World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

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On the future of science and technology and science ethics

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World Journal of Advanced Research and Reviews, 2022, 15(02), 616–623

Publication history: Received on 13 July 2022; revised on 19 August 2022; accepted on 21 August 2022

Article DOI: https://doi.org/10.30574/wjarr.2022.15.2.0861

Abstract

In the 21st century, human humanistic spiritual culture shows a trend of lagging behind the development of science and technology. The spiritual culture of humanity and faith, from which the ability of technological self-control could have drawn rich resources, is now struggling to sustain itself. Therefore, based on the trend and background of the faster development speed and greater impact of the scientific and technological revolution and industrial transformation on life, this study tries to combine the specific characteristics of man-machine symbiosis, complexity, opacity, risk concealing and spiritualization in the scientific and technological society, this study deeply explores the limitations of scientific and technological ethics research under the framework of normative ethics, including the retardation of the system, the threshold of ethics and the weakening of spirit. Furthermore, on the basis of expounding the dilemma of contemporary scientific and technological ethics research, this paper puts forward the main suggestions that future scholars should make scientific judgments based on the trend of future scientific and technological development and its influence on society.

Keywords: Scientific and technological ethic; Development tendency; Research delimma; Social impact

1. Introduction

Ethics of science and technology is oriented to reality, but also to think about the future. However, the contemporary research on ethics of science and technology mostly starts from the reality of science and technology. As science fiction writer William Gibson once said, "The future is here, but unevenly distributed. "[1]. It shows that "the future is here, " or even that one leg is already in the door. Therefore, the analysis of the dilemma of contemporary scientific and technological ethics research should be based on the scientific judgment of the future trend of scientific and technological development and its impact on society. Specifically, there are four characteristics of development change.

1.1. Trends in science and technology

The world today is undergoing profound changes unseen in a century. The new round of scientific and technological revolution and industrial transformation has made rapid progress, and the world has entered a new era of innovation. In addition, the medium - and long-term trends of global scientific and technological innovation are also undergoing profound changes. From the perspective of the development trend of modern and contemporary science and technology, the future may present the following characteristics:

1.1.1. Science and technology are developing more rapidly

Engels pointed out in the Critical Outline of Political Economy in 1844: "The development of science is in direct proportion to the amount of knowledge left by the previous generation. In its most general form, therefore, science proceeds geometrically. " Since the Second World War, the rapid development of human science and technology, the

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scale of development, the scope of action, and the far-reaching impact are unmatched with any other period in history. Mankind has successively begun a new era of using nuclear energy to enter outer space, to control genetics and life processes, to expand the capacity of the human brain, and to enter the age of information and network [2]. In the face of the continuous emergence of emerging technologies and their frontier, subversive nature and great impetus to economic growth, major countries in the world have issued technology and innovation strategies in order to seize the commanding heights of scientific and technological innovation. It is foreseeable that with the continuous acceleration of the development of science and technology in the future, the applicable period of scientific theories and the aging cycle of technology will be increasingly shortened, and the creative scientific research and development will become the main activity of human beings in the future. "In the next 100 years, 20 percent of the world's population is expected to be engaged in scientific research. "[3].

1.1.2. Emerging key technologies affect the future

The OECD identifies 40 key emerging technologies that will have a significant impact in the future and divides them into four groups: digital technologies, biotechnology, energy and environmental technologies, and advanced materials technologies. Emerging Technology Trends, 2017-2047, published in the US, identifies 10 emerging technologies. Robots, automatic systems and automation; Advanced materials and manufacturing; Energy production, harvesting, storage and placement; Biomedical sciences and human enhancement; Quantum computing; Mixed reality and digital simulation; Food and water safety technologies; Synthetic biology; Space technology; Climate change adaptation technologies [4]. On the whole, information networks, biotechnology, clean energy, new materials and advanced manufacturing, which are the areas with the most concentrated R&D investment in the world, are breeding a number of disruptive technologies with great prospects for industrial transformation. Quantum computer and quantum communication, stem cells and regenerative medicine, synthetic biology and "artificial chloroplasts", nanotechnology and quantum dot technology, graphene materials, etc. , have shown attractive prospects; The intelligent manufacturing mode of man-machine integration and the 4D printing technology formed by the combination of intelligent materials and 3D printing will promote the transformation of industrial products from mass centralized production to customized distributed production, leading the trend of "Materialization of the digital world" and "Intellectualization of the physical world" [5].

