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The Philosophy of Science, Scientist Responsibilities, and Functional Analysis from an Islamic Perspective

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A B S T R A C T

Background: The responsibility of scientists holds deep significance in the Islamic worldview, where responsibility is seen as human awareness of one's behavior and actions, whether intentional or not. Within this framework, Muslim scientists bear a broader moral and spiritual obligation beyond their professional duties. **Objective:** This study aims to explore and synthesize the concept of scientific responsibility from an Islamic perspective, highlighting how religious teachings shape the ethical and social obligations of Muslim scientists. **Method:** The study adopts a qualitative approach through thematic analysis of classical Islamic texts, scholarly interpretations, and the views of contemporary Islamic scholars, particularly focusing on the framework proposed by Dr. Yusuf Al-Qaradhawi. **Result:** The findings indicate that the responsibility of a Muslim scientist includes seven core elements: preserving knowledge, pursuing its depth and essence, applying it in practice, teaching it, publishing and disseminating it, preparing future generations, and dedicating all knowledge and actions to Allah alone. These elements reflect an integrated responsibility that binds scientific endeavor with religious and ethical accountability. **Conclusion:** The responsibilities of Muslim scientists go beyond secular academic standards, calling for the integration of faith, knowledge, and moral responsibility as a way to uphold the Islamic mission of mercy to all creation (rahmatan lil 'alamin). **Contribution:** This study contributes to the discourse on Islamic ethics in science by offering a synthesized framework of responsibilities grounded in Islamic teachings. It provides guidance for Muslim scholars and educators in shaping a science that is both spiritually conscious and socially responsible.

K E Y W O R D S

Philosophy of Science; Scientist Responsibilities; Functional Analysis; Islamic Perspectiv

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C O N T E N T

1. INTRODUCTION

The Philosophy of Science and Responsibility is a study that links the understanding of science with the ethical and moral responsibilities of individuals or societies in developing and applying that knowledge (Aryati, 2018). In the philosophy of science, profound questions arise about the nature of knowledge, how it is acquired, and its boundaries and purposes. Regarding responsibility, the philosophy of science also examines the extent to which

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scientists or society must be accountable for the outcomes of their research and the application of scientific knowledge, especially regarding its impact on social life, the environment, and humanity (Popa et al., 2015).

Knowledge is highly valued in Islam, as emphasized in many verses of the Qur'an, where Allah encourages His followers to seek knowledge to know Him and manage worldly life wisely. Surah Al-Alaq [96:1-5] states:

"Read in the name of your Lord who created. He created man from a clot of blood. Read, and your Lord is the Most Generous, who taught by the pen, taught man what he did not know."

This verse highlights the importance of knowledge as the first command in the revelations received by the Prophet Muhammad (PBUH). The knowledge obtained through divine revelation and scientific research serves as a tool to understand God's creation.

In Islam, scientists are responsible for applying knowledge to benefit humanity and the common good. Knowledge must be used for positive purposes, not to harm others or nature. Surah Al-Isra [17:36] states:

"And do not pursue that of which you do not know. Indeed, the hearing, the sight, and the heart—about all those [one] will be questioned."

This verse underscores that scientists must be accountable for their decisions and actions when applying their knowledge, as they will be held responsible before Allah.

The philosophy of science seeks to address issues by examining concepts such as objectivity, truth, and values inherent in each field of knowledge (Winarno, 2018). Meanwhile, responsibility pertains to ethical considerations regarding using knowledge for the public good and the potential consequences of its application in technology, medicine, and the environment. Therefore, studying the philosophy of science and responsibility is crucial to ensure that knowledge development is conducted wisely, considering its impact on society and nature, and grounded in high ethical values (Frémeaux et al., 2020).

The philosophy of science reflects the work of a scientist that is communicated and studied broadly. When the work meets scientific standards, it becomes knowledge that society can use (Nagatsu et al., 2020). Hence, scientists bear significant responsibility as members of society because of their specific functions. Their role as scientists is not limited to conducting research but also includes ensuring that their findings benefit society and safeguarding their work from misuse.

