

Research on the Object and Category of Safety Science

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Abstract

Guided by science, interdisciplinary science, and dialectical materialism, the research object and scope of safety science The domain, the essential characteristics of safety science, and the relationship between safety science and related disciplines are described. Take the big security concept as the main line and give It comes out that safety science is the essential law of studying the safety of things, revealing the objective factors and transformation conditions corresponding to the safety of things; Research on theories and technologies for predicting, eliminating or controlling the safety and risk factors and transformation conditions of things, and research on safe thinking methods Law and knowledge system. Safety science is to study the rheological-mutation process of safety and danger, revealing the reasons for the safety and danger of things And consequences, as well as their unique interrelationships, the use of basic disciplines, engineering disciplines and other related disciplines, for things or departments The loss mechanism of comprehensive functions of the system is analyzed and researched as a means, and the prediction, prevention and evaluation of disasters and accidents is the research goal. Based on science, on the basis of previous work, discuss the research objects and categories in safety science.

Keywords

Safety science, safety concept, scope.

1. Introduction

Security science is an emerging science at the intersection of natural science and social science. In recent years, the disciplinary status and role of security science have been further recognized and enhanced in the academic community and society as a whole. However, with the progress of society and the times, security issues involving the expansion of the spatial and temporal scope, security science is facing many challenges and more deep-seated problems, and there are still some basic issues in the process of establishing the status of security science as a primary discipline that need to be explored in depth. The establishment of a scientific discipline should be clear, first of all, the object of study, followed by its scope of research [1]. So, what is the object of study of safety science? What is the scope of safety science research? This is the first problem should be clarified before discussing security science, but also the construction of security science is an urgent need to discuss and resolve the basic issues. Guided by science, cross-science, and dialectical materialism, this paper expresses the research object of safety science, the research scope of safety science, the essential characteristics of safety science, and the relationship between safety science and related disciplines. The main line of the concept of safety, given the safety science is the study of things safe and dangerous contradictory laws of motion of science. The study of the essence of the laws of safety, reveal the objective factors and transformation conditions corresponding to the safety of things; study the theory and technology of predicting, eliminating or controlling the safety of things and dangerous influencing factors and transformation conditions, and study the thinking methods and

knowledge system of safety. Safety science is an emerging discipline that only began to emerge in the 1880s. The Chinese academic community of safety science attaches great importance to the rational overview and summary of safety science and technology from a macroscopic perspective, and two national symposiums on the scientific and technological system of labor protection, namely the Qingdao Conference and the Xiangshan Conference, have laid an important theoretical foundation for the development of safety science in China [2]. Comrade Liu Qian and other comrades put forward relatively novel theories on the concept of safety and safety science, the basic elements and scope of safety research, and the disciplinary system of safety science, which has written an important page in the history of the development of safety science and technology in China [3]. In this paper, we try to discuss the object and scope of research in safety science on the basis of the work of the predecessors, based on scientology.

2. Current state of research in security science

2.1. Research status of foreign security science

The West began to enter a capitalist society with an unprecedented increase in labor productivity. However, the number of accidents in which workers were killed, injured, sickened and disabled in front of the machines they created also increased significantly compared to the period of handicrafts. In order to obtain the highest profit rate, the owners of capital regarded "all measures for the safety, comfort and health of workers" as unnecessary waste, and even "the waste of workers' lives and health and the depression of their living conditions themselves as savings in the use of unchanging capital, and thus as a means of increasing profits. as a means of increasing profits. The struggle of the workers and the practical needs of mass production forced the Western countries to enact laws on labor safety and regulations on improving labor conditions. For example, Massachusetts passed the law of factory inspectors in 1867; the Northern Confederation of France enacted the Act on the Prevention of Work Disasters in 1689. In this way, the owners of capital had to put aside certain funds to improve the labor conditions of workers, while some engineers, experts and scholars were needed to study the problems of unsafe and unhygienic production processes. Thereby, organizations such as insurance foundations for the prevention of production accidents and occupational diseases emerged in many countries, and funded the establishment of non-profit scientific research institutions. For example, in Germany, the Westphalian Mining Joint Insurance Tombola was established in 1863, and the Public Works Accident Coinsurance Foundation and the Accident Coinsurance Foundation Federation were established in 1887. Research institutions have also been established by national government departments according to the law. For example, in 1871, Germany established research institutions for the study of noise and vibration, fire and explosion prevention, and the theory and organization of occupational hazard protection. Then in 1890, the Dutch Ministry of Defense supported the establishment of the study of explosion prevention technology and measuring instruments, as well as participation in the international identification of explosive hazardous substances for the purpose of the Netherlands Institute of Applied Sciences Industrial Technology Laboratory. By the early twentieth century, the United Kingdom, the United States, France, Japan, the Netherlands and other countries have generally established similar organizations and scientific institutions [4]. According to the incomplete statistics in 1977, 36 were built in Germany, 44 in the United Kingdom, 31 in the United States, 64 in France, and 13 in the Netherlands. From the perspective of research content, they basically belong to the level and scope of safety engineering technology, and only a small number of them have entered the level of technical science. At the same time, countries have added safety engineering, health engineering, ergonomics and other courses in university engineering education and set up their own research institutions.