1.1.3. The disciplines intersect and converge

In the development of modern science and technology, the interaction between more and more disciplines and technical fields has promoted the generation of major scientific and technological breakthroughs. Interdisciplinary comprehensive research has become a fertile ground for the integration of scientific knowledge system and the breeding of new disciplines.

The National Academy of Sciences in the United States calls this convergence of interdisciplinary approaches the Convergent Approach, which combines knowledge, tools, and ways of thinking from life and health sciences, physical sciences (physics, chemistry, materials science, etc.), mathematics, computer science, engineering science, and many other professional fields to build a comprehensive and integrated framework"[6]. This approach will continue to be strengthened and deepened in future scientific and technological innovation. The comprehensive research of natural science, technical science and social science, as well as basic research and applied research, will become the norm, and a huge comprehensive science and technology group will gradually take shape, which will bring about the continuous emergence of subversive technologies, and the industrialization of high and new technologies will be accelerated.

1.1.4. Realizing the intelligent transformation of scientific research paradigm

According to J. Ray, the paradigm of human scientific research has undergone four stages of evolution: The first stage is through scientific observation and experiment method to exploration and discovery. The second stage is through calculus and reasoning to get laws and theorems to summarize natural phenomena. The third stage is to use computers to simulate scientific experiments, and the fourth stage is to form a new generation of scientific research paradigm and system characterized by intelligent drive. In particular, the research paradigm of the fourth stage has gradually emerged and developed rapidly in the past 20 years. Therefore, in the future, the human-machine symbiosis and iterative optimization of the scientific research environment will be continuously strengthened, and "intelligent scientists" and human scientists will collaborate to achieve "intelligent exploration of scientific mechanisms, automatic generation of scientific hypotheses, intelligent support for experimental verification, intelligent integration of research results, scientific research results are intelligently presented [7].

1.1.5. The trend of international cooperation in science and technology is hard to reverse

Research and development of science and technology has always been an international social phenomenon, and the global dissemination and diffusion of knowledge and international scientific research cooperation are the most important forms of scientific globalization. In particular, the new scientific and technological revolution is flourishing, the demand of national science and technology exchanges and cooperation is more urgent, the trend of innovation globalization will not change, but the technology competition in the leading field will be more intense. Scientific and technological cooperation has always been an important way to meet the common challenges of mankind and seize the dividends of the new scientific and technological revolution and industrial transformation. As the demand for scientific and technological cooperation in emerging economies continues to rise, new space for international scientific and technological cooperation will continue to expand and a more diversified opening up is taking shape [8].

1.2. The trend of social development in science and technology

The future will be defined not by human inventions, but by how evolving technological forces are embedded in co-evolving social practices, values and institutions [9]. Regarding the future society, some scholars have proposed concepts such as "Anthropocene/Anthropocene", "Post-human" and "Society 5. 0". In view of the all-round and deep involvement of science and technology in nature and human society, the concepts of "Deep Technology Era", "Technology Generation" and "Super-Intelligent Society" have been proposed. In this process, the world and human beings are constantly being reshaped by science and technology. Scientific and technological innovation will become the source of all civilizations and progress. Human beings need to anticipate the scientific and technological future being created and immersed in. Therefore the future technological society may present the following characteristics:

1.2.1. Human-computer symbiotic society

Of all the future technologies, the one that may have the greatest impact on human society is artificial intelligence. In his book Technology and Ethics, Swiss scholar Nicoletta Iacobacci argues that machine intelligence is likely to surpass human intelligence in the coming decades, bringing about technological changes unprecedented in human history that will soon lead to both biological and abiotic intelligence. The fusion of software-based immortal humans and conscious artificial life forms is beginning to take shape. According to Ray Kurzweil, futurist and director of engineering at Google, "Artificial intelligence will reach the average human level around 2029, followed by a multifold increase in intelligence and a billionfold increase in biological machine intelligence of our civilized species by 2045. " As increasingly intelligent robots are woven into the fabric of society, there will be a world where there is no distinction between the biological and the mechanical, the physical and the virtual [10].

1.2.2. Society of complexity

The future society is a complex mixture of information technology society. It requires individuals and organizations to acquire complex knowledge, techniques and capabilities through learning. This society needs to solve established social problems and adapt to the society through the application of complex man-machine collaboration and interdisciplinary methods (including understanding and innovation of collective social science, computing science, network technology, crowd wisdom and research methods, etc.).

