reason, he adjusts the conditions and situations that exist so that he can save himself from danger. The name Lakatos is also a form of his respect for Geza Lakatos who was one of the Hungarian generals who succeeded in bringing down the pro-Nazi leadership (Muslih 2020, 60). Lakatos completed his doctoral studies at Cambridge University with the dissertation title *Proofs and Refutations.*

Imre Lakatos is an alumnus of the *University of Debrecen*. Imre studied math, physics and philosophy and graduated in 1944. In the same year he was faced with a choice offered by Hitler to Hungary, namely siding with Hitler or the German army that was in power in Hungary at that time. Imre Lakatos was appointed minister of education in 1947. In 1950 Imre was thrown into prison forapproximately 3 years due to his thoughts that were different from scientists at the time. After being released from prison, Imre began to be active again as an academic by translating mathematics books into Hungarian (Guna and Ramadhani 2021, 133). When the Hungarian Revolution occurred in 1956, Imre then fled from the Vienna region to London. This revolution was a step in opposing the government of the RRH (People's Republic of Hungary) and the intervention of state policy by the Soviet Union.

Imre's escape to London was a blessing for him, he later obtained his doctorate after composinga dissertation entitled *Proofs and Refutations: The Logic of Mathematical Discovery* and successfully defended it. As is well known, Lakatos had an orthodox Marxist education, and his dissertation was in line with the Marxist tradition (Shibarshina 2018, 53). His extensive experience in translating mathematical books led him to write extensively on the philosophy of mathematics before turning to the philosophy of science. Imre's phenomenal work was when he wrote a philosophical dialog pioneered by Euler. This philosophical dialogue addresses the fundamental proofs that arise in geometry and is considered one of the best intellectual works of art. The same will be found when reading the works of Hume, Plato and Berkleywhose writing techniques are very similar (Mustansyir 2017, 258).

Imre Lakatos' activeness in academia led him to become a lecturer at the *School of Economics, London. The* book *Methodology of Scientific Research Programmes* is a phenomenal work of Imre published in 1965. In that year Imre, Popper, Feyerabend and Kuhn also met to discuss his ideas in his work. In the course of the discussion, Imre became more and more convinced that what he initiated would be able to contribute to the scientific field as an epistemological structure of scientific research. Three years after the meeting, Imre published two more books. The first was *Criticism and the Methodology on Scientific Research Programmes*. This book is Imre's evaluation of Popper's concept of falsification and tries to fix the flaws in it. The second book is the result of Imre's collaboration

with Feyerabend with the title *For and Against Method*. Imre died when he was in the process of completing the book *The Changing Logic of Scientific Discovery* which is an update of Popper's book entitled *The Logic of Scientific Discovery*. Imre died on February 2, 1974, in London (Honderich 2005, 521).

Background of Imre Lakatos' Thought

Scientists and philosophers before Imre Lakatos basically already had thoughts related to science. But most of them criticized and blamed each other. Many philosophers and scientists who lived at the same time as Imre Lakatos, namely Karl Popper, Paul Feyerabend, Wiilard Van Orman Quine, Thomas Kuhn and many more (Muslih 2020, 49). One of the triggers for Imre's thinking is Karl Popper and Thomas Kuhn. Popper is famous for his falsification science. Popper's theory was born from his criticism of the *Vienna Cricle's* concept of verification, as well as the theory of hypothesis, demarcation and the meaningfulness of metaphysics (Riski 2021, 264).

Popper rejects the existence of the induction method recognized by the *Vienna Circle of* neo- positivism with the assumption that the method is not immune to criticism. The induction method states that all findings and achievements of scientists are a hypothesis based on their provisional nature (Riski 2021, 264). Then the demarcation issue is Popper's response to the *Vienna Circle* statement which considers that the main problem in finding science is language. From here, the concept of verification was born, where a statement that is meaningful and can be proven empirically can be considered scientific if the word is not meaningful and cannot be proven empirically, it is notscientific. This statement was later criticized by Popper, that science is not through verification but falsification. This means that not all unscientific statements are meaningless and vice versa. This debate then inspired Imre Lakatos in initiating his thoughts, science is falsification not verification and can be tested (Muslih 2020, 50).

Popper's falsification logic is actually interesting to explore further, but if you pay close attention to its epistemology, it will cause problems. For example, when there is a statement "all swans are white", then this statement will be falsified if there is an opportunity and proof that there are swansthat are not white. This statement illustrates that falsification will lead to the continual elimination of the theory if one day it is disproved. On the other hand, the scientific proof of whether or not a science actually arises from a variety of complex problems that are universal. On the one hand, science is expected to be able to simplify the problems that continue to emerge (Assya'bani 2020, 222). Popper's falsification was later criticized by Thomas Kuhn. Kuhn initiated the concept of paradigm and scientific revolution. Kuhn's scientific revolution is characterized by a transition fromthe old paradigm to the new paradigm. Kuhn disagrees

with the statement that science is evolutionary. For Kuhn, science is revolutionary, this is based on his opinion that the development of science lies in its history which is always continuous or continuous (Latif 2014, 138).

