
Science, Technology and the Human Society: A Philosophical Inquiry

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Abstract

It is no longer an issue as to whether science is of any advantage to human society. Science and technology, no doubt, have made and are still making tremendous contribution to the development and advancement of the society. Science has increased human knowledge and understanding of himself and nature. The application of scientific knowledge – technology - has benefitted human society in many unprecedented ways, in agriculture, medicine, communication, transportation, economy, etc. Notwithstanding these numerous advantages of science and technology, there are increasing actual and potential dangers they pose to mankind and his environment. Science and technology have endangered human life, the environment and ecosystem, world peace and security, undermining human moral and social values etc. In consideration of the foregoing, this paper therefore critically inquires into the ultimate essence of science and technology, arguing that although science and technology have their own limitations, it is only rational for humans to encourage that which is beneficial to him and discourage those anti-social and moral aspects of these disciplines. In conclusion, the paper avers that humanity must always strive to manipulate science and technology to their advantage, that is, in the most proper manner as a means in order to ensure that they do not slip from human control.

Keywords: Science, Technology, Humans, Development, Society,

INTRODUCTION

The history of human society has been that of scientific advancement and technological innovation. Man is in a continuous struggle to master his environment. In his quest to live longer, better and meaningfully he engages in quite a number of inventions and innovations. The series of man's innovations have been increasingly dramatic. It is thus no longer an issue whether science has been of any advantage to human society. Science no doubt has made unprecedented contribution to the advancement of technology and the development of the human society in general. The security, pleasure and ultimate survival of man depends on the extent to which the unfolding technologies are integrated into the quality of human life in an unfolding century.

It is said that science evolved from common sense. However, the evolution and development of science was possible because the human mind has indefinite capacities; it continuously emits thoughts and ideas and wonders why and how things happen, and most

importantly, how to be in control of the way things happen. This is the essence of philosophy in science. In the same way science and technology equally have their own reasons for being.

The essence of science is not scientific, neither is that of technology, technological. Science and technology are disciplines aimed at the acquisition of knowledge with which to solve human problems. This means that human's vast, varied and complex and ever increasing needs gave rise to science and the quest for scientific knowledge. Scientific knowledge enables the scientist to understand, explain, and predict human problems as well as natural events. Science attempts to explore the world for man's advantage. According to Nwala (1997), science aims at enabling man to explain how the world, events and objects around him originate, develop, operate or function. It also helps him to predict how they will behave in the future and thus enables him to control the behaviour of the things around him, once he is able to develop the appropriate instruments for such control. Science helps us to express and systematize our understanding of objects and phenomena. It also provides us with practical knowledge in various ways, mechanism and instruments which enables us to control objects and phenomena.

There is a relationship between science and the society. This relationship is expressed by the statement that "the worth of the society can be well judged by the extent to which it supports its scientists adequately" (Lifshitz cited in Udoidem & Inoka, 2004). In like manner, the best way to determine the importance of science is to consider the value and applicability of its achievements and discoveries to the society. In this work, therefore, we are not only concerned about how these achievements and discoveries have benefited man, but also how they have endangered human life and existence.

SCIENCE AND TECHNOLOGY: ANY RELATIONSHIP?

Whereas technology is the practical application of the principles, laws and theories of science in order to achieve specific objectives; science, being a derivative of the Latin word *scire* or *scientia*, meaning *to know* or *knowledge* respectively, is used in a narrower sense to designate a quantitative and objective body or system of well-arranged or organized and orderly knowledge that covers general truths of the physical world and its phenomena as well as the operation of general laws especially as obtained and tested by means of methods of observation, experimentation, classification and measurements, verification, hypotheses etc. (Nwalozie, et al., 2000, p.1).

Technology which means the application of scientific knowledge and research, with the aim of developing products and processes for the use of man, is etymologically associated with the Greek term *technikon*, which means that which belongs to *techne*. The word *techne* is the name used to not only refer to the activities and skills of the craftsman, but also for the arts of the mind and the fine arts (Heidegger 12-13). *Techne* refers to a set of principles involved in the production of an object. The word *Techne* pertains to acts of making and doing things. It is a form of "bringing forth", an *instrumentum*. Its equivalence is *craft*. Heidegger puts it thus:

Techne was a skill and through knowledge that disclosed, that was, as such, a mode of bringing forth into presencing, a mode of revealing. Philosophy, as a thinking that considered reality and therewith made it manifest in its Being, was techne also in its own way. In the Western tradition, the metaphysical thinking born of that philosophy carried forward the expression of techne into modern times (Heidegger, xxv).