Science leads to the development of technology applied in society (Belo et al., 2020). Applying science and technology can be a blessing and a salvation for humanity or a disaster. Therefore, the proper use of knowledge and technology requires careful consideration. Applying science and technology involves ethical dimensions influencing their development (Sodikin, 2016). Ethical responsibility concerns the activities and use of science and technology. This implies that scientists must consider human nature and dignity, maintain ecological balance, prioritize the common good and future generations, and uphold universal values. Science and technology aim to strengthen and develop human existence rather than destroy it (Haleem et al., 2022).

Sometimes, scientific responsibility arises not from science but from addressing humanitarian issues such as natural disasters, critical environmental conditions, and social conflicts (Goldschmidt & Kumar, 2016). Scientific responsibility goes beyond normative aspects, such as moral obligations tied to legalistic considerations, encompassing broader dimensions (Firmanto, 2017). For instance, scientific responsibility may involve addressing social changes that impact moral order. It also means positioning humans with dignity so that they are neither exploited by science and scientists for prestige nor crushed by ignorance and poverty due to a vicious cycle of lack of knowledge. Responsibility implies causality- being "accountable for" something. In this sense, it refers to what must be borne. Those responsible for a cause can be held accountable, even if the science or scientists themselves did not directly cause the issues. Responsibility as a fundamental attitude of scientific practice becomes an inseparable part of scientific life and is closely tied to the progression of knowledge through the ages (Rau et al., 2019).

While the philosophy of science and the ethical responsibilities of scientists have been extensively discussed in Western literature, there remains a significant gap in integrating these themes within an Islamic framework. Existing Islamic perspectives on science often focus on historical achievements or general moral obligations without offering a comprehensive, functional analysis that aligns religious principles with contemporary scientific practice. Moreover, the responsibilities of Muslim scientists are frequently addressed in isolation, lacking a structured philosophical foundation that connects epistemology, ethics, and professional duties. This study addresses that gap by offering a holistic framework that synthesizes Islamic teachings with modern scientific roles, drawing on classical sources and contemporary interpretations. Its novelty lies in presenting a functional, value-based model of scientific responsibility rooted in Islamic principles, thereby contributing to a more inclusive and culturally grounded discourse on science and ethics.

This study aims to provide a profound and contextual understanding of how knowledge and scientists' responsibilities are positioned in Islam and how a functional analysis approach can help explain the contributions of science to society. It focuses on how science and Islamic teachings can be integrated, viewing knowledge as a tool to understand God's creation and strengthen faith. It analyzes how Islamic ethical and moral values guide scientists' research, including their responsibilities to society and the environment.

2. METHOD

2.1 Research Design

A qualitative approach was employed to gain an in-depth understanding of the phenomena under study, specifically the philosophy of science, scientists' responsibilities, and the role of science in society from an Islamic perspective. The primary focus of this research is on meanings, concepts, and interpretations of texts and viewpoints from classical and modern literature relevant to the research topic.

A descriptive method is used to depict the existing phenomena based on the data and facts collected during the research process without altering or manipulating the object of study. This research presents the main ideas and concepts within the Islamic philosophy of science, scientists' responsibilities, and the functions of science according to Islamic teachings.

2.2 Data Collection

Data collection was conducted through a literature review (library research) involving the study of various sources related to the following topics:

1) Islamic Philosophy of Science: Exploring classical works of Islamic philosophy, such as those by Al-Farabi, Ibn Sina, Al-Ghazali, and others, as well as modern literature discussing the development of the philosophy of science in the Islamic tradition.
2) Scientists' Responsibilities in Islam: Examining Qur'anic verses, hadiths, and scholars' thoughts on scientists' moral and social responsibilities in utilizing knowledge.
3) Functional Analysis of Science in Islamic Society: Analyzing the role of science in the social, cultural, and spiritual contexts from an Islamic perspective, as well as the role of scientists in addressing social issues through science.