Another philosopher who influenced Imre Lakatos' thinking is Ludwig Wittgenstein. Ludwig is an Austrian philosopher who is famous for his philosophy of language. Through his work, he influenced Imre Lakatos in the history of science. Then there is a philosopher from the United States who coined the concept of paradigms and scientific revolutions, namely Thomas Kuhn. Kuhn has the view that the development of science comes from ongoing paradigm changes. This concept then influenced Imre Lakatos in understanding the methodology of science. Paul Feyerabend's criticismalso influenced Imre's thinking. Through criticism, Imre understands that there are many ways that can be taken to gain knowledge and truth in science, meaning that he is not fixated on just one way (Mustansyir 2017, 260).

Imre's journey in understanding and exploring science later produced works that are very usefulfor researchers and scientists. Among them are *Essays in the Philosophy of Science (Hutchinson University Library, 1965), Problems in the Philosophy of Mathematics (Nort-Holland Publishing Company, 1967), La Methodologia de los programas de investigacion cientifica (Alianza Universidad, 1978), Critisim and the Growth of Knowledge (Cambridge University Press, 1970), Proofs and Refutations; The Logic of Mathematical Discovery (Cambridge University Press, 1976), The Methodology of Scientific Research Programs; Philosophical Papers Volume 1 (Cambridge University Press, 1978),* and *Mathematics, Science and Epistemology; Philosophical Papers Volume 2 (Cambridge University Press, 1978).*

The phenomenal work that made Imre Lakatos known for his scientific research method is *Criticism and the Methodology of Scientific Research Programs.* This work was born when Lakatos was often involved in discussions with Popper, Feyerabend, and Kuhn. In 1965, a symposium was held to bring together the ideas of the thinkers at that time. From that meeting, Lakatos was able to introduce his ideas regarding scientific research methods. Finally, in 1968, his work was published, which criticized Popper's concept of falsification and offered ideas related to scientific research methods (Aziz 2006, 451).

Popper's Falsification

Popper's concept of falsification is one of the ideas that underlie Lakatos' thinking. Falsification itself was born from Popper's criticism of the Vienna Circle verification concept. Falsification can beunderstood as a way of looking at things from the point of view of error, meaning that if there is a theory that appears, it will be seen first whether it has an

error or not. If the theory is proven wrong, then what will be done is to find another theory and the theory is abandoned. Popper believes that ifa theory after being tested continuously and not proven wrong, it will be stronger, but if it is proven wrong once, the theory will be replaced with a new one (Riski 2021, 64). *Logical asymmetry* is central to Popper's philosophy of science. This view then inspired him to make falsification a dividing criterion between scientific or not a statement. Muhammad Muslih in this case says that falsificationis a step in which the goal is to find a counter theory through a series of experiments so that the strongest theory is obtained when tested. Popper said that something that is certain is not scientific (Saepullah 2020, 64).

Among the main characteristics of Popper's epistemology: Objectivism approach, which is an approach that considers human knowledge the system of proposals or theories that are the subject of critical discussion, the approach knows the objective problem to solve the objective success in this case. The problem is that objective knowledge of a person's opinion is separate from the subject. Analysis refers to an objective approach and attitude towards problem solving based on reason and experience more than feelings and passions; problem solving is an epistemological study with an objectivist approach from a scientific point of view. Our analysis can be seen from the point of view of solving the problem of free creation of our own minds, the result of experiments in intuitive understanding of natural laws. There are some of Popper's views on Vienna Circle thinking. *First, the* objection to the method of induction which is the temporary nature of a theory. Induction is a pattern used to conclude problems that were previously specific to be universal. This indicates a generalization of the problems that occur by the same object. Popper argues that all previous scientific findings are hypotheses, most ofwhich are not immune to criticism, this is because of their temporary nature. The generalization that occurs in the induction process is rejected by Popper, for him this induction thinking cannot be used as a scientific basis. Popper said how could something that is particular become something universal. Popper gave an analogy to a statement "all swans are white", Popper said that any number of white swans would not be able to make the material as long as at some point a black or brown swan wouldappear (Yuslih 2021, 441).

Second, the separation between scientific or non-scientific knowledge is known as demarcation. Demarcation is a limitation between the scientific or not of a science. Positivism assumes that whether science is scientific can only be known through the verification process. This view sees from the point of view of language use, the language that gives rise to the statement is either scientific or not. This can be proven by positive empirical data. Popper considers that not all meaningful statements are scientific and vice versa, not all meaningless statements are unscientific. Because in Popper's view, scientific or not is not based on whether a

statement is meaningful or not but whether it is strong or not from a refutation or falsification. Popper uses criticism as the main method for finding truth. A theory is said to be scientific if there is a possibility of being declared wrong and vice versa if the theory is unable to be declared wrong then the theory is not scientific (Yuslih 2021, 441).

In his statement, Popper makes falsification in determining the scientific boundaries of science. So, in this case the theory will be considered scientific if it can survive the process of refutation. The application of this falsification will affect the nature of science. Progress will occur when eliminating theories that cannot accept refutation. Every theory will face hypothesis testing, if the potential for error is getting bigger, it will be replaced or eliminated by a new theory. So in essence, falsification isa tool used to distinguish whether a theory is scientific or not (Yuslih 2021, 442). The truth or error of a theory will be seen if the theory is used in trials by adding new facts from the field. The more able to answer new facts in the field, the stronger the theory will be. If the opposite happens, the theory will be abandoned and replaced with a new theory. Popper also said that there is no science that reaches absolute truth, there is only near truth.