Onyeocha writes that “Technology refers to the shaping of sensibly perceptible things in the service of some need or idea.” He goes on to say that “Technology involves the methodical utilization of natural resources and forces on the basis of the knowledge of nature, in order to take care of human needs” (1995, p. 203).

We ordinarily understand modern technology as having arisen subsequently to science and as subordinate to it. We consider it to be a phenomenon brought about through scientific advance. Heidegger points out that on the contrary, modern science and machine technology are mutually dependent upon one another. More importantly, technology, in its essence, precedes and is more fundamental than science (Heidegger, xxviii).

Now, concerning science and technology, there is a symbiotic relationship. The relationship between science and technology as pointed out above is in the sense that science provides information to technology, and technology in turn provides science with ingenious precise instruments which extends the scope of human sources of knowledge, as well as provides avenues for practical utilization of scientific theories. Before we proceed, there is yet an important point we must make with regard to the Greek word “*techne*”, from which technology finds its etymology. We must understand the place of philosophy in both the meaning and essence of technology. This is to the extent that from earliest times until Plato the word *techne* is linked with the word *episteme*. Both words are names for knowing in the widest sense. They mean to be entirely at home in something, to understand and be expert in it (Heidegger 13). *Episteme* is the root word for epistemology, a branch of philosophy. This is in the sense that Aristotle explains that science is “wisdom”. And wisdom applied, is technology which amounts to development. Let us therefore at this point consider the place of philosophy in science and technology.

THE PLACE OF PHILOSOPHY IN SCIENCE AND TECHNOLOGY

Prior to the seventh century, there was no distinction between philosophy and science, specifically, the natural sciences. The history of the emergence and development of the natural science shows that it is a breakaway from philosophy. From the Early philosophers down to Plato and Aristotle’s writings, it is pretty difficult to distinguish between philosophy and science. This is mostly because scientific learning ranging from the Early philosophers until Galileo was largely speculative. They constructed and tested several scientists’ theories. For them, there is no difference between philosophy and science; they are theoretically based knowledge,

Science, being the first off-spring of philosophy before the social sciences like politics and psychology includes subjects like physics, chemistry, biology, geography, etc. Although many people have argued that philosophy cannot be considered a science; yet, others claim that it is a science especially when one considers the fact that science is an organized knowledge. To this extent, let us in a few paragraphs make a few points that may be helpful in laying bare the above dispute. Philosophy satisfies as science since it is an organized knowledge, a rational explanation of anything so-called, having a general principles under which all facts could be explained. In their nature and origin, philosophy and science are related; in fact they are indistinguishable. They are closely related in their goal or quest for truth. Philosophy constructs theories about man, his environment and their entire universe, and sees these theories as the basis for beliefs and actions. It provides analysis of these theories in order to eliminate inconsistencies and errors. In the same way, science does.

However, the aim, scope and method of investigation of philosophy and science are quite different. Philosophy and science deal with the wholeness of the physical world, but philosophy advances beyond the physical to include the metaphysical or transcendental realm. So while science deals with the physical world alone, philosophy deals with the whole world - the physical and the metaphysical world. Hence, while philosophy is not limited to any subject matter, science is limited, i.e. to subject matters of the physical or material world.

In the method of investigation, philosophy differs from science. Science uses empirical method of investigation that is applicable to sense experience while philosophy uses speculative method. The scientists give answers that are factual, and try to achieve objectivism in answering questions through observation and experimentation. Such answers of science may give room for further investigation and improvement, but answers of philosophy are open-ended giving room for more different views or opinions through critical reasoning and argumentation.