In addition, data may also be obtained from religious texts, reference books, journals, articles, and interviews with experts in Islamic philosophy of science or the ethics of scientists.

2.3 Data Analysis

To ensure the validity and reliability of data in this descriptive qualitative research, the following steps were undertaken:

1) Source Triangulation: Using various sources of information, including classical texts and modern literature, to obtain a comprehensive and balanced understanding.
2) Consistency in Analysis: Ensuring that interpretations of the collected data align with the Islamic context and are not distorted by personal biases.
3) Researcher Reflexivity: The researcher continually reflects on their position and maintains objectivity during the analysis and interpretation of data.

Data analysis in this study was carried out as follows:

1) Concept Categorization: Identifying and classifying various concepts related to the Islamic philosophy of science, scientists' responsibilities, and the role of science in society. For example, distinguishing between beneficial knowledge according to the Qur'an and knowledge used for unethical purposes.
2) Meaning Interpretation: Analyzing and interpreting philosophical and ethical meanings in classical and contemporary texts. For instance, how scientists' responsibilities are explained in Islamic teachings or how science functions in building a just and prosperous society.
3) Phenomenon Description: Describing the understanding and views found in the literature about the relationship between science, scientists, and society from an Islamic perspective.

2.4 Data Presentation

Data are presented in a descriptive narrative format that outlines the analysis results. This presentation includes not only textual narratives but may also include tables, diagrams, or excerpts from primary texts to strengthen arguments and explanations.

Tools and Data Collection Techniques:

1) Library Research: Collecting information from books, articles, journals, and other written sources relevant to the research topic. This includes Islamic philosophical texts, classical works, Muslim scholars' contributions, and contemporary literature discussing the philosophy of science, scientists' responsibilities, and the functions of science from an Islamic perspective.
2) Textual Analysis: Using a hermeneutic approach to interpret religious texts (the Qur'an and Hadith) and writings by Muslim philosophers and scientists in relevant contexts.
3) Expert Interviews: If necessary, conduct in-depth interviews with experts in Islamic philosophy, scientists' ethics, or specialists in social sciences to gain deeper insights into their views on the research topic.

3. RESULT AND DISCUSSION

1) Development of Knowledge

According to Gunawan, Westerners approached the Islamic world to deepen and develop their knowledge, consulting both Greek and Arabic sources (Kamal et al., 2024). Moreover, Islam contributed significantly to transforming the harsh civilization of Jahiliyyah in the Arabian Peninsula. Historically, Islam played a crucial role in developing knowledge and information through methods different from those in the Western world. Historical records indicate that from the time of the Prophet Muhammad until his passing, there were continuous expansions led by Muslims. These expansions were not solely for economic or material gain but aimed to achieve justice and build and develop civilizations. Islam demonstrated a high degree of tolerance toward the culture and mindset of other nations (Yaylaci & Islam, 2013).

One prominent Muslim scholar is Al-Khwarizmi, who advanced algebra to enable society, particularly Muslims, to divide wealth accurately (Putri, 2019). Many Quranic verses have inspired scientific and technological research, including Surah Al-Insan: 17, which states, "In Paradise, they will be given a drink mixed with ginger." This sparked curiosity among Muslim scientists to study the properties and benefits of ginger, such as its antioxidant effects and pain relief qualities. This demonstrates that Islam is inherently aligned with advancing science and technology. Three factors driving Islam's participation in the development of knowledge and intellectual traditions (1) Religious Motivation: The pursuit of understanding and gathering information about scientific progress; (2) Public Appreciation for Knowledge: Recognizing its potential to advance humanities and gather insights; (3) Patronage: Support and protection from philanthropists and authorities for scholarly activities, ensuring diverse contributions to the arts and sciences.