Third, the Vienna Circle states that science is a collection of evidence that is collected continuously. Popper said that science was born from the process of elimination of theories that could not survive the proof of error. *Fourth,* this shows Popper's consistency in his thinking by issuing a three-world opinion. World one is the fascist reality of the world, world two contains the reality ofthe psychic in humans such as prejudices, scientific concepts and theories, and world three is a hypothesis, theory, law where it is the result of human creation (Muslih 2020, 49–52).

There are three reasons why Popper rejects verification: verification will not obtain universal laws because it only deals with particular laws; verification only considers something that can be observed to be meaningful, but it cannot be denied that metaphysics is also meaningful, this is what verification rejects; and the truth and meaningfulness of a theory will only be obtained if it is understood, in this case the verifications (positivists) have placed restrictions on whether or not a theory is meaningful without trying to understand it first. Several steps are formulated by Popper inusing falsification. The steps are as follows:

a. Logical comparisons between theories were made to prove the consistency of the theories beingcompared.

b. Matching the theory with the logic of thinking, this is used to see whether there are empiricalfeatures in the theory.

c. Comparing between theories to prove the robustness of the theory.

d. Finally, empirical application.

The above stages are carried out to see how far the theory can survive, both scientifically and after being practiced in the field. These steps are carried out carefully to see the consequences that may be faced with a scientific perspective on field practice. It can be said that falsification is the opposite of verification. Popper said that absolute truth cannot be obtained by relying on verification alone, but the theory will be stronger if it is proven wrong but can survive (Ulum 2020, 83). Furthermore, Popper argues that *falsifiability* is the main reason in the process of knowing the blackand white truth of science, this then makes science scientific or not.

Thomas Kuhn's Scientific Revolution

Thomas Kuhn is an American physicist and philosopher. His work is phenomenal and later became the foundation of Lakatos in publishing his ideas is *The Structure of Scientific Revolution* published in 1962. Paradigms and scientific revolutions are the main thoughts in this book. In addition, many also discuss the history of science and philosophy of science related to the thought of paradigms and scientific revolutions. This book is also reading material for contemporary scientists in understanding the history of development and thought of philosophy of science. Kuhn's own thinking is classified into new philosophical thinking (Verhaak and Imam 1991, 16). Kuhn'sown thinking is based on his background as a physicist and therefore conducts a series of experiments. With his experience, Kuhn then led to the concept of paradigm and scientific revolution (Lubis 2015, 162).

The birth of Kuhn's thought is inseparable from his predecessors, including Popper. Plus, he wasborn in the midst of the growing positivism school. His book published in 1962 as mentioned above is Kuhn's criticism of the Positivism school at that time. Kuhn was of the same mind as Popper in rejecting verification as a method for determining truth. Meanwhile, Popper, who thought that falsification was the most suitable step in determining a truth, was also criticized by Kuhn. Kuhn believes that theories that are unable to survive in the face of problems should not be discarded butused as a foothold to predict what kind of situation is suitable for using the theory. Thus, the falsified theory is actually not thrown away, but used to give birth to and even develop the theory. This is thenwhat we know as the Scientific revolution (Sabila 2019, 85).

The main concept coined by Kuhn is paradigm. Alan E. Musgrave as quoted by Widodo said that the paradigm has two differences. First, the paradigm is considered as something obtained from testing conducted on a group of scientists. Second, the paradigm in the view of the general public towards beliefs, values, norms and so on (Widodo 2020, 76–77). Kuhn himself, in providing an understanding of the paradigm always adjusts to the context being discussed. Masterman then classifies three concepts from Kuhn's paradigm. *First, the* metaphysical paradigm,

including methods,values, norms, laws that are generally known. *Second, the* sociological paradigm, which includes habits that exist in general society. And *third, the* construct paradigm which is the narrowest paradigm of the two (Ulya and Abid 2015, 255–56).

In Thomas Kuhn's scientific revolution, we will find the terms anomaly, crisis and *shifting paradigm.* Anomaly is one of the important components in the process of scientific revolution. Initially, science is something that is certain in its own time or called *normal science*. The development of the times then makes this fixed science begin to find obstacles in explaining new problems, this iswhat is called an anomaly. Anomalies that continue to emerge will then turn into a crisis where the paradigm cannot be used at all to solve problems. At this time scientists will re-dissect the problematic paradigm to find the cause which will then lead to a renewed paradigm. This new paradigm is not immediately accepted by scientists. They will conduct tests to validate the paradigm before it is agreed upon as a whole. If it has been agreed upon, this is then called *paradigm shifting*, a change from the old paradigm to the new paradigm (Kesuma and Hidayat 2020, 177). So, it can be understood that the paradigm will produce:

a. A new way of thinking, because the old way does not find a solution, will be replaced with a newone.

b. A new paradigm in the development of science is normal, this is a result of the times that havedifferent problems so that it is required to make changes.

c. The paradigm is not a justification for some groups but a step towards finding solutions to newproblems that have no effective way to overcome them.