In short, from the scope of foreign research on safety science, we can see that it involves natural science: safety engineering, health engineering, occupational safety, occupational health, protective equipment and technology, and other safety conditions; social science and system science: methods of controlling hazards and their effects, theoretical analysis of occupational accidents, economic views on accident prevention and the development of standards, regulations and guidelines for hazardous substances. In addition, the research involves human science and thinking science: ergonomics and biomechanics, neurology, labor physiology, labor psychology, occupational diseases, women workers' labor, etc. In addition, from the relevant disciplines and specialties of higher education: those belonging to engineering include safety engineering, safety engineering, health engineering, safety and fire prevention technology, safety management, etc.; those belonging to medicine include toxicology, toxicology, hygiene, social and health care organization, etc.; those belonging to education include safety education, etc. This shows that safety science has obvious cross-science characteristics.

2.2. The current status of China's security science research

China's security science can be broadly divided into two stages from the perspective of discipline construction.

(1) In the first stage, from the early stage of the founding of the People's Republic of China to the end of the 1970s, the administrative management and operational supervision and monitoring of labor protection were well developed, and specialized institutions were set up from the central to the local level as well as various enterprises, and equipped with a considerable number of full-time personnel. The Ministry of Labor Protection Scientific Research Institute, the Ministry of Health Institute of Labor and Health, the Ministry of Metallurgy Safety Technology Research, as well as some research laboratories under the Institute of Coal Science, and other limited scientific research departments, scientific research staff of no more than a thousand people.

(2) The second phase, the second phase, i.e., from the end of 1970s to the present, the administrative management and publicity and education of labor protection have been strengthened. Since 1980, annual national safety month activities have been carried out to strengthen labor protection, continuing engineering education for cadres and occupational safety education for production personnel. Provincial and municipal labor departments have generally established labor protection publicity and education centers, and large industrial enterprises have also established labor protection publicity and education rooms, and by 1983 the country built 31 scientific research institutions of safety, and the number of researchers developed to more than 4,000 people. Higher safety education, the development of rapid, to July 1984, the Ministry of Education, high "and other schools undergraduate engineering catalog" issued, the country has six universities set up safety undergraduate program, and the opening of the mine ventilation and safety and aviation of environmental control and safety life-saving two undergraduate program, in some institutions also began to enroll, so far, the country's industries set up safety engineering undergraduate school nearly more than 30. In addition, there are 21 schools with safety engineering specialist education, distributed throughout the coal, geology, petroleum machinery, chemical, weapons and other industries, safety engineering has formed a certain scale in China, including academic education, continuing engineering education, employee safety education and official safety education of the complete teaching system [4].

3. The object of study of security science

Science is a systematic summary of the results of human understanding of the real world, any science has a specific object of study. Safety science is the study of the contradictory laws of motion of things safe and dangerous doctrine. Safety science is to study the flow of safety and

danger - sudden change process, reveal the causes and consequences of things safe and dangerous, as well as their unique interrelationship, the use of basic disciplines, engineering disciplines and other related disciplines, the loss of things or systems integrated function of the mechanism of analysis and research as a means to predict the prevention and evaluation of disasters and accidents as the goal of research.

3.1. North American security science research objects

In 1974, the Safety Science Digest was founded by the School of Safety and Systems Management at the University of Southern California [5]. The concept of "safety science" reflected in it is very general, including a series of safety issues such as medical, public health, industrial, transportation, environmental, military, and natural disasters, and all factors that endanger human survival and health are included. However, the boundaries between North American "safety science" and other disciplines are not clear, and there is too much overlap, and there is no specific object of study that is distinct from other disciplines, making it difficult to form an independent discipline.