2) The Concept of a Scientist in Islamic Perspectives and Professionalism

a) Scientist

In Islam, those with knowledge hold the highest position and are considered successors of the prophets. Thus, they are obligated to disseminate knowledge and teach, guiding people along the path of Allah. Kamal et al. (2024) emphasize the importance of seeking knowledge (tholabul' ilmi) as one of the most critical responsibilities in expanding human understanding and advancing the world, particularly when knowledge is combined with righteous deeds.

In Arabic, the word ilm (knowledge) is derived from alimu, meaning "to know." As understood in Islam, science refers to knowledge about a subject that can be explained systematically and consistently to answer natural phenomena. In Islamic terminology, ilm encompasses religious, natural, social, and human sciences. A scientist, therefore, consistently researches to understand phenomena and seek solutions to problems.

b) Professionalism

A scientist is deemed professional when they can deliver high-quality knowledge and training supported by extensive experience in their field (Maksum, 2016). Scientists have autonomy in their professional duties, enabling them to act within established theoretical frameworks. However, this freedom is not absolute; it adheres to professional standards. Professionalism is reflected in intrinsic motivation, fostering a strong work ethic and a

commitment to excellence. To perform their roles effectively, scientists must exhibit honesty, assertiveness, rationality, critical thinking, objectivity, openness, and pragmatism.

c) Prophetic Traits as the Foundation for Professionalism

A professional scientist is expected to possess expertise and in-depth knowledge and embody moral and ethical values rooted in prophetic traits (Forster & Fenwick, 2015). The four key prophetic traits Siddiq (truthfulness), Amanah (trustworthiness), Tabligh (communication), and Fathanah (intelligence) serve as a strong foundation for professionalism:

(1) Siddiq (Truthfulness). Truthfulness represents honesty and integrity. Scientists must uphold transparency at every research stage, ensuring no data falsification or manipulation (Nguyen & Tuamsuk, 2024). Truthfulness forms the foundation of scientific integrity and ensures that research outcomes are trustworthy and beneficial.
(2) Amanah (Trustworthiness). Trustworthiness encompasses responsibility and accountability. Ethical responsibility requires adherence to academic integrity, avoiding plagiarism, and acknowledging others' contributions (Amigud et al., 2018). Scientists must conduct research with integrity, uphold ethical standards, and maintain public trust in scientific endeavors.
(3) Tabligh (Communication). This trait reflects a commitment to convey knowledge effectively (Mao et al., 2016). Scientists must ensure their findings are communicated clearly, accurately, and comprehensively to diverse audiences.
(4) Fathanah (Intelligence). Fathanah emphasizes intellectual and emotional intelligence, enabling scientists to identify the root causes of problems and devise innovative solutions. Intelligence fosters creativity, effective communication, and leadership in addressing complex issues (Darvishmoteva et al., 2018).

d) The Role of Scientists in Islam

Numerous Muslim scientists have contributed to advancements in modern knowledge and technology. For example, Ibn Sina (Avicenna) is regarded as the "Father of Medicine" for his groundbreaking work, which remains influential in contemporary medical practices. This highlights the vital role of Islamic civilization in the evolution of modern science (Sabic-El-Rayes et al., 2020). The Quran and Hadith encourage the pursuit of knowledge, as reflected in Surah Al-Imran: 190:

"Indeed, in the creation of the heavens and the earth and the alternation of the night and day are signs for those of understanding." This verse underscores the importance of reasoning and intellectual reflection as pathways to understanding and advancing knowledge.

e) The Responsibilities of a Scientist

Scientists bear ethical responsibilities in pursuing knowledge, ensuring their work aligns with societal and humanitarian interests. This includes (1) Contributing to the dignity and well-being of humanity; (2) Upholding ethical standards to mitigate potential negative impacts of scientific discoveries; (3) Ensuring that their research benefits society and is not misused.

f) Implementing Scientists' Responsibilities

(1) Responsibility to the Nation. Scientists have both social and ethical responsibilities to their countries. Socially, they ensure their innovations are beneficial to society. Ethically, they act objectively, accept constructive criticism, and set an example of intellectual openness.
(2) Responsibility to Religion. Muslim scientists play a crucial role in preserving Islamic cultural heritage, conducting systematic research, and educating future generations about the richness of Islamic traditions. By fostering a deeper understanding of Islamic arts, sciences, and philosophies, they contribute to sustaining the legacy of Islamic civilization.