It is true that philosophy starts from common sense. However, it goes beyond common sense into the foundations of many things including that of science. Every real scientist as distinct from a “cheer-leader of science” knows that nearly all fundamental problems of science, whether it is the determinism of classical mechanics, Einstein’s Theory of Relativity, or Heisenberg’s Indeterminacy Principle, are essentially philosophical (Nwodo, 1982, p. 11). Nbetec concedes to the above thought when he explains that:

The application of philosophy to science is called the philosophy of science. Philosophy enquires into the epistemological metaphysical and ethical foundations of science. Epistemological questions border on what science investigates; metaphysical questions concerns how science conducts its investigations (i.e. scientific methodology); and the ethical issues about science focus on why certain things are investigated, i.e. the justification in conducting the investigation (2014, p. 37).

The latest in technological innovation and advancement like skyscrapers or mansions, prestige automobiles, bridges, computers, etc all have philosophical bearing in the sense that philosophy participates or contributes in bringing them about. This is another way of saying that the products of science and technology are simply the practical result of theoretical or philosophical thinking and reflection. For instance, there is no doubt that whenever we want to produce or manufacture something, that which we want to produce or manufacture, is usually first conceptualized in our mind or intellect. The intellect or mind is therefore the starting point of every scientific and technological development. It is in this sense that Wahba claims that conceptual understanding of a thing precedes and betokens its practical realization (1985, p. 23). UNEGBE states this point vividly thus:

Philosophy plays much role in science and technology in very many less visible manners. An architect in making design on paper deals with abstract concept of what he considers good for his client. Such designs require some philosophical wisdom in conceptualization, in a way of imagination and ideation. Whatever structure that would be put in place must begin with its vision, imagination or conceptualization. Philosophy and ideology always come into play whenever any form of material or structural development is concerned. Philosophy therefore

remains at the realm of the spirit of any structural/ material developmental project (2002, p. 111).

The place of philosophy in scientific cum technological work is in relation to imagination. It must therefore be stated that science and technology are first and foremost works or constructs of human imagination as they are works of the laboratory bench. It is with the aid of disciplined and rationally controlled imagination that hypothesis as to the nature of things are invented. Science and technology, just as philosophy are intellectual enterprises which aim at understanding the world. One of the differences they make when compared with philosophy is that they are done under the discipline of experimental method. Philosophy remains a critique of science and technology. It rationalizes science and technology, making it possible for them to be further investigated in view of ultimate clarity and understanding. It provides cognitive or rational justification for doing anything including science and technology. Technology and its products are the outcome of human cognitive ability and creative credentials. There would never have been technology without cognitive ability or thinking. Dusek concurs with the above claim when he writes “Technology is meant to be tailored by genuine philosophical, dialectical and higher rationality.” The role which philosophy plays with technology is to investigate the origin and conditions of technology in human nature. It also looks into the multiple influences which technology has on humans and on the concrete structuring of human life and the society at large. Ekanem writes:

...the origin, the use and value of technology are both epistemological and philosophically rooted. This can be seen in the methodology of technology, which is systematic. This makes use of both theoretical and practical intelligence in the design and construction of every technology (Ekanem, 2012, pp. 180-81).

According to Innocent Asouzu, philosophy is the science whose duty it is to lay the foundation for true and valid knowledge about the fundamental reality of all realities. It offers guidelines with regard to how reality should be sought in every area of human experience. It adjudicates in conflicting cases concerning what has relevance to reality, and what should qualify as mere fiction. For this reason, philosophy offers the foundation of every area of knowledge including the sciences and technology. Analogous to the above is Wiredu’s explanation that “Our societies are being rapidly changed by industrialization, and if we wish to understand this change and control its direction, we must adopt new ways of thinking, a new outlook upon man, society and nature. The philosopher can, and must, spearhead this endeavour” (1980, p. 61).

To be sure, it is philosophy that establishes the kind of science and technology that is or will be desirable. Put differently, the choice of science and technology is neither a scientific question nor a technological problem to be solved by science and technology, but rather a philosophical question (Unegbe, 2002, p. 109). Philosophy investigates into the foundation of science. There is rarely any fundamental problem of science that is not essentially philosophical. According to Herbert Dingle, “In both origin and nature, science is essentially a particular kind of philosophy” (Nwodo 1982, p. 11). This is so because both science and philosophy require at their foundations the rational explanation of the nature of the universe and the human experience of it. Nwodo further explains that:

Philosophy permeates the entire structure of science: its method, its theory, and its implication. Its method is philosophical in the sense that it starts with some basic theoretical assumption usually “philosophical in character”, and then moves into

controlled experimental observations to establish the truth or falsity of the assumption. Similarly, scientific explanations of “experimentally verified theories” are usually extrapolations of philosophical assumptions that frequently go beyond what the scientific experiments and observations themselves confirm (pp. 11-12).