The future society aims to enable participants to obtain information, resources, and expand their capabilities to achieve a degree of self-regulation and social autonomy. But at the same time, there is always tension between social autonomy and rational use of intelligent technology. Society wants to make the overall pattern of human behavior conform to society, but often cannot overcome the inherent contradictions. Therefore, the future society is not only the product of the innovation and development of science and technology, but also a complex social state in which the conflict of interest groups is difficult to reconcile [11].

1.2.3. The opaque society

Of all the contingencies that philosophers, scientists, novelists and futurists contemplate, the possibilities raised by emerging technologies have proved the most difficult to predict successfully. The shortcomings of existing technology, as well as the biases and limitations of normal human scale perception, have prevented many people from grasping human prosperity. Compared with the relatively stable traditional society, the new technological development has brought about serious opacity and instability in the future society, making it difficult for us to imagine the concrete life we will face in the future. Given the accelerating changes in the current geopolitical and cultural environment, these surprises and their potential effects are likely to multiply, and Western scholars even refer to them as "Societies shrouded in fog. " In the future, the influence of science and technology will not only stay in the impact on the living environment of human beings, but also go deep into the level of human values, such as biotechnology and information

technology, which will have a huge impact on the existing ethical value system of human beings. It is increasingly difficult to identify, seek, and ensure the ultimate goal of morality: a life worth choosing, a good life [12].

1.2.4. Risk hidden society

When it comes to the opaque society, it is not hard to find that the impact of future technological forces on society is already beyond people's calculation and imagination. In their book "Unhealthy Futures, " the philosophers Ingmar Person and Julian Savulescu argue that the 20th century's scientific and technological advances gave humanity unprecedented power to upset the balance of traditional moral arithmetic, which in turn brought about "ultimate harm. [13]. According to Jonas, the future is poorly understood, and people's ability to create the future greatly exceeds their ability to predict the future. This gap determines that people's behavior always has the potential to bring unimaginable consequences. Modern transgenic technology can enable human, animal and microbial genes to be artificially hybridized, but if the transferred genes escape into the environment, the original ecological balance will be destroyed by changing the competition between species. Such effects cannot be detected and determined in the short term, and some effects will show up in a long time, posing a great threat to the future of mankind [14]. Some technical risks can only be predicted by professional and technical personnel, and the control of risks often depends on the inherent moral power of technical experts.

1.2.5. Spiritualized society

Aurobindo, an Indian philosopher, believes that the ultimate goal of social evolution is the "Age of Spirit", or "Spiritualized Society". Through the internal development, the individual realizes his inner spirit, transforms his body, life and mind under the guidance of the inner spirit, breaks the nature of selfishness, and makes his life harmonious with the whole life of the society. Similarly, though internal development, social collectives reveal the underlying "Collective Mind" and eliminate the collective ego, so as to achieve coordination and unity with other collectives. In this society, all human activities, including scientific, ethical, educational, artistic activities, will take the search for internal sanctity as its first goal. People's scientific activities are not only for the purpose of understanding the world or using it for material life, but also to reveal the "Divine" and "Spiritual Way" behind the world. The purpose of ethical life is not simply to establish and fulfill the moral code of conduct, but to develop the inner divine nature of man.

1.3. Standardizing the ethics of science and technology ethics in the ethical framework

Since modern times, the ethics of dominance is centered on the norm, and the representative theory of work and the sense of righteousness, the basic question they answer is how we should act, or what actions are morally justified or correct. Therefore, the problem of normative ethics is the specification or principle of behavior or guidance. Under the influence of normative ethics, the research on the solution of science and technology ethics and the research of science and technology ethics gradually form a path of dependency or institutionalization. If this research paradigm based on institutionalized dependence is effective or limited in the context of low technology and traditional society , its limitations and contradictions will become more and more prominent in high-tech and future technology societies.

1.3.1. System lag problem

According to the theory of institutional school, although the system plays a role that cannot be ignored in the development of economic society, a valid system is established and then has some relevant and strengthening activities. Therefore, once the system is selected for the practice, there is a kind of inertia, and when the system changes, because many people are familiar with the old system, the choice of the new system is bound to be affected by the old system [15]. This inertia inevitably brings the lag of the system. In another case, because the negative effects of technology are mostly seen in the past few years, the control of the negative effects of technology is often posttended. Another is that technology is so active that the system is unable to enforce it strictly. As American scholar t-rozzk says, the system is trying to keep up with the development of technology, and the result is that technology is ahead of technology, almost a permanent rule. Moreover, with the update of science and technology, the original system is out of touch with technological innovation, hindering the spread of new science and technology [16].

