Philosophy of Information System Science

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Abstract. Today, humans live in the era of the Industrial Revolution 4.0 where people are very dependent on the presence of Information and Communication Technology (ICT) in carrying out their activities. The Industrial Revolution 4.0 gave birth to a new pattern of life called Society 5.0, which means that humans in carrying out their activities in daily life are closely related to the use of ICT and all kinds of supporting tools. In the era of Society 5.0, humans rely heavily on information systems to support all business processes and digital activities. This research comprehensively explores the scientific philosophy of information systems viewed from the aspects of ontology, epistemology and axiology to find out the scientific basis of information systems viewed from the three aspects.

Keywords: Ontology, Epistemology, Axiology, Information Systems

1. Introduction

The Industrial Revolution continued to develop from 1.0, 2.0., 3.0., until finally it was in the Industrial Revolution 4.0 era. Along with the development of industry and the times, people experience lifestyle changes such as the gradual decrease of paper usage and everything slowly leading to the digital era. Information and Communication Technology (ICT) as part of Science and Technology (IPTEK), generally includes all technologies related to the retrieval, collection (acquisition), processing, storage, dissemination, and presentation of information. ICT is rapidly adopted by almost all people. From the results of a survey conducted by Hootsuite & We Are Social (2020), almost 60% of the world's population is online and continues to increase by 7% every year.

In this research, we try to examine philosophy from the point of view of information systems taken from some previous literature, namely *Information Systems Epistemology: a Historical Perspective* by R. A. Hirschheim, *Epistemology of Information Systems: Time for Something New? Positivism, Interpretivism, and Beyond* by F. Ricciardi, and *Developing a Meta model for the Bunge–Wand–Weber Ontological Constructs* by Michael Rosemanna & Peter Green. From the said literatures, the development of information systems is mentioned to be more complex; this is indicated by the use of different methods and techniques in achieving a system modeling. From the use of flowcharts, data flows, and entity relationships diagram, to process models and object-oriented

schemas. The purpose of this study is to provide an overview of understanding related to the information systems paradigm from the point of view of ontology, epistemology and axiology in the philosophy of science.

2. Method and Science

Information systems in the perspective of the philosophy of science is a science that examines the process of extracting information systems to see the nature of the science of information systems. The study of the philosophy of information systems science method is seen from three **main** aspects, namely: ontology, epistemology and axiology.

2.1 Ontology Aspect

Information systems, as a branch of computer science, is closely related to the concept of ontology in philosophy. What is learned and what is in the information system is a concrete, real, and clear reality. As part of science and technology in general, Information Technology and Information Systems are all technologies related to the retrieval, collection (acquisition), processing, storage, dissemination, and presentation of information (State Ministry of Research and Technology, 2006: 6). Included in the previous definition are all hardware, software, content, and computer and communication infrastructure. The terms Information Technology and Information Systems emerged after the integration of computer technology and communication technology as a means of disseminating information in the second half of the 20th century. The combination of these two technologies is growing very rapidly and far beyond other technological fields. Even until the beginning of the 21st Century and entering the Industry 4.0 era, the saturation point has not yet seen. At the global level, the development of Information Technology and Information Systems has affected all areas of human life. The role and function of Information Technology and Information Systems into other technology fields has become so advanced that there is not a single piece of equipment resulting from technological innovation that does not utilize Information Technology and Information Systems. The ontology of science limits itself to the space of scientific studies that humans can think rationally and which can be observed through the five human senses. The area of scientific ontology is limited to the range of human scientific knowledge. Meanwhile, the object of study that is within the boundaries of pre-experience (such as human creation) and post-experience (such as heaven and hell) becomes the ontology of other knowledge outside of science. Schools in the field of ontology include realism, naturalism, empiricism. Ontology is a concept that is starting to develop in information systems and can also be a "Specification of Conceptualization" where all knowledge has a relationship with conceptualization, either implicitly or explicitly. Ontology basically functions as a knowledge engineering tool that standardizes knowledge. The rise of ontology in computer science represents the victory of content over process, which has also led to software development becoming increasingly complex and data focused. The science of information systems and information technology can be understood through material objects and formal objects. The material objects are understood as monotheistic at the most abstract, or as a unity and similarity as beings or objects at the highest level. On the other hand, formal objects view information systems and technology as a point of view which further determines the scope of the study itself.

Ontology discusses the object that will be studied in a science or the nature of the studied object. The object refers to the object of an event. In the discussion, there is metaphysics that discusses the basic things. The five senses plays a very important role in studying objects in life. The Five Senses will help examine the theory of existence, where something that exists must be real. The definition of an information system itself is to obtain, process, store, analyze and disseminate information for certain needs. The information system contains of components called building objects, which consist of input, model, output, technology, database, and control objects. As a system, all these objects interact with one another to form a unity to achieve the target.

2.2 Epistemology Aspect

In studying epistemology, we must understand that epistemology is a branch of philosophy that investigates the origin, nature, methods, and limits of human knowledge. This gave rise to a fierce philosophical debate around human knowledge, which occupied the center of problems in philosophy, especially modern philosophy. Human knowledge is the starting point for philosophical progress to

build a solid philosophy about the universe and the world. Therefore, the undetermined sources of human thought, criteria, and values are impossible for any study to be carried out, regardless of form. According to Ritchie Calder, the process of scientific activity begins when humans observe something. Therefore, it can be understood that the existence of human contact with the empirical world makes them think about the realities of nature on the observation of empirical objects.

The main problem faced by every epistemology of knowledge is basically how to get the right knowledge by considering the ontology and axiology aspects of each science. The object of epistemological study is to question how something comes, how do we know it, how do we distinguish it from others, so that it relates to the situation and conditions of space and time regarding something. To be able to obtain reliable knowledge, think rationally or otherwise, or just think empirically is not enough because both have limitations in reaching the truth of science. So, the attainment of truth according to science is obtained through the scientific method which is a combination or combination of rationalism and empiricism as a complementary unit. The basic framework of scientific procedures can be described in six steps as follows:

1. Awareness of the problem and problem formulation
2. Observation and collection of relevant data
3. Compilation or clarification of data
4. Formulation of hypotheses
5. Deduction from hypothesis
6. Implementation of truth-testing (Verification).

Each step contained in the scientific method have empirical and rational elements. Epistemology is a systematic science of knowledge. Epistemological basis is needed in information systems. Epistemology includes sources, means, and procedures for using these facilities to achieve (scientific) knowledge. In the theory of epistemology, there are several schools in which these schools try to answer the question of how humans acquire knowledge.

First, the group that suggests the origin or source of knowledge, namely the schools of:

1. Rationalism, that suggests that the source of human knowledge is the mind, ratio, and soul.
2. Empiricism, which stated that human knowledge comes from human experience itself, through the outside world that is captured by the five senses.
3. Criticism (transcendentalism), which argues that human knowledge comes from the outside world and from the soul or human mind itself.

Second, the group that puts forward the nature of inclusive human knowledge, in which there are schools of:

1. Realism, namely the school which holds that human knowledge is a good and accurate picture of the truth. In good knowledge the truth is depicted as it really is.
2. Idealism, namely the school which holds that knowledge is only an event in the human soul, while the reality that is known to humans lies outside of itself.

2.3 Axiology Aspect

Etymologically, the term 'axiology' comes from the Greek word *axios* and *logos*. Most experts translate the word *axios* from a philosophical point of view as 'value', while for *logos* can be interpreted as 'theory' or 'science'. Zaprulkan (2016) defines axiology as what is valued, what has high value, and what is valued as goodness. Meanwhile, according to Kattsof (2004), axiology is the science of the nature of values which is usually perceived from a philosophical point of view. Based on lexical definition, axiology is a study related to the theory of value or the study of everything that can be valuable or provide benefits. Value in philosophy is a trait or quality attached to an object but not the object itself. Value is a phenomenon but does not exist in a space and time. In addition, values are also logical essences and can be understood through reason.

Quoting from Bramei, axiology is divided into 3 important parts, namely:

1. Moral actions that give birth to ethics.
   The first is moral, ethical, or human action. The main role of axiology is to give direction to humans to do a better action.
2. Expression of beauty that gives birth to aesthetics.

The second is the expression of beauty. Axiology acts as a guide in humans for expression which gives birth to a beauty in themselves

3. Socio-political life that gave birth to socio-political philosophy.

The third is socio-political. At this level, axiology acts as a means of human socialization process.

Aspects of axiology are closely related to pragmatic goals, so that a science is seen from its usefulness. Information technology as a science, when viewed from the aspect of usefulness, can begin with questions of critical nature and reasoning. These questions can be the beginning of understanding information systems/technology from the axiology point of view: What is Information Systems and Technology used for? How is the relationship between the use of knowledge and knowledge systems/information technology with moral principles? How is the relationship between the science of information systems and information technology based on moral choices? And how is the connection between the operationalization of the scientific method in an effort to create and discover theories and applications of information systems science and technology with moral and professional norms? In the context of philosophy, ethics discusses human behavior in terms of good and bad. Ethics is more concerned with the basic principles of justification in relation to human behavior.

Therefore, ethics is a science and not a teaching. Ethics and morals are also not on the same level. Moral teachings determine how humans should live what is allowed and what is forbidden, while ethics helps someone to understand something. In other words, ethics as a science requires humans to behave morally critically and rationally. In general, ethics is a theory of human behavior or actions that are viewed from the aspect of good and bad values that can be determined by reason.

