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PHILOSOPHY OF INFORMATION TECHNOLOGY

Mr. Geofrey Mwamba Nyabuto[1], Prof. Franklin Wabwoba[2]

[1,2]Department Kibabii University Information Technology P.O. Box 1699—50200, Bungoma County, India.

Corresponding Author

Email: fwabwoba@kibu.ac.ke

Email: gmnyabuto@gmail.com

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ABSTRACT

Computing and Information Technology (IT) continues to offer many life-changing experiences across the globe. With the dynamism that comes with computing, human beings are changing how they traditionally used to do things. The Internet through the era of the information age has made the world to be like a small village where you can get information from any part of the world in just seconds. This has been made possible through social media, penetration of mobile technologies, cloud computing, internet of things and advancements in telecommunication equipment.

The field of computing keeps on generating other new fields of study with computer science being the oldest field of study, computer engineering, software engineering, informatics, artificial intelligence and information technology, data science, and machine learning is among the new fields of study and research. Since the emergence of information technology in the 90s, this field has been integral in our day-to-day life and has changed how we interact and socialize. Even though this field has been in existence for nearly 30 years now, little has been done to understand the philosophical issues surrounding information technology.

There have been life changing innovations that have been a target along the development and adoption of information technology. Through these advancements, now it is possible for a patient to get a prescription virtually. Information technology has penetrated all fields of sphere including transport industry using mobile devices to locate and request for services. Same innovations have been witnessed in the banking and financing industry where it is possible for users to access and transact on their mobile devices at the comfort of their homes.This paper discusses the history of computing, computer science and IT and the philosophical issues surrounding these fields. This paper reviews various philosophical issues in the field of computing and information technology taking into consideration new advancements.

Keywords: Science, Technology, Information Technology, Computing, Computer Science, Philosophy of IT, Information Age, Philosophy of Information Technology, philosophy of computer science

1. INTRODUCTION

The philosophy of information technology is a special branch of the philosophy of technology that seeks to find the truth regarding the storage, extraction, processing, and use of information (Bunker, 2001). This branch of philosophy became a focus for philosophers in the 90s because of the earlier evolution of computers and computing technologies. For us to better understand the history and evolution of philosophy of IT, we will discuss various aspects of philosophy that have evolved to deliver the philosophy of IT. The field of computing has been quickly evolving from the 60s when computer science was one of the oldest fields till the 1990s when information technology evolved (ACM & IEEE, 2017). With the evolution of information technology, philosophers have been trying to understand philosophical issues surrounding information and data security, ethical issues surrounding information use and storage, cybersecurity, robotics, and their use in our daily life among other things. There has been a steady increase in the number of internet users over time. In 2000, there were 400 million internet users and as of Jan 2023, there are 5.16 billion internet users in the world (Petrosyan, 2023). This has been necessitated by various advancements in computing and information technologies including but not limited to cloud computing, and social media among others. With such many users adopting use of technology, it is paramount to review various philosophical issues surrounding the use of IT and how it impacts the society.

1.1 Philosophy

Philosophy is what humans do when they want to know the truth about anything in the universe. Through philosophy, we seek to establish why things happen the way they do. It raises key concerns about the world as is, what is known about it and what can be done. Philosophy has 7 branches i.e., Metaphysics, Axiology, Logic, Aesthetics, Epistemology, Ethics and Political Philosophy (Edu, 2022). Metaphysics, Epistemology and Axiology are the three key branches of philosophy. Metaphysics as a branch of philosophy seeks to understand the world and nature epistemology studies all concepts of knowledge whereas axiology seeks to understand ethical and aesthetical values as they exist in the world (Edu, 2022).

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2. Philosophy of Science

In a traditional set-up, the way of thinking of people is formed around customs, beliefs and myths that cannot be explained rationally. This made it possible for traditional societies to forbid some kinds of questions that will destabilize their beliefs. Modern societies came because of the power of questioning these traditional myths. This is what gave birth to science.