In consideration of the fact above, Koyre similarly records that “It is not by following experiment, but by outstripping experiment, that the scientific mind makes progress” (1968:80). This “experimental outstripping”, to use Imre Lakatos’s expression, is “connected with vast cataclysmic metaphysical revolutions”, which means that even a widely accepted scientific theory can be challenged if it can be argued that the metaphysical presuppositions of the theory make no contribution to its predictive success. In other words, all scientific theories have a philosophical “hard core” essential for the generation of hypotheses and theoretical assumptions. For instance, it is not in doubt that the philosophical principle of *causality* which holds that there is an intrinsic connection between cause and effect, a principle which involves the process of inferring a set of circumstances in the future from a set of circumstances in the past or present is one of the main presuppositions on which science is based (e.g. in the cause of experience, we notice that certain events are contiguous; that is, when event “A” happens, we expect “B” as the effect).

Another philosophical assumption on which science depends is that of *determinism*, which holds that the world behaves in an orderly manner; and that nothing comes out of the non-existent or destroyed into non-existence. The fact that people can predict an eclipse, earthquake, flood, etc. depends on these philosophical or meta-scientific assumptions. Russell in his book *Determinism and Physics* avers that scientific knowledge will be impossible without determinism unless by chance. It will not be less *apropos* to also state here that modern science is also based on the principle of *induction* which no doubt is also a philosophical principle. All these point to the fact that science and technology are in many ways so dependent on philosophy for any meaningful progress or success, and to think otherwise is a negation of the foundation of science and scientific achievements.

SCIENCE, TECHNOLOGY AND THE HUMAN SOCIETY

There is no doubt that science and technology have contributed in many unprecedented ways to the development of the society. Like we have noted above, the best way to determine or ascertain these contributions is to consider the utility values of scientific achievements and discoveries to mankind. Science and technology have produced products that are useful for man in the society. These products can be found in the areas of agriculture and food production, medicine, architecture, engineering, communication, space exploration, pharmaceutical industries, etc. Modern science is responsible for the production of gadgets and computers, automobiles, antiballistic missiles, skyscrapers or mansions. Scientific knowledge has also been used to solve societal problems such as environmental degradation, space exploration, heart diseases, cancer, etc.:

Equally obvious without contradiction however, is the undeniable fact that scientific-technological development or breakthroughs have brought tremendous achievements and benefits to mankind and the advancement of human society.

They have enabled man to conquer the land, water and the airspace with the use of railways, carriages and cars, steamships and airplanes. They have brought about satellites employed to relay television programmes, transmit communication over longer distances, forecast the weather, and discover deposits of minerals. Other good things which they have brought that have shaped the outlook of man in many unprecedented ways range from the field of technological medicine, food and agricultural technology to the field of communication and information technology, without neglecting ammunition technology and many more (Ihuah, 2012, p. 118).

It has been discovered that factors that distinguish our present age from the past include the fact that the present recognizes the importance of science and technology in human affairs. The quest for Scientific-technological knowledge has immensely increased leading to rapid development and better standard of living. To start with man's earliest natural tools, we were told were his hands and teeth. He later graduated to stones, and then to sticks shaped to be used as tools. As time progressed, he developed special tools for hunting, fishing and the production of cloths and shelters. In our present time man has replaced the natural tools of the primitive man with more viable machines like tractors, ploughs, etc. This is made possible by science and technology. The hydrogen bomb, nuclear weapons or missiles have replaced the bows and arrows of the old eras. Labour saving machines like microwaves, electric ovens, vacuum cleaners, blenders, have made life easier for modern housewives. Science and technology therefore forms the foundation of modern existence and integral strategy for the development of a modern and secure nation or society.