In the view of experts, ethics can be broadly classified into three fields of study, namely descriptive ethics, normative ethics, and metaethics (Zaprulkhan, 2016).

1. Descriptive ethics describes and explains moral awareness and experience in a descriptive manner which is classified in the field of empirical science and is related to sociology.

2. Normative ethics provides guidance or guidance in making decisions concerning good and bad or right and wrong.

3. Metaethics investigates the meaning of normative terms expressed through ethical statements that justify or condemn an action.

Information and Communication Technology (ICT) has become part of people's daily life in the era of the Industrial Revolution 4.0. Intelligent devices connected to the internet are almost always used by people to help facilitate work or find solutions to a certain problem. The collection of data through such intelligent devices generates big data, which could become an ethical problem if it is misused due to the data contains a lot of personal and confidential information. In order for the data to be used according to its function, it is necessary to make terms and conditions for the use of big data based on ethics and morals. The use of blockchain technology, fog computing, machine learning, and edge computing can be utilized to maintain the use of big data in accordance with the terms and conditions that have been determined or agreed upon (AboBakr dan Azer, 2017).

3. Conclusion

From the description of three aspects in the study of ontology, epistemology, and axiology, it can be concluded that Information System is a scientific insight from computer science which was initiated by Charles Babbage in 1822 by creating a machine that can be run for arithmetic operations. The development of computer science also led to the existence of information systems science which has a third dimension of philosophical aspects of science ontology, epistemology, and axiology. Problems and questions related to science and technology require an ethical dimension to be considered and sometimes have an influence on the process of further development of science and technology. Ethical responsibility is something that concerns the activities and use of science and technology. In developing science and technology, Scientists must pay attention to a particular human nature, dignity. humans, which are responsible for maintaining the balance of the ecosystem, are universally responsible for the interest of public and future generations. Rapid technological innovation has both positive and negative impacts. The implications of the development and application of information systems must also be controlled based on the philosophy of science and the existence of scientific ethics so as not to be further away from ethical, moral, and religious values.

References

1. A Bakhtiar, "Filsafat Ilmu," Jakarta, Rajawali Pers, 2013.
2. A. S. d. M. D. Keraf, "Ilmu Pengetahuan, sebuah Tinjauan Filosofis," 2001.
3. AboBakr and M. A. Azer, "IoT ethics challenges and legal issues," 2017 12th International Conference on Computer Engineering and Systems (ICCES), 2017, pp. 233-237, doi: 10.1109/ICCES.2017.8275309.
4. Aceng Rahmat, "Filsafat Ilmu Lanjutan," Prenamedia group, 2015.
5. Alex Rosenberg (2003). Philosophy of Science: A Contemporary Introduction. 2nded. New York: Routledge. ISBN 0-203-08706-2.
6. B. P. R. K. Rainer, "Introduction to Information Systems," 2021.
7. D. R. E. Indrajit, Pengantar Konsep Dasar Manajemen Sistem dan Teknologi Informasi, 2021.
8. Dr. Noor Rachmat & Dr. Frederikus Fios (2018). Pengantar Filsafat Ilmu & Logika. Jakarta: Hegel Pustaka
9. Frederikus Fios (2013). Pengantar Filsafat Ilmu dan Logika. Jakarta: Salemba Humanika
10. Syaputra, "Sinopsis Filsafat Ilmu Ontologi, Epistemologi, Aksiologi dan Logika ilmu Pengetahuan".
11. Irving M. Copi, Carl Cohen, & Kenneth McMahon. (2014). Introduction to Logic. The 14th edition. Essex: Pearson Education Ltd. ISBN 978-1-292-02482-0.
12. J. M. &. B. S. N. R. Hassan, "Philosophy and information systems: where are we and where should we go?," European Journal of Information Systems, 2018.
13. M. Adib, "Filsafat Ilmu," Yogyakarta, Pustaka Pelajar, 2014.
14. M. D. A. Susanto, "Filsafat Ilmu," 2019.
15. M. Wahyudi, "Konstruksi Integralitas Ilmu, Teknologi dan Kebudayaan".
16. Ricciardi, Francesca. "Epistemology of information systems: time for something new? Positivism, interpretivism, and beyond." Information Systems: People, Organizations, Institutions, and Technologies. Physica-Verlag HD, 2009. 267-275.
17. Rosemann, Michael, and Peter Green. "Developing a meta model for the Bunge–Wand–Weber ontological constructs." Information systems 27.2 (2002): 75-91.
18. W. D. S. Rachmad, "Filsafat Ontologi Kecerdasan Buatan Pada Perkembangan Teknologi Informasi," 2020.
19. Zaprulkhan, Filsafat Ilmu Sebuah Analisis Kontemporer, Jakarta: PT. Raja Grafindo Persada, 2016.