Kuhn argues that science will continue to develop marked by the discovery of new facts in the field. In this case, it means that science will develop if exploration activities are carried out continuously. The presence of the paradigm will not immediately receive a warm welcome. There aresome groups who will doubt it and will slowly be accepted. In determining a paradigm is difficult because there is no standard measure. Everything happens with the approval of scientists who thenturn it into views for the general public.

Thomas Kuhn's scientific revolution itself underwent several phases resulting in paradigm shifts and revolutions. *First, the* pre-paradigm phase. In this phase the paradigm already exists but there isno agreement between scientists. In this phase there are theories that have incomplete characteristics. Theories are compared with each other and those that survive will be used as a guide.This phase will continue until the paradigm used slowly begins to be recognized by all levels. *Second,the normal science* phase*.* This phase is characterized by agreement on a paradigm. At this

time, science has become a standard reference, studied and researched continuously (Kurniawan and Rahman 2021, 44). *Third*, the anomaly and crisis phase. In this phase, irregularities begin to be found so that doubts arise in scientists, this situation is known as the anomaly phase. After the anomaly phase, then the crisis arises because the anomalies begin to pile up. The paradigm used at that time was considered unable to answer the crisis that occurred. *Fourth, the paradigm* shift phase. Because the crisis has arisen, it forces scientists to find a solution, this is the paradigm shift phase. Scientists will dissect the old paradigm to find loopholes and try to find something that can cover the gap. These phases show that revolutions and paradigm shifts will not occur unless the anomaly has turned into a crisis. If there is a small amount of anomaly, then it is considered as something normal.

Kuhn argues that the failure of the old paradigm to answer the challenges of the times is not a reason to be completely abandoned as Popper's falsification. The complexity of the unknown future became Kuhn's reason, hence the term *puzzle.* This process is known as *puzzle solving*. During the development of science, new facts will be discovered. These facts are referred to as part of the *puzzle.* So, the more science develops, the more other *puzzles* will be found. This reason makes Kuhn believe that the old paradigm can be used as a foothold to find holes and close them with new *puzzles* (Kesuma and Hidayat 2020, 177).

Lakatos' Critique of Popper and Kuhn

Imre Lakatos' research methodology is closely related to Popper's falsification and Thomas Kuhn's scientific revolution. The thinking of these two figures has given a distinctive style to the development of epistemology in philosophy of science. His thoughts also inspire his followers to obtain the truth through what they believe. In its development, Imre Lakatos emerged as a person who evaluated and deepened the thoughts of the two figures (Burhanuddin 2015, 140). Before the emergence of Lakatos, the world of science was a collection of independent theories. The two dominating schools were inductivism and falsificationism. According to inductivism, if a theory has been experimented and proven empirically, the existing truth is considered eternal. This school assumes that science can only develop by making observations (Mardiana, Ainin, and Iskandar 2022, 4375). Meanwhile, the adherents of falsificationism assume that the theory must be open to all possibilities, especially the ability to survive the proof of error. This school has the view that science develops by shedding theories that are unable to answer the challenges of the times so that a new theory is obtained. So Popper said *science is revolution in permanence and criticsm is the heart of the scientific enterprise* (Haryono 2014, 75).

Lakatos is one of Popper's students. Lakatos developed his thoughts

on science as a form of criticism of those who believe in falsification (Guimarães et al. 2017, 5). Popper's thinking was later criticized by Thomas Kuhn. Kuhn disagrees when it is said that science is an accumulation of its own theories. Kuhn argues that science is a collection of theories under the paradigm. Meanwhile, Lakatos said that science is a series of theories under the umbrella of a research program. This means that Lakatos sees that in science there are various possibilities that can be done to the collection of theories. So in this case the research program is considered as a forum for concocting various kinds of theories so that *mature science* (mature science) or *immature science* (immature science*)* can be produced (Afandi and Sajidan 2017, 72)*.*

Lakatos himself argues that falsification leads to a way of practicing science. This would lead scientists to see the progress of science by conducting experiments that can then be falsified. This can be considered quasi-scientific where one refuses to give details every time falsification is done. Popper himself emphasizes more on practice. Popper indirectly states that scientists must immediately let go of the theory if they find various errors and put a new hypothesis to start again (Mustansyir 2017, 259).

The Kuhn Revolution says that science will undergo a series of phases until it reaches the *normal* phase of *science.* At this stage science is considered capable of being a guide in solving the problems of the day. However, if an anomaly occurs which then causes a crisis, this is what causes the revolution. (Kesuma and Hidayat 2020, 166). In contrast to Kuhn's view, Lakatos believes that science can develop through continuity. If a research experiences proof of untruth, it does not make it failed research, but rather a steppingstone and a foothold for further research programs. This is known as patchwork or *trial and error* (Mustansyir 2017, 259).

Popper and Kuhn's thoughts criticized by Lakatos do not mean that he blames them, but rather that the thoughts of the two figures are used as a steppingstone in the development of his thinking. Some even argue that the concept of research programs is a combination of Popper's falsification theory and Thomas Kuhn's paradigm thinking. In contrast to Kuhn, who said that paradigms cannot be compared and closed themselves off from comparing with other thoughts. Lakatos sees that comparing is one of the traditions in research to see which one is better and the possibility of finding gaps as a process for conducting further research (Saumantri 2022, 274).