For example, the insecticide named DDT was invented in 1948 by Swiss chemist muller. In the 1950s, DDT was widely used in agricultural production, and in 1962, the book named "Stillness of the Spring" by R. Carson, revealed the long-term and deadly dangers of synthetic pesticides, such as DDT, which were represented by DDT, but it was not until the 1970s that the United States passed legislation to ban the use of DDT [17]. In 1991, the world wide web appeared, but the system of management of the network was introduced in 1996, the United States issued the 1996 Telecommunication Act and the Communication Purification Law, China promulgated the Temporary Rules on the Management of the Network of Computer Information Networks, and in 1998, Germany implemented the Multimedia Law to ensure the healthy development of the Internet.

Since the 21st century, the development of science and technology has exacerbated the departure of science and technology innovation and institutional innovation, and the explosive development of science and technology has broken the existing management order, so that the original management system can not effectively prevent the control of scientific and technological ethics in the environment of new technology, and therefore, it has caused the imbalance of the ecological and institutional system of scientific and technological ethics [18]. In the future, the uncertainty, plurality, complexity of the scientific and technological society, and the norms of the purpose and the consequences of the system, need to have a clear cognitive contradiction, which makes the information between technology and the specification not be highlighted. The development of technology development brings the contradiction between the new behavior specification problem and the regulation and the slow change of the program, which makes the regulation of the Norms are often based on the design behavior of the established value system, and the new knowledge and the new approach of the new knowledge and the interaction of the technology development band will also promote the contradiction of the social value system, which will make it too strict to reflect the dynamic change of social view [19].

1.3.2. Ethical domain problems

The core of the normative ethics is to make ethics a mandatory structure of technical activity through institutional arrangement. The establishment of a large number of ethical codes and the establishment of ethical organizations is a common method. But ethics has lost its cultural nature when it is part of the institutional and legal system of norms and codes. Although their problems point to ethics, however, methods and mechanisms are not ethical, and it will be in harmony with law, and also loss of the role of cultural factors and cultural arrangements that are established in the civilization system. Because the object of its role has been the will, not the faith and the value. At the same time, normative ethics will not only suffer from the expensive social costs of law, but also will encounter the paradox of "restriction - freedom" like law [20].

Virtue ethics argues that norms of ethical theory expect to apply to the rules and principles of all situations, but these rules and principles are rigid and therefore cannot use all the moral situations that we face. If the problem is changeable, then we can't expect to find their solution in a rigid and fixed rule. Ethics is "unscripted", and Literacy should be studied by a non-fixed and situational response, like the topic itself.

In this context, the traditional ethics based on individual ethics cannot cover and deal with the ethical problems that arise in modern science and technology, which humans need to face a vacuum of ethics, because the characteristics and capabilities of high-tech interaction, which makes people's behavior more and more to the system, lead to "Ethical Loss" or "Ethical Domain". In determining the ethical principles of scientific research, the Bilmon Report points out that rules are often not enough to cover complex situations, and sometimes there is a conflict between rules, and often difficult to explain or apply. In other words, although ethical rules are necessary in many cases, even sufficient, it may not be enough to help solve the ethical difficulties that scientists have brought in the research process [21].

Due to the invisibility of future technology, the ethics of the norm limit certain aspects, even certain small aspects -- That is, while limiting the predictable aspects of non-ethical behavior, there are some dangers that provide legitimacy and greater legitimacy for non-ethical and even anti-ethical technologies. High technology gives people a major responsibility before they act, but it also provides an unprecedented ability and means to avoid responsibility. In the history of ethics, the attempt and ability to avoid responsibility are almost born with responsibility [22]. As zhuzi said in "remove the pleas", "the amount of dendrobium is carried out, and it is stolen from the dendrobium; for the tradeoff, it is stolen; the seal of the seal is written by the seal and the seal is stolen. ". The great benefits of high technology not only make individuals but also make the purpose and beliefs of the group and even the country's elimination of ethics, which make it possible and realistic to avoid responsibility. " If scientists lack the scientific ethics of their needs, they will be easily threatened by capital forces and business practices [23].