It is difficult to define the field of philosophy of science just as it is hard to define philosophy itself. However, the view of science and philosophy seems to be cut at some point making it a key interest for both philosophers and scientists. Philosophy of science looks at any reflection derived around the scientific methodology and analysis of findings (Ponce et al., 2017). Both fields look at the questions that have not yet been answered and attempt to answer them. Philosophy looks at the questions science is yet to answer or cannot be explained and tries to explain them. At the same time, science tries to find why things are happening the way they do.

If there are any initial questions yet to be answered is a question or concern that philosophy tries to understand and at the same time if science tries to answer these questions, then it is philosophy that can answer them. A reflection on how theories and scientific finds influence philosophy is a clear indication of how the two fields depend on each other.

The philosophy of science deals with studying science, how science works, its assumptions, limitations and how to build scientific knowledge. Science deals with the study of the natural and physical world in its entirety (Carroll & Cena, 2022). Some of the questions in the field of philosophy of science are epistemological, ontological, and methodological. They are questions like what is real? How can we know that something is real? It involves observations, carrying out experimentations and validating various theories against set evidence (Our definition of science, n.d.). The philosophy of science seeks to answer questions about science and not scientific questions (Stemwedel, 2014). This field of study deals with core scientific issues like the foundation of science, theories, assumptions, and limitations of science.

The philosophy of science looks at various methods of science, epistemological issues surrounding science, assumptions, and limitations of scientific knowledge. The philosophy of science is concerned with how to build and acquire scientific knowledge. With advancements in technology, day in and day out, we are building new scientific ways of doing the same things we did previously. This makes facts about science not to be a big concern as things keep on changing as technology progresses. Some examples of philosophies of science include logical positivism where science should be verifiable to make it categorizable.

2.1 Relationship Between Science and Philosophy

As we understand science, it emanated from ancient Greek after breaking off from philosophy and emerging as a separate field of interest for researchers and scientists. Based on Euclid's research and work on geometry i.e., "the science of space" but still taught in Plato's academy by philosophers (Rosenberg, 2000). In the 17th century, Galileo, Newton, and Kepler made physics (a branch of science) a separate subject from metaphysics (a branch of philosophy). Many of these fields that spun off from philosophy have left several key issues to philosophy that cannot be resolved or are temporarily unresolved. For example, science uses the concept of time to derive many of its findings for example acceleration is a function of time but what is time? This is a question science has left to philosophy to answer. Another example that biologists and philosophers are yet to answer is the purpose and meaning of life.

2.2 Scientific Questions and Questions about Science

Apart from the many questions science cannot answer, there are questions about why science cannot and will never answer those questions. The first set of questions is the very questions that science itself cannot answer. As discussed in an earlier section above, the questions of time, and life among others are questions that science is yet to answer. Additionally, there are questions on why science cannot answer an earlier question. This now raises new concerns about the limits of science, what questions science is unable to answer, what methods are applicable and how they are applied. Philosophers are asking themselves what question science is unable to answer, and what can be done about those questions. Is philosophy able to answer them? If philosophers and scientists can answer these questions, it will be very big steps towards answering the pertinent questions that science was unable to answer.

2.3 Modern Science as Philosophy

Apart from the traditional questions that science was unable to answer and was left to philosophy, big developments in science in the recent past have brought out another set of new questions that both science and philosophy are supposed to answer. Since the 17th century, there have been numerous developments in the field of science, and this has changed how philosophy works and answers pertinent questions.

This has given a lot of inspiration to philosophers. Among the key inventions were Newton's laws of motion, and the introduction of computers among others.

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2. PHILOSOPHY OF TECHNOLOGY

The rise of philosophical issues around technology is as old as philosophy itself. Technology roots from ancient Greek with an old common assumption that technology imitates nature. In this thought, it was believed that technology "copied" how nature occurred. We will try to understand what technology is, how different it is from science and some of the philosophical issues arising from technology and its advancement.