The effort to expand Popper's thinking is seen when he says that the main task is not made as a stand-alone theory but is combined into a program. From this collection of theories, it contains a *core* which is a generally accepted basic theory, then a *belt* or safety (belt) which is an auxiliary theory. This *belt* is then testedwith the intention of protecting the

core. However, this applies only temporarily, if after several ways on the *belt* which then cannot solve the challenges faced, the overall falsifiability program is carried out (Nur 2012, 11).

Lakatos Scientific Research Program Methodology

Lakatos divides two distinct phases in the development of science. The first phase is the transition from one theory to a new theory, this phase is characterized by a certain research programwhile maintaining its essence. In this phase the old theory undergoes the addition of new assumptions from the previous theory. The second phase is characterized by a transition from one research program to another, this phase is characterized by a change in the essence or hardcore of the theory (Karaba 2022, 678–79). Lakatos' research program methodology is a set of methodological structures that provide direction when conducting research (Salazar 2016, 146). Lakatos provides an alternative in the development of science that departs from Popper's falsification and Thomas Kuhn's scientific revolution. Lakatos' research program has three main bases: *hardcore*, *protective belt* and *a series of* theories (Aziz 2006, 448).

a. Hard core

The core is a basic assumption in research that must be protected from falsification. This core is often referred to as a *negative heuristic*, meaning that it is a fundamental assumption underlying the research. The core must be maintained throughout the research process. If a researcher makes changes to the core, he or she is automatically out of the research being conducted (Lakatos 1999, 47). This core point is derived from various logical arguments. For example, the main point initiated by *Copernicus* astronomy is that all planets revolve around the sun and the earth rotates on its axis (Saumantri 2022, 276).

The main point basically works as a reference base in making assumptions. If from these assumptions new facts are found and do not match the assumptions, it is not blaming the assumptions but rather changing them to adjust to the hypotheses and other assumptions in the theory. Research that is able to predict and explain newly discovered facts with an unchanged main core indicates that the theory used is successful or can be recognized as true. Conversely, ifthe theory in the research does not have the ability to predict or even explain new phenomena and facts and begins to waver towards the main core, it is a failed theory (Assya'bani 2020, 225).

b. Protective belt

The protective circle is a set of auxiliary hypotheses which function as a shield for the main core. This protective circle can change at any time according to the conditions at hand. The protective circle has a more

vague or abstract nature and is difficult to specify. So, if there is a theory that then cannot explain new facts, the protective circle equipped with hypotheses will work. It could be by changing the hypothesis or adjusting to the conditions encountered without changing the main core (Lakatos 1999, 49). This protective circle is also known as the *positive heuristic.* This heuristic explains that the core of the program must be protected, able to predict, and even adjust to the facts and possible rejection of new facts. Lakatos claims that thisheuristic is an important part of conducting research. Through this heuristic, variants will continue to emerge that can be refuted and then make it a new research material.

c. A series of theory

Lakatos said that scientific truth cannot be obtained from a single theory but is born from several theories combined. Thus, the relationship between one theory and another will continue and continue to be developed. It can be said that the presence of a new theory is the result of the accumulation of several theories that form a new theory that is established and difficult to break the truth (Lakatos 1999, 49). Lakatos said that the scientific value or not of a theory is not independent but dependent, it must come from a combination of several new theories then it can be said to be scientific. Lakatos said that there are two requirements for the scientific of the theory, first, it has a high level of coherence to enter the planning of the next research program, second, it has succeeded in making a discovery which is a new fact. This series of theories indicates that there is continuity between the theories that are combined with pre-existing theories (Förstner 2023, 142).

The research program methodology is an original thought that came from Lakatos. Lakatos saidthat the most appropriate way to prove the truth is to conduct research. Proving scientific research takes a long time. This is because no human being can predict with certainty what will happen in the future. Therefore, research programs need to be continuously developed, tested and updated. This framework of thinking then underlies Lakatos' thinking that the crystallization of science is wrong because it can cause degeneration and can even reach the finalization of science. As Lakatos said: *Ouranswer, in outline, is that such an objective reason is provided by a rival research program which explains the previous success of its rival and supersedes it by a further display of heuristic power* (Lakatos 1999, 140).

The research program itself contains a set of methodological rules known as heuristics. It is a method of solving problems by utilizing reasoning skills, experience and experimentation to avoid mistakes in problem solving. In practice, this research program can be seen from two perspectives, first from the point of view of the research itself and second by comparing the research with another research. With these two perspectives, it is expected to produce new findings. Through this

scientific research program, Lakatos wants scientists in the world to make science dynamic. Through the methodology, it will be seen to what extent scientists can develop their findings through further research. If the research carried out experiences positive developments and can even have a positive impact on human life, it will be considered successful research. But if the opposite happens then the theory used will be taken over by another theory that is stronger. It can be concluded that science can be said to be science if it has the ability to continue to be followed up (research) continuously. So Lakatos' epistemology is not something that is empty because it departs from something that exists which then tries to be developed (Assya'bani 2020, 225).

So, it can be concluded that this research program can actually be seen from how far a scientist is able to develop more discoveries obtained from previous research results. Failure in the implementation of research will provide a way for another research to continue to advance. Thus, scientists will continue to strive to conduct continuous research in order to have an impact on the development of science. Research that is carried out continuously will open doors for discussion, be developed and can even be criticized for further development. The closer the theory is to empirical facts will make the theory stronger or better.