3.2. Subjects of safety science research in Western Europe

The so-called security science, represented by Kuhlman, is the study of security in the application of technology. And it is clearly stated that it does not involve the safety or security of the military or society. The definition of the object of safety science in this theory has actually existed in China for many years and continues to this day. China is influenced by the former Soviet system, many people regard labor protection as the object of study of safety science. Later, although on this basis, production safety and including industrial hygiene (occupational diseases) as the object of study of safety science, but basically did not go beyond the category defined by Kuhlman as the representative. Kullman pointed out that safety science studies the safety problems arising from possible dangers in the application of technology, and it is neither concerned with safety in the social or military sense, nor does it study safety in relation to diseases [5]. This makes it clear that the object of study in safety science is technical safety issues, independent of safety in natural disasters, social security, military, disease, etc. The system-based approach to predictive research is the most important feature of security science advocated by Kuhlman. The development of security technologies has long been driven by the experience gained from damage in the application of the technologies in question. However, this experience was only gained within a limited range of cognitive ability, and it perceived only a simple causal relationship between damage and cause, rather than insight into the universal causal links between many different phenomena. In short, traditional safety technology was based on accident statistics is empirical and mainly characterized by post-event rectification. This situation, which is no longer adaptable to the modern high-risk technical environment, necessitates a variety of predictive studies to replace or at least complement the traditional purely reactive approach with a completely new approach, especially critical is to take the right targeted measures at the very beginning of the technical system design. In order to break away from simple cause-and-effect analysis or from a perceptual model that targets only a single group of elements, safety science has to deal with the various groups contained in the system, i.e. with those safety issues that consist of people, machines and the environment, but also the technical applications, which "labor protection" cannot include. At present, there are two trends in the world of occupational safety bathroom issues, one is the expansion from factories to offices, and their interactions constitute many problems of safety technology pollution control.

3.3. The object of our security science research

3.3.1. Disaster

Safety science should study various phenomena that endanger human body and mind, human society and its living conditions, as well as their prevention and control. In other words, the

object of study of safety science is the phenomenon of various hazards or hazard events. Hazardous events include all kinds of major disasters currently facing mankind, as well as accidents, injuries, etc. These concepts are different in meaning and crossover. Injuries emphasize the target people, can be accidental or intentional, the severity of the consequences are relatively light; accidents can target people, objects or property, emphasizing the accidental and episodic, the severity of the consequences can be large or small; disasters tend to emphasize the severity of the consequences and the huge losses, emphasizing the multiplicity, can target people, objects or property, can also be accidental or intentional. What these events have in common is that they can endanger people, human society and their conditions of existence. However, there is no unified concept to represent the above-mentioned harmful events caused by various causes, of various sizes and consequences, and these events are the object of study of safety science, as a scientific research object, there is a need for a unified concept to be summarized. There is a word called "disaster", from the current use of the situation, can summarize the above types of events, here for the time being using the concept of "disaster", whether it is appropriate, subject to further study. In this way, we can express the object of study of safety science as "disaster", which refers to the human body and mind, human society and its living conditions from external factors or external factors on the human body and mind, human society and its living conditions to produce harm to such phenomena or events. With the development of science and cross-science and the establishment of the concept of security, international and national political, economic and military changes, changes in nature and the deepening of people's understanding of it, as well as the intertwining of social security and disasters and the security of nature and disasters, people propose that the object of security science should be safety in the field of human life, survival and production [6]. That is, the object of safety science is the natural and social safety problems related to people, or the object of research in safety science is the safety problems related to natural and man-made disasters.

3.3.2. Accidents say

Another thing to mention is the statement that the object of safety science is the "accident" [7]. This statement is still widespread, but it is inaccurate. The reasons for this are twofold.

(1) On the one hand, the statement that safety science is reduced to the study of accidents is too narrow in terms of content and object, and the safety problems of nature and society cannot be summarized by just one "accident", especially after the introduction and formation of the concept of safety, production accidents can no longer be regarded as the entire study of safety.

(2) On the other hand an accident is only an extreme state and more and longer time is a dynamic process or trend of transforming a safe state into a safer or breeding accident as opposed to a large amount of safety research, safety management work [8]. Accidents are only a transient and instantaneous state of occurrence. Therefore, the object of study of safety science should be defined by the idea of a large safety concept. Thus, many specific objects have been proposed, such as war, terrorist attacks, genetic engineering and biochemical weapons, safe use and preservation of nuclear materials, proliferation of nuclear weapons, sudden infectious diseases (e.g., SARS), Bacillus anthracis, avian influenza, AIDS, drug addiction and drug trafficking, global climate Global warming, land desertification, rapid population growth, safety of huge dams, pollution of water sources, stockpiling and supply of materials related to national livelihoods, Asian financial crisis, sudden public safety, traffic safety, mining accidents, safety of new technology applications, engineering safety and production safety, safety of food, drugs, home appliances, etc.