In Canada, aside from TCPS core training and REB approval, scientists have access to few resources to help them navigate the complex ethical issues that may arise. While the Belmont Report recognized that ethical issues were complex and rules would conflict or be difficult to apply, there was little guidance on how to handle these situations after REB approval. And it is impossible for governments or ethics committees to make clear all the rules, any absolute mandate for human research subjects. Where REB does not provide guidance, scientists must apply their own ethical framework to evaluate decisions about potential harm. Scientists need to balance the risks, harms, and rewards of different individuals, institutions, and research goals. In doing so, scientists develop competing values, and the decisions scientists must make in the course of their research can unwittingly create situations that lead to harm [24].

1.3.3. Mental weakening problem

In traditional virtue ethics, the question of what a person is includes the question of what to do. What can we expect from a person who has a certain quality or character, because virtue is a key factor in achieving that. It was not until modern times that deontological and utilitarian ethics separated the two, and normative ethics suggested that the question of what I should do could be answered by invoking a proven principle, rather than from the intrinsic virtue of man [25].

The core of science education is to shape the spirit of science and the virtue of scientists. Under the influence of normative ethics, people look down on the status of science education and narrow the connotation of science education. Science education is "Artificial", and "Tao" is gradually evolved into art. On the one hand, replacing science education with science knowledge education, science education in schools is only selling knowledge, teachers only have the responsibility to transfer knowledge to students, only attach importance to the value of scientific research results, but not the value of science itself, or ignore the inherent requirements of scientific spirit and scientist virtue [26]. On the other hand, the education of scientist's virtue depends on the assessment of each item after decomposition. The virtue education of scientists should be carried out with the method of "Artificalization" and evaluated with the standard of "Artificalization", so that the virtue education of scientists will become mere formality and empty talk. Many people use the "Art" of "Speaking" morality to cover up immoral behavior [27]. Thus, "The majority of people know only fear, not honor, they do not do evil not out of shame, but out of fear of punishment [28].

The lack of scientist's virtue also promotes the existence of power standard, money standard and utility standard of science. As a result, the government and learning are not separated from each other, and the phenomenon of studying by officials exists in a certain range, and the sacred learning becomes vulgar. Academic status and reputation also become the object of money chase, money corrupts the academic; Academia has become a branch of the interest relationship. The academic circles often show a kind of eager and impetuous interest mentality and lack of original innovation in scientific research [29]. The scientific spirit of "useless use" disappears in the utilitarian spirit of "useful use".

The main reason lies in the one-sided regard of respecting science and supporting science as the means of promoting economic development, without taking the spirit of science as the soul of science education, and ignoring the rich and profound spiritual value of science as the knowledge of understanding the world. The spirit or virtue that a scientist should possess is only regarded as the norm, as the objective stipulation external to the subject, rather than as the internal stipulation of the subject, and as the unity of subjective and objective and autonomy, self-discipline and heteronomy of the moral subject. The scientist's virtue and ethics are not regarded as the realization factors of an ideal personality [30].

2. Conclusion

The humanistic spiritual culture of the 21st century shows a trend of lagging behind the development of science and technology. A kind of technology self-control ability could have absorbed rich resources from the humanistic and faith spiritual culture, but this spiritual culture is difficult to maintain itself. The value orientation of scientists has experienced a change from "Learning to Grow up" to "Learning to Control Objects", and will again change to "Resist Their own Creation" in the future. The full flow of material wealth brought by the development of science and technology will help mankind to reject mediocrity and call for elegance. Mankind will enter a more favorable era for humanity, a pursuit of spiritual excellence, pursuit of all irreproducible and irreplaceable and even incalculable creativity [31].

Since we cannot a priori determine whether the research environment will produce moral dilemmas, it is our responsibility as ethics researchers to be prepared for moral dilemmas in general, not just specific ones thought of in advance.

What should be advocated in the future, therefore, is the cultivation and production of more noble scientists who are "not only dependent on rules, sensitive and intelligent enough to perceive what is noble or right". Ethics committees and institutions should be concerned not only with the rules that restrict the actions of scientists, but also with the development of "intrinsic traits, characters and motivations that make them virtuous persons". To create this virtuous scientist is to abandon concern with rules and constraints as a basis for ethical behavior and to develop a theory of what an ethical scientist is, rather than simply listing "DOS and DON 'TS. " To produce such virtuous scientists is to abandon the rules and constraints that are the basis of concern for moral behavior, to develop a theory of what an ethical scientist is like, rather than simply listing "DOS and DON'TS"[32].

Compliance with ethical standards

Acknowledgments

Shanxi Provincial Department of Education Top young and middle-aged Innovative Talents Program; Program No: 2018052003.

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