Negative and Positive Heuristics in Research Programs

Understanding Lakatos' research program requires understanding what Negative and positive heuristics are. Basically, all scientific research must start from the *hardcore*. This is then the main feature of Lakatos' scientific research program. This core is a general theory that may be developed (Guna and Ramadhani 2021, 136). In research, researchers must first pass through a *protective belt before they* can lead to the main core, this is what is commonly called an auxiliary hypothesis. This auxiliary hypothesis is then in charge of protecting the main core and must even adjust until it is likely to be replaced if it is unable to maintain the main core. In addition, the main core can also be protected by changing the theory on which the observation is based. A research program can be considered successful if there is a progressive *problem shift* and is considered a failure if it leads to a downward problem shift or creates many other problems. A progressive research program is characterized by (Abdullah 1998, 14):

a. Generate new theories, both core and auxiliary, and defend old theories that have not beenproven wrong.

b. The empirical content of the research conducted is more than the previous theory and is able to predict the possibility of new facts that have not yet been discovered.

c. The facts predicted at the time of the research were able to provide strong support for the newtheory.

If only the first and second conditions are present, the research is theoretically progressive. If all three conditions are present, the program is empirically progressive. A successful research programwill degenerate if the new theory then creates anomalies and is unable to provide discoveries and predict new facts (Abdullah 1998, 14).

An example of a research program is Newton's discovery of the theory of gravity. In Newton's research, the negative heuristic was aimed at avoiding research on the three laws of dynamics and the theory of gravity, which are the *hardcore* core. Research must be directed towards auxiliary hypotheses that must be separated from the main core and must surround it as a safeguard (Fitriana 2020, 73). Physicists before Albert Einstein used the theory of mechanics and Newtonian Gravity (N) as the core, accepting initial conditions as I. From N and I, new discoveries about dwarf planets were calculated. However, something new has appeared on the planet, the results deviate from the calculations. The question is, do Newtonian physicists consider that the central core, in this case the theory of gravity, is rejected? Apparently not. Instead, they thought there must be something about the dwarf planet that caused inaccuracies in their calculations. They then calculated the planet's mass, orbit, etc. and made assumptions and asked the astronauts to test their assumptions. But unfortunately, at that time with the existing tools, observations could not be made. This condition then triggered scientists to create tools, in this case a more sophisticated telescope (Lakatos and Musgrave 1970, 100–101).

After waiting for three years, the telescope that was dreamed of being able to answer their curiosity is finally ready. Is the telescope ready to justify Newton's theory of gravity? Apparently not. They then began to theoretically speculate that there must be some kind of dust covering the planet so that it was invisible. They then calculated the position of the dust and launched satellites to get certainty. But again, they found nothing. Having found the bitter facts did not stop scientists from proving their point. Scientists believe that there was electromagnetic interference when launching the satellite so that it failed (Saumantri 2022, 278). That is an example of research that is carried outcontinuously in order to protect the main core (*hardcore*).

If we analyze the example above, we can see that every discovery and shift in the problem will always lead to a new prediction. Each step that has been passed has actually provided an improvement to the empirical experience. It should be underlined that predictions are always present at the end of every research, even though predictions made repeatedly still cannot find the truth does not mean it has failed. The possibility is that

theoretically it is still possible to be researched while empirically it is not possible. Therefore, the possibility of failing when conducting research is not a fatal thing. Through the research conducted and the facts found, it can then be used as material for consideration as well as evaluation for the next research. This is the meaning of the negative heuristic that *hardcore* (Newton's theory) should not be blamed directly and disturbed but must test the hypotheses that exist outside it or *protective belt.*

To counterbalance the negative heuristics (the *hardcore* ones that should not be disturbed), positive heuristics are present. Positive heuristics are a series of suggestions and cues that emerge which are then used to change, develop and modify rejected variants in a research (Iskandar, Rohman, and Yusuf 2019, 16). When scientists are confused in the face of anomalies that arise, positive heuristics are present as a helper. For example, a research program conducted by Newton. At first Newton compiled a program for the planetary system. With this, Newton then obtained the *square* law. However, the *square* law model was contradictory and incompatible with Newton's third law of kinetics, so it had to be replaced by a model in which the sun and planets rotate around a center of gravity. This change was not driven by observations (as the data showed no anomalies), but due to theoretical difficulties in theory development. Then Newton calculated many planets and the sun as the center (heliocentric), but there was no interplanetary force as such. Then he also calculated based on the planets as mass balls instead of mass points (Saumantri 2022, 280).

Newton did not need any observations to produce an anomaly. The infinite density of the mass point concept contradicted the touchstone theory, so the planet had to evolve into a ball of mass. This change left a mathematical problem that constrained Newton's work. Since the puzzle (anomaly) was solved, he began to calculate the rotation and swings. Then he recognized the existence of interplanetary forces and began to calculate the anomalies that had arisen during his previous research projects. Based on the results of these calculations, he then turned to empirical research. Many of the results of empirical studies could explain the theory well, but some could not. Thus, Newton began to do calculations based on the theory of planets protruding into spherical planets.