4. IMPLICATIONS AND CONTRIBUTIONS

4.1 Research Implications

This study clarifies how the concept of science in Islam differs from or aligns with the concept of science in Western traditions. It can potentially broaden the understanding of epistemology (the theory of knowledge) and ontology (the theory of existence) from an Islamic perspective. By addressing the responsibilities of scientists, this research can encourage the integration of Islamic ethical values into scientific practices. The implication is increased moral awareness among scientists regarding their research's social, environmental, and spiritual impacts.

4.2 Research Contributions

This research expands the discourse of the philosophy of science by incorporating an Islamic perspective, which is often underrepresented in global academic literature. It offers new insights into the relationship between science, religion, and human responsibility. The findings of this study can be utilized to design higher education curricula that integrate the philosophy of science, scientific ethics, and Islamic perspectives, thus shaping a generation of more responsible scientists.

5. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

5.1 Limitations

This research focuses on the philosophy of science within an Islamic perspective and the responsibilities of scientists in Islamic tradition. Hence, the study is limited in scope as follows:

a) Focus on Islamic Philosophy of Science: The research delves deeply into the philosophy of science as proposed by classical Islamic scholars such as Al-Farabi, Ibn Sina (Avicenna), and Al-Ghazali, as well as modern figures. Consequently, it does not emphasize the study of Western or non-Islamic traditions of philosophy of science.
b) Scientist Responsibility in an Islamic Context: The analysis of scientists' responsibilities is limited to perspectives derived from the Qur'an, Hadith, and works of Islamic scholars. The discussion may not extensively address modern ethical or scientific responsibilities outside the Islamic framework.
c) Limited Functional Analysis Approach: The functional analysis of science in society is focused on the roles of scientists in the social and religious contexts of the Muslim community. Therefore, the study may not fully cover the broader functional dimensions of science in a global societal context.

5.2 Recommendations for Future Research Direction

Suggestions for future research on The Philosophy of Science, Scientist Responsibilities, and Functional Analysis from an Islamic Perspective could include the following areas Comparative Analysis of Islamic and Western Philosophies of Science Explore similarities and differences between Islamic philosophy of science and Western traditions. This could include a focus on how ethical considerations and metaphysical assumptions shape scientific inquiry in each context.

6. CONCLUSION

In Islam, scientists hold an esteemed position as they are considered successors of the prophets' mission. A Muslim scientist's responsibilities extend beyond their profession and are deeply intertwined with religious values. Professionalism among scientists is marked by expertise in their field and adherence to ethics such as honesty, objectivity, and critical thinking.

Prophetic traits like Siddiq (truthfulness), Amanah (trustworthiness), tabligh (conveying the message), and fathanah (wisdom) form the foundation of a scientist's professionalism. Scientists bear social responsibility towards societal and humanitarian interests and obligations to their nation and religion. These include ensuring the beneficial outcomes of scientific products and preserving religious and cultural heritage. Implementing their responsibilities encompasses social and ethical aspects, such as guiding society in using scientific products and being open to constructive criticism.

This concludes the discussion on the professionalism and responsibilities of scientists from an Islamic perspective. Scientists must demonstrate expertise in their fields while adhering to religious principles and embracing wide-ranging social and ethical responsibilities. The author sincerely welcomes constructive suggestions and criticisms to refine this paper and improve future writings. Hopefully, this paper benefits both the author and the esteemed readers.

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The authors declare that each author contributed to the preparation of this article by their duties and responsibilities.

Conflict of Interest Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical Approval Statement

The authors declare that this study was conducted with due regard for research ethics, including obtaining approval from the institution. This includes respecting the autonomy of participants, maintaining confidentiality of data, and ensuring their safety and well-being, in accordance with applicable research ethics guidelines.

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