3.3.3. Hazardous sources say

Hazardous source is said to be a major breakthrough, so that the scientific study of safety from reactive to active, the concept of essential safety is a good interpretation of this view. Although

the elimination of hazards is the most effective means, the complete elimination of hazards is unrealistic, and with the progress of science and technology, the energy and magnitude of hazards have increased dramatically and are the needs of modern life [9].

3.3.4. Liu Qian's three elements of security

Comrade Liu Qian then proposed the idea of the structure of safety science and technology system based on the principle of science and technology systematics, as well as the different properties of the three elements of safety (people, things and the internal connection between people and things) and the mechanism of their interaction [7]. Its disciplinary structure is vertically divided into four branches: safety equipment science, safety sociology, safety anthropology and safety system science; horizontally it is distinguished into four levels: safety philosophy, safety science, safety engineering and safety engineering technology.

Liu Qian also believes that: safety science should be a large scientific sector, it should occupy the same position in the entire scientific system and natural science, social science. This is because in the objective world, safety problems are universal, all human activities are safe and dangerous contradictions. For a long time, safety science research is divided in various industries, people in different industries in isolation, passive application of safety technology, research safety problems. The development of safety science from multidisciplinary to interdisciplinary is to strengthen the links that have been divided in the past, which is a manifestation of the modern scientific development of synthesis and helps to solve the contradiction between safety and danger in a holistic way. On the basis of these understandings, Comrade Liu Qian formed his own concept of safety science: safety science is dedicated to the study of the contradictions between physical and mental safety (including safety, health, comfort, pleasure and even enjoyment) of people in production and other activities, in order to achieve cross-disciplinary and comprehensive cross-sectional science that protects the activities of people and their activities and guarantees the efficiency of activities.

This definition makes it clear that the object of safety science is the physical and mental safety of human production and other activities, and that the purpose is to protect the active person and his or her ability to perform activities, and to guarantee the efficiency of activities, characterized by cross-disciplinary and comprehensive cross-cutting science.

3.3.5. Specific objects of study in security science

We define safety science as follows: safety science is the science of studying the contradictory laws of motion of things safety and danger [9]. The study of the essence of the laws of the safety of things, revealing the objective factors and transformation conditions corresponding to the safety of things; the study of the theory and technology of predicting, eliminating or controlling the safety of things and dangerous influencing factors and transformation conditions, the study of safety thinking methods and knowledge systems. Safety science should reflect the comprehensiveness of the object of study, now the object of safety science research is mainly human technology applications resulting in disasters or accidents, with the continuous development of science and technology, all aspects of human life include the content of science and technology, so the object of study of safety science should include all the negative effects faced in the process of human survival and development [10]. Specifically, the objects of safety science research are summarized as follows.

(1) the philosophical basis of safety science. Marxist philosophy is the world view and methodology of human understanding and problem solving, the establishment of security, scientific philosophy is the basis for the study of security, only the establishment of the correct concept of security and methodology to correctly analyze security problems, solve security problems, establish the essence of the laws of security science, to provide scientific guidance methods for the security problems faced by human society.

(2) The basic theory of security science. The safety problems faced by mankind are various, each has its own special laws, but in the essence of safety has its common laws, the basic theory of safety science, is under the guidance of Marxist philosophy, the application of the achievements of the current stage of the basic disciplines, the establishment of things common to the essence of safety laws.

(3) Safety engineering and technology. The study of engineering and technology problems of safety, including safety system engineering, safety control engineering, safety management engineering, safety information engineering, safety man-machine environment engineering and safety engineering problems in various engineering fields [11].

(4) The economic laws of safety science. The basic theory of safety economy, engineering theory, loss theory, evaluation theory, management and decision theory, etc.

4. Scope of research in security science

Comrade Mao Zedong pointed out that "the distinction of scientific research is based on the particular contradiction that the object of science has. Thus, the study of a particular contradiction peculiar to the field of a phenomenon constitutes the object of a particular science". Any science is the study of a particular form of movement or a particular contradiction, the specificity of the object of study, distinguishing different disciplines. Safety science as an emerging independent discipline, its object of study is the application of technology in the process of safety and danger of this special contradiction, in short, is the study of technological hazards, and technological hazards exist in various areas of human production, life and transportation. What we usually call the defense against foreign aggression, the defense of national security, this security issue does not belong to the study of safety science; safety science also does not study the earthquake, mudslides, floods, landslides, volcanic eruptions and other aspects of natural disasters; in addition, safety science is not involved in general diseases, social security and other aspects of safety issues. Because security phenomena are extremely common in all areas of human production and life activities in time and space, so that it is commonplace, but