Lakatos further indicates that the current theories are not absolute truths, although some can be said to be better than others. Lakatos emphasizes the importance of understanding the *protective- belt* area so as not to get caught up with justification. Justification will only hinder the development of science, and what may even emerge is a lot of dogmas and repeating what has existed before. The presence of this heuristic method indicates that Lakatos wants to secure the basic theory that is already strong by not being immediately justified if an error is found, so here is the importance of the safety circle as mentioned above. Lakatos' consistency

is seen when he criticizes Popper's falsification by not discarding it but developing it. This is what Lakatos says is continuous research to see the truth.

The Contribution of Scientific Research to Islamic Scholarship

Talking about Islam cannot be separated from the Qur'an and Hadith. Both are revelations from God to be used as a guide by mankind. The Qur'an and Hadith have timeless and eternal properties and to this day can still survive even without the slightest change. So, in answering the challenges of the times what is needed is an understanding in interpreting the contents contained therein. It is this understanding of God's revelation that has led to the development of science in the Islamic world today. Among the sciences that resulted from the interpretation are *'ulūmul Qur'ān, tafsīr, ḥadīth science, kalām science, uṣūl fiqh, fiqh,* Islamic philosophy and many more. All of them are derived from human interpretation and understanding of the Qur'an and Hadith. When looking at today's conditions, the growth and development of Islamic studies is in line with the problems of life that continue to emerge. The complexity of these problems then requires Muslim scientists to continue to study and find solutions that are suitable for the times.

Hasan Hanafi with his tradition and modernity, Fazlur Rahman with *double movement hermeneutics*, Abdullah Ahmed an-Naim with the deconstruction of sharia are some Muslim scientists who try to renew the interpretation and understanding of the Qur'an and Hadith adapted to the context of the times. Although faced with various problems, it does not make the *core of* Islam change, namely the Qur'an and Hadith. So, in this case these scientists are trying to protect the core of Islam by interpreting in accordance with the context of the times as a protector for the *core of* Muslims. This is an illustration of how Lakatos' epistemology in an Islamic perspective.

Lakatos' thinking provides positive things for many people, including Muslims, namely getting used to having a critical attitude. One way to do this is through serious and sustainable research into Islamic science. Today, research conducted by Muslims is lagging. Fazlur Rahman in this case once conducted a critical research activity. The factor that drives him in anxiety is because he is trying to stimulate discussion about religious discourse. He then conducted research by applying a historical approach. His findings were then named "Islam", which contents criticize Islamic sciences comprehensively by presenting objections to the methodology used (Sutrisno 2006, 46).

Basically, the activity of reconstructing religious science departs from the history of the development of science itself. Humans have a share to adjust to their era, so does science, it must be adjusted to the conditions and circumstances so that it can be a guide for life. Due to the fact that problems will vary in each era, scientists have the opportunity

to conduct trials or research and rearrange them in accordance with the times. The existence of history as a guide to see if there have beensimilar problems that can then be adopted and adapted to the current context. To understand how Imre Lakatos' scientific research program applies to Islamic scholarship, seethe diagram below.

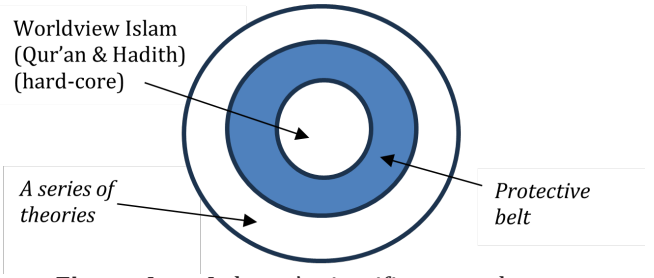

Figure. Imre Lakatos' scientific research program.

First, *hard-core* describes the core of research that cannot be changed or interfered with in any way. Adi says that this core contains the essence of Islamic views (Setia 2008, 56). Al-Attas in this case says the core of the Islamic view contains the Islamic vision of truth and reality, or the nature ofnatural events that have been explained in the Qur'an and Hadith. This Islamic view contains variouskeys in looking at life such as God, ethics, religion, science and so on. Muslih calls this the area of theology of science (Muslih 2020, 73).

Second, the *protective belt* describes a set of auxiliary hypotheses that are useful in protecting the main core. Muslih calls this second layer the area of the paradigm of science. This layer has passive, negative and apologetic characteristics. In this layer there are various kinds of paradigm clashes of a theory. Paradigms can be replaced with other paradigms if there are so many anomaliesfound that they experience a crisis, which in this case is called Thomas Kuhn with the term *shifting paradigm.* This layer is relevant to the thoughts of al-Attas who mentioned *The "Islamization" of knowledge today precisely, after the isolation process described above, the knowledge, get rid of isolated elements and key concepts, and inject Islamic elements and key concepts* (Attas 1993, 162–63). So, in this case Muslim scientists have the task of re-examining the paradigm or hypothesis that is used as the basis for a theory and replacing the hypothesis obtained from the parent layer. The hypothesis is the basic assumption in developing a new theory.