As good and commendable as these benefits of science and technology to man and the society, there is no doubt that some of the problems of humanity have either been brought about or heightened by science and technology. Science and technology have threatened the pursuit and achievement of peace in the world. Science and technology have made devastation possible on the large scale with the massive production of different weapons of war. Man, in his quest for peace has waged wars. Science and technology have also furnished man with different instruments of warfare and weapons. Modern society is thus characterized by mass production of weapons, huge cannons and chemical agents. The commonest example of such dangerous weapon is the atomic bomb and hydrogen (H) bomb; the former was dropped by Americans on two Japanese cities of Hiroshima and Nagasaki in 1945, with the total number of 152,000 people killed within a few minutes of dropping the bomb. The latter is said to be at least fifty times more powerful than the former. This simply means that science and technology can manufacture weapons that have the capacity of exterminating the human world in seconds:

It is sometimes argued that there's no real progress; that a civilization that kills multitudes in mass warfare, that pollutes the land and oceans... that destroys the dignity of individuals... can hardly be called an advance over the simpler... existence of prehistoric times (Pirsig, 1975, p. 121).

More still, the application of modern scientific and technological products have brought about industrial and chemical pollution of the environment, thereby posing grave danger plants and animals as well as the health condition of humans.

Against these mounting consequences of science and technology, experts and supporters of these disciplines have in defense persuasively argued that science and technology are morally neutral. According to them the moral and political problems arising from them are rather the consequences of misapplication of the results or products of these disciplines by man. They argue that the choice to use or not to use these products whether for the benefit or destruction of humanity is scientific or technological, but man's decision. This argument borders on man's wisdom or rationality, for man is capable of choosing what is good and healthy for him and shunning that which is evil and devastating. This is possible through the human power of reason.

More so, it is argued that the values or benefits of science and technology to man are far immense when compared with the dangers. There is no doubt that life in the pre-scientific societies is better, easier, and more comfortable than what obtains in our contemporary times. Science and technology made these possible. Copi (1986) corroborates this view when he writes:

Terrible as recent wars have been, their toll of human life has been much smaller than that of the great plagues which... have been almost completely wiped out by modern medical science. The practical value of science lies in the easier and more abundant life made possible by... scientific knowledge (p. 480).

Also with reference to the benefits of science and technology to man Isaac Asimov writes that these disciplines have:

...ended slavery; brought more security, health and created comfort to more people than was dreamed of in all the centuries before science; made art and leisure available to hundreds of millions (1992:527).

There seems to be lack of sensitivity or disregard to the sacredness of human values, life and dignity as can be attested by debates in medical ethics and genetic engineering. Science and technology as a global trend is now nothing but a sort of humanism devoid of humanistic individualism. There is no doubt that in most cases the manner of perceiving this global trend has been complicated by cultural and religious differences, and heightened by some forms of extreme measures aimed at protecting regional and national interests by nations that are technologically inclined, resulting almost to a global universal war of values between these countries with its attendant threat of global peace. Technology has been turned to formidable mechanism of human destruction. There appears to be open war against anything that spell of modernity, science and technology by neo-Islamic Fundamentalists, indicating some sort of open rejection of tolerance. The source and solution of these problems lies outside of technology itself; they are products of human irrationality. They are products of human actions which require the role of morality for correction, because one of the greatest weaknesses of science and technology is the fact that it cannot provide for itself an ethics to restrain and control its applications. This is solely the purview of philosophy under its branch known as Ethics.

CONCLUSION

The needs of the society and mankind in general remain the object of science and technology. Science and technology are meaningless except in their relation in meeting the needs of man and the society. And there is no doubt that the scientists and technologists respectively and

collectively have brazed up to this all-important needs-satisfaction. Science and technology are contributing immensely to the welfare of humanity in many unprecedented ways, medicine, economics, infrastructure, and the human insatiable quest for knowledge, etc. Therefore, any society that wants to develop, and enhance the wellbeing of its citizens must seek science and ensure that it is found. However, neutrality is one of the fundamental principles of science. Therefore scientists in his profession must endeavour not to take ethical or moral positions while carrying out their assignment. This is because Science is not concerned with what ought, but rather with what is. Despite the fallibility associated with science, we must encourage its knowledge and practice at all levels of human life, while discouraging the undesirable and antisocial aspects of it. Humanity must always strive to manipulate science and technology to their advantage, that is, in the most proper manner as a means in order to ensure that they do not slip from human control.

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