Science and Technology share a lot in common as they are both concerned with rational thinking by making empirical observations and knowledge in natural science. Over time, science and technology have been able to reshape cultures to be what we think of today. Modernization of the world has been possible through research carried out in the field of science and technology to where we can be able to judge whether it as being of value or not, being ethically justified or not among other things.

Technology is the application of knowledge in a specific field (Carroll L. S., 2017). Since ancient times, there has been progressive use and developments in technology. The philosophy of technology encompasses all studies about technology and society. Whereas science is concerned with truth, technology is concerned with the usefulness of the truth that science and other disciplines unveil. Whereas science seeks to know, technology seeks to control (Feenberg, 2003). The philosophy of technology seeks to understand questions like what technology is, and how has technology fostered human development among others.

We say technology is neutral, it is how you use it that justifies its importance. For example, hackers are using computing technology to hack, steal and harm other internet users. On the other hand, ethical hackers are using the same tools to explore vulnerabilities within the system and seek to strengthen its use and security. Technology has become so integral in our lives to the point that science which is considered the mother technology relies on technology to come up with or even proof concepts (Franssen et al., 2013).

In the current time, we look at convergent of technologies where different set of modern technologies are totally changing how we look at the world to the point of being thought of bringing modern civilization. In the 21st century that has been great influence brought about by information technology, biotechnology, cognitive science, and nanotechnology. One key feature of these convergent technologies being their maximum proximity to natural processes. This is evident by production and reproduction of things of living nature, artificial intelligence, context aware systems, disclosure of secrets of the brain among others (Rendl et al., 2019).

3. PHILOSOPHY OF COMPUTING

The philosophy of computing focuses on any philosophical issues that relate to computers (Philip A.E. Brey, 2009). It investigates the nature and principles of computing systems. For us to better understand computers, we will define what computers are, what qualifies to be computable and which ones do not. This will look at the limitations of computing. Then we will also look at all data and information-related issues in computing. With the above computing issues, we will form our philosophical issues about computing from the above notions and deeply discuss them in the next sections.

A computer is a machine that processes information based on a set of instructions (Mugivane, 2014). These instructions are executed sequentially. Allan Turing, one of the founding fathers of computational machines defined a computer as a device that can perform any computation that can be performed by human beings (Turing, 1950). While computers can solve any problem, the theory of computation complexity arises to help evaluate resources needed and the limits of computing systems. Two key resources are important i.e., time and space. In time, we look at how long the computing system takes to process a given set of inputs based on set instructions to give an output. In space, we look at what space is needed to process given input as per set computer instructions.

With computing complexity, we take note of computing problems that can be solved theoretically but in practice, it is difficult to solve them. Some of these problems can be solved and constructed mathematically but will be difficult to solve them physically or practically. This can be a great concern for philosophers as they try to find and understand such problems. Solvable problems can run to completion even in their worst-case scenarios.

For us to discuss computing systems, we must understand the 3 key building blocks of computing systems. They are data, programs, and information (Philip A.E. Brey, 2009). Though there has been no clear definition and distinction between data and information, in computing, data can loosely be defined as what the input computers are given to process whereas information is the output computers give after processing data. Computers are given instructions (programmed) to perform a given set of instructions on data and they convert these instructions to machine-readable codes that guide the operations that can be performed on data. There are a lot of philosophical issues surrounding data and information as philosophers try to understand if data and information are objective or subjective. What one finds out to be data or even a set of a program may be ambiguous as the other philosopher may find it different.

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3. 1 Philosophy of Computer Science

For us to better understand the philosophy of computer science, we should be able to understand computer science and the building blocks of computer science. But what is computer science? Is it a science just like other sciences? Is computer science programming? For us to answer these questions better, we will start by defining computer science, its evolution, and its current state. Computer science is a field of science that deals with defining, writing, and understanding computer programs (Turner, 2008). This field of science is mainly concerned with building computer programming with algorithms and data structures being key theories of programming. Algorithms are stepwise instructions on how a program should run. Algorithms should not be ambiguous, and the same input should always give the same output. Data structures on the other side define how data should be stored and retrieved for execution by computers.

Being able to map out philosophical issues in computer science is not easy. With the existence of philosophy, we can have a general outlook of how the philosophy of computer science should look like. Traditional philosophy can give a blueprint and guidance on how this can be achieved. Given that computer science emanated from the fields of mathematics and physics, we can borrow some of the philosophical views and build them into computer science (Rapaport, 2005). An example is what an object is, what constitutes knowledge and how knowledge can be gained. In computer science, we can ask ourselves what the building blocks of computing are, what is a computer? What constitutes knowledge in computer science and how can knowledge of computing be gained?

In a nutshell, the Philosophy of computer science reflects on the analysis, evaluation and interpretation and clarification of concepts surrounding the field of computer science. Some of the concerns of the philosophy of computer science include, what is data? What is a program? What are data structures? What are databases? What are computer networks? What are computer algorithms? What is software engineering and how does it correlate with other engineering disciplines? What is computer programming? Are there agreed on programming paradigms? How different are computer programming languages from other natural languages? Such philosophical questions and concerns can be well answered using philosophical tools with deep reflections on these concepts.

By discussing the various building blocks of computing, we will be able to outline some of the concepts in computer science.

3.1.1 Algorithms and Program

Algorithms are the building blocks of any program. Algorithms outline step-by-step instructions a computer is given to execute to give a desired output. Algorithms can be viewed as mathematical objects and if this assumption/view is true then they belong to the philosophy of mathematics. The reality is algorithms are more central to computer science than they are to any field like mathematics, engineering, and physics. Some of the philosophical questions asked in this field include, what are algorithms and how different are they from programs? What constitutes a good algorithm? How can people gain knowledge about algorithms among others.

3.1 Programming and Programming Languages

Programming languages are central to computing. The programmability of computers gives them the ability to carry out different functions as defined in the program that runs on them. The computer understands the binary-coded language. Programming languages allow computers to carry out functions as guided by the program built using specific algorithms in them (Pei, 2018). Abstraction is one of the key concepts in programming and computer science. Though it has been in existence for a long time, it has not received the philosophical attention it deserves. Abstraction outlines inventions like data abstraction, objects, classes, and inheritance among others.

3.2 Ethical Issues in Computer Science

The activity of developing computer systems raises pertinent ethical issues that should be answered as programmers design systems. Some of the concerns in computer ethics include patents, copyright, and software identity. Copyright protects the software. It is an assumption that the software is copyrighted and protects the idea from being copied by other entities. In terms of computing, ideas are expressed as algorithms that will determine how the software will work. However, on the other hand, it is difficult to patent an algorithm since these are mathematical theories in place (Ogunlere & Adebayo, 2015). Another aspect of ethics in computing is the correctness and responsibility of the use of this software. Some applications of the software written are used to manage critical systems like in a medical set-up managing human life, and nuclear running systems among others. This calls for a rigorous testing process taking into consideration all possible instances before the software is deployed (Turner, 2008). However, from the computing perspective, it is the responsibility of the programmer to develop a system that is free of bugs and runs without any challenges.

3.3 Importance of Philosophy for Computer Scientists

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Understanding any discipline is very important. Understanding how it co-relates with other disciplinary is equally important. It is important for computer science philosophers to understand creation, maintenance, diffusion and sharing of knowledge as it relates to computer science. Computer science has several branches, and it is possible that computer scientists specializing in different branches of computing do not understand what their colleagues in other computing fields are doing. It is important for computer science philosophers to get a place for computing in the bigger umbrella of science and research. It has been a journey for computer science to achieve its specific field of computing off mathematics, engineering, and science.

Since its inception in the 60s, there has been a lot of research going on regarding methodologies and ways of computer science. This science now offers different ways of solving problems by use of algorithms and different computational models. With great investment in research around computing, it has led to growth of other computing fields like computer engineering, software engineering, information technology, data science, machine learning, networking, artificial intelligence, and decision support systems.

Although computer science emanated from interdisciplinary it is possible that the same is creating problems for the field of computing. Sometimes it is confusing to know the exact topics that should be covered in computer science as opposed to the other related fields and the kind of research that should be carried out in the same field. Without a clear understanding of what computer science is, it makes it very difficult to define what should be covered within the course of computer science. It will make it easier for computer scientists to accommodate the use of computer science in other fields if they have a core understanding of the limitations, assumptions and theories that define computing (Rosa et al., 2016).

3.4 Philosophical Questions in Computer Science

There are several philosophical questions that computer scientists can ask themselves. One of the key question researchers and scientists are asking themselves is what is knowledge and how can it be gained? These are some of the philosophical questions that can be asked in computer science like, what is knowledge in computer science and how can knowledge of computing be gained? Are we able to differentiate between assumptions, beliefs and knowledge in computer science and how can this be done? Do we have things that are impossible for computer scientists to know just like in other fields? Which are these? Can things be proved in computer science just like they are done in other fields like mathematics and engineering?

Other questions as discussed in prior subsections include ethical issues surrounding computing. How can computer scientists make programs that are safe for the world? Are there problems that cannot be solved by computer science? Which problems are these? Are they solvable through other fields?

4. PHILOSOPHY OF ARTIFICIAL INTELLIGENCE (AI)

Artificial intelligence is the science and engineering of intelligent machines. These are machines that can make their own decisions. These machines are thought of as being environmentally aware. These machines try to mimic human beings in their ways of making decisions (Marvin et al., 2023). This field has attracted a lot of attention as it is closely related to many philosophical fields such as the philosophy of mind and the philosophy of language. The philosophy of artificial intelligence is concerned with whether AI is possible, whether it is possible to build intelligent systems, applications of AI, and philosophies of various applications of AI (Müller, 2023).

This field of AI has been in existence for the same duration as computing. Hence it can be termed as one of the oldest fields just like computer science. The initial thought of AI was that the systems were to be programmed in a way to simulate the human mind. It is through this that researchers thought they were able to reach and get to understand human thought processes and be able to simulate them using computers. Intelligence can be thought of as the ability to reason, think and solve a problem, be able to understand language, learn and at the same time understand ideas. Research around AI try to understand these concepts by building systems that can understand language, be able to think, solve complex problems by themselves and as well learn based on past experiences (Marvin et al., 2023).

One of the pertinent issues in earlier research was how possible it was to have a computer just think and be able to make decisions just like human beings. Allan Turing proposed that a machine is intelligent if it can fool a person to believe that it is human. As with Allan Turing, a computer and a person are to be given a set of questions and the test person is to ask them questions. If the test person is unable to distinguish between them and who the real person is, then the computer is said to have passed the test. There was a general agreement among AI researchers that the aim of AI is to create intelligent computer programs. However, there has been no agreement on the level of programming that the system needs for them to be intelligent. Herbert Simon and Allen Newell are some AI researchers who believe that

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intelligent computer systems AI could be used to simulate human thought processes. This in its sense is called cognitive simulation of AI.

Ethical issues are bound to arise from the development of intelligent systems. Some of the key concerns in this field include, what qualifies to be an intelligent system, and how possible and true is it that humans can develop systems that are more intelligent than them. What are the social implications of developing these intelligent systems? Are computers replacing humans if they can do everything humans do? How do computers teach them to be able to imitate humans? Is this the end of humans? These are some of the philosophical issues that are arising in the field of artificial intelligence that researchers and philosophers are trying hard to answer.

5. INFORMATION TECHNOLOGY

Information technology is coined from two words, information, and technology. Information bears different meanings based on the context of use but the most common being the building block of truth (Rapaport, 2005). While computer science is one of the oldest fields focusing on algorithm design, programming, and data structures among others, Information Technology is the newest field dealing with applied knowledge in hardware, software, and database systems. Information Technology is a field of technology that studies the use of electronic devices (computing and telecommunication devices) to create, store, process, analyze and present all forms of information and data (Victoria, 2020). This field evolved with the evolution of computers and computing technologies. Information technology eases the way facts and knowledge are transferred from one point to another. Information can be used in various ways as outlined below.

1. Information as a process – This involves the act of passing knowledge from one entity to another. By passing this information, you are informing the other person or entity.
2. Information as knowledge – This is the fact that is passed to another entity. It is the piece of information passed over to the next person.
3. Information as a thing – In this case, the concept of information is used as an object or document. They have the quality of information and can "inform".

Several typologies relate to information technology, and they include technologies related to systems development. They include system requirement gathering technologies, analysis, and design technologies, prototyping and programming techniques as well as database design techniques, program testing and debugging among others. Another typology is software and hardware support technologies. They include support for various operating systems, database systems software systems, networking equipment, and computers among others.

Management of people and other technological resources also comes in as an important consideration in the field of information technology. Information Technology is an ever-changing field with people daily being reminded that they are in an information age where different technological advancements like cloud computing, and mobile technologies are having a very big impact on how we carry out our day-to-day activities (shirandula et al., 2015). With a deep understanding of information technology, it lays a good basis for us to discuss and review different philosophies surrounding the field of information technology as discussed in the next section.

5.1 Relationship between Information Technology and Computer Science

Information Technology is an applied field that deals with the application of computing technologies to impact human life. On the other hand, computer science is concerned with processes and methodologies of programming, algorithm design and data structures. It is said that information technology emerged from the business school of thought whereas computer science emerged from the field of mathematics and engineering. Information technology supports business processes by applying computing skills in business.

5.2 Philosophy of Information

Information is the fundamental building block of reality (Meijer, 2013). Philosophy of information is a field of philosophy that seeks to understand the nature, use and advancements within the field of information. This field of study involves looking at the concepts of information, dynamics, application context, and systemic issues that arise from information use and application in the day-to-day life of humans. It also deals with how the field of information relates to other fields. Although the concept of information is relatively old, advancements in technology through computing technologies have changed how information is currently viewed.

5.3 Philosophy of Information Technology

The philosophy of information technology takes information technology as a research subject and is one key branch of philosophy since information technology is an integral part of human life nowadays. The philosophy of IT is formed along the field of philosophy so at the end of the day we have the axiology of IT, the epistemology of IT and the ontology

of IT as well. With new advancements in technology, the field is bringing new frontiers and challenges to philosophy. Key recent advancements include the Internet of Things (IoT) machine learning and data science, and Cloud Computing among others (Xiao, 2020). This poses new challenges for philosophers as they try to understand all the philosophical issues surrounding these fields.

The philosophy of information technology aims at evaluating the impact of modern technology on human life, well-being, and their co-existence in society. This field of philosophy of IT is a relatively new field that came into being in the 90s with the introduction of information technology as a domain. The philosophy of technology had a lot of focus on the impact the technology had on society as opposed to the evaluation of the engineering processes behind the technology. This made this philosophy have a lot of bias leaving behind a relook at the philosophical processes that led to the technology.

The Philosophy of IT looks at the influence brought about by advancements in information technology (Kiget & Mugeni, 2014). The current society is fully supported by information technology that has brought out the idea of the universe being a global village. Advancements in social media, improvements in computing capabilities in mobile devices and the use of mobile devices to undertake a whole bunch of activities have made it possible for humans to carry out activities that were considered impossible in the recent past.

Information technology has transformed how work was being done previously and new developments like COVID-19, have further pushed the application of information technology to several areas including how sessions like court proceedings, meetings and even work itself are being done. These advancements have changed the world from being a physical wealth-creating economy to knowledge or information-based opportunities (Kiget & Mugeni, 2014).

Information Technology, just like any other field of technology, has both benefits and harmful effects depending on how it is applied. This is always subject to the individual making the judgement and the case study under investigation. This has been the foundation of the philosophy of IT as it tries to undercover some of the philosophical concepts behind information technology. As ethics have it, the philosophy of IT will try to look at the impact IT has had on society including both beneficial and harmful effects. For example, through ICT people can hold virtual meetings and anybody from any part of the world can attend these meetings. Some of the benefits of this include using fewer resources to hold meetings as people only need the internet and a computing device to join the meeting as well as increased coverage. On the other hand, such developments may not be beneficial since some participants just join the meeting and continue carrying out their other duties just to appear as if they are in the meeting whereas they are not.

One of the philosophical issues raised about information systems that include technology is what is the relationship between scientifically based information systems theories and the actual practice of people about information technology and systems (Philip A.E. Brey, 2009). People working in the information technology field are bound to interact more with people as compared to any other computing field. IT practitioners are considered more users and supporters of computing systems developed by other computing fields (Gichuki et al., 2019).

5.4 Information Ethics

Information ethics refers to ethical issues surrounding the collection, storage, analysis, and use of information (Beavers, 2019). We are in the “information age”, and this has been necessitated by several advances in information technology. Given that information technology is an applied field, philosophically we tend to look at the ethical aspects of how information is stored and retrieved from computing devices. This field may sometimes be confused with computer ethics which deals with ethical issues surrounding the use of computers in day-to-day life. With millions of records digitally created on an hourly basis, and the increasing data processing speeds available, new ethical concerns are coming up that should be addressed not just like the traditional way ethics was viewed. Development and adoption of social media has seen rise in use and generation of numerous digital records in short span of time. Terms like big data, data lakes, data science have all come to try and make sense out of the numerous records created and used globally.

5.5 Importance of Philosophy of Information Technology

As discussed in the above section, in the recent past there have been various innovations and applications of IT in human life. With the importance IT has in human life, it is important for researchers and philosophers to try, and answer hard questions on the implication of use of these technologies in human life. Technology is both beneficial and harmful based on how it is used. Information technology being a relatively new field, there is a need to look at all philosophical issues surrounding this field. This is in bid to ensure that as many questions as possible are answered on the use of information technology and there is no room left for ambiguity.

Philosophy will play a key role in enhancing on we look at information technology, how we learn and use it. It is with an assumption that humans will use IT to advance and improve human life.

6. CONCLUSION

In conclusion, there have been several developments and advancements that have been brought about by science, computing and now information technology. These fields closely related to each other and gave birth to another field. With the invention of computers in the 20th century, a lot of inventions have happened that have totally changed how things were done traditionally. Although science as a field has been in existence for several years, currently science depends on inventions brought about by technology to run. An example could be the use of machines and computers to do research and now without some of these innovations, it could be impossible for science to advance.

Information technology, being one of the new fields that have emanated from the use and adoption of computers, is totally changing how human activities are being carried out. For example, social media that came into play in the 2000s has totally changed how humans interact and socialize, nowadays it is possible to share information with people in other continents just as if you are physically together. Adoption of new technologies in relation to IT has totally made it possible to do things that were considered impossible 20 years ago. In the current era, it is possible for people to work off their workplace thanks to adoption of virtual working concepts and use of internet to connect places.

In conclusion, we will continue to witness new innovations that are coming with advancement and adoption of technology. New applications of artificial intelligence in data science, big data and machine learning have made it possible for systems to make informed decisions based on previously collected data. Systems are now able to make accurate predictions on what is about to happen. This has been applied in several fields to detect anomalies in activities for example, Google is able to use certain patterns to detect if you are the same person on the internet even if you are using different devices and accounts.

Above lays a basis for philosophers to think and try to answer some of the questions that will come with such developments. An example is “is it ethical for the internet to collect and use personal data online? to what extent is this data used and is true that data can only be used to the extent a user has allowed or there is illegal use of personal data to do advertisements?”

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