Third, is the layer that contains the theories. In this layer there are more clashes to find a strongtheory. Its characteristics are creative, active, and productive in creating new theories. This layer contains theories that reinforce each other. In addition, theory strengthening can also be obtained through empirical observations in the field. It is in this layer that new theories are born, as said by Muslih that this layer is the area of

scientific theory (Muslih 2020, 80). After understanding Lakatos' concept of scientific research, we can see that the research procession in Islam only occurs in the outer two layers. The reason is that the *hard-core* of Islam willnever be replaced, in this case the Qur'an and Hadith. To better understand this, it can be explained in the following points:

a. Analyzing the impact of the initial research theory. This stage is conducted to prove that the theory is irrelevant, has a negative impact, is harmful or even destructive and reach the conclusion that the theory is problematic.

b. Discovering the paradigm of the original theory. Once declared problematic, the next task is to dismantle the paradigms and hypotheses that are used as basic assumptions in the theory.

c. Finding new hypotheses by looking at the *hard-core of* Islam. According to Golshani, the paradigmof Islamic science is the Islamic *worldview* (Qur'an and Hadith). This new paradigm is then used as a foundation for building new theories.

d. Building a new theory is based on a new paradigm. To build a new theory, old theories are neededas a foothold to minimize errors like previous theories. In addition, empirical facts from reality in the field are also needed.

One of the contemporary figures who sees that it is time for Islamic science to change its paradigm is M. Amin Abdullah. The integration-interconnection paradigm applied at UIN Sunan Kalijaga is the fruit of his anxiety to see Islamic science today. The hope is that UIN alumni who have been equipped with this paradigm are able to become pioneers in social life by integrating what they have learned during their time as UIN students. This integration-interconnection paradigm shows the relevance of Lakatos and Amin Abdullah's thoughts. The thought initiated by Lakatos was reconstructed by Amin with much more comprehensive. Amin Abdullah made his reach to Islamic science. Therefore, from the point of view of the philosophy of science, the debate about how philosophy becomes the basis for the development of natural sciences for the development of social sciences and humanities becomes something that is not impossible because they share a philosophical foundation. This is because, throughout the history of science, philosophical bases and even methodological details have been shared to discuss possible connections between one science and another. While sociology may use the methodology of natural sciences to explain social facts, sociology of science has undeniably utilized the methodology and logic of sociology to read the evolution of all sciences, including natural sciences. In the same way, the science of history and the science of anthropology have

exchanged methodologies. Nevertheless, related to the use of Lakatos' concept for the development of Islamic sciences, especially those developed by several PTKIN, it is not new or far-fetched because it has become an important part of its paradigm construction. Although in practice it still needs improvement, this concept tries to make religion a base that can connect with existing sciences (Muslih 2020, 75–77).

Yongki Sutoyo (2020) believes that Integration-Interconnection has not been able to become a paradigm in a research program. There are 2 things that are of particular concern to Yongki: first, the absence of a protective belt that contains philosophical foundations and key concepts, both of which are the basis for the development of science. Second, a series of theories that verify and falsify existing theories in each science family. Verification and falsification are needed so that previous concepts become more mature and concepts that are not feasible are then removed. To make integration-interconnection a paradigm in research programs, it must meet at least three criteria. First, there is recognition from most of the scientific community or researchers. Second, the thought or concept has been cultivated among the scientific community so that it becomes a characteristic and even forms a madhhab of thought. Third, the number of works that adopt the concept of integration-interconnection so as to produce works (Sutoyo 2020, 267–68).

Conclusion

Based on the explanation above, it can be concluded that Lakatos' idea is the result of his thoughts from his predecessors. Lakatos in this case combines two very extraordinary thoughts of his day, namely Popper's falsification and Thomas Kuhn's scientific revolution. Popper has the idea that proving the truth of a science must be tested by trying to prove that the science is wrong, if it is not proven then the science can be considered a truth. Popper also argues that if a science has been proven wrong, it must be discarded and no longer used. In contrast to Kuhn who considers that science is collected parts. Kuhn departed from the concept of paradigm as the initial foothold of the scientific revolution. Paradigms that encounter many crises or experience proof of guilt in Popper's falsification are not discarded or abandoned. Kuhn uses the old paradigm as a steppingstone to find problems and will change to a new paradigm when it is found.

Lakatos views that theory can only be born if research is carried out continuously. If it gets stronger, it becomes a strong theory and vice versa. There are three important elements in Lakatos' research program: 1) *hard-core*, serves as a refutation of negative assumptions from outside; 2) *protective-belt, serves to* protect the theory in the *hard-core*; 3) *a series of theory,* this part serves to test theories that are worthy of being used as science. In the Islamic world, the implications of Lakatos' thinking at least invite Muslims to continue to conduct research on Islamic science so that

it continues to be relevant to the times. This is because in Islam the *hard-core* will never change, so it is humans who must adapt by looking back at the *hard-core* and trying to do research (interpreting) so that it becomes in accordance with the problems faced.

One form of the application of Lakatos' research concept is the presence of the integration- interconnection paradigm initiated by Amin Abdullah. This paradigm tries to connect all types of science with a religious basis. Connecting one science with another. Thus, connections and discussions occur. Although there will be opportunities that cannot be connected, at least it has built a bridge to be researched further. As said by Lakatos, there is no absolute truth, so it is not impossible that one day a connection will be found that was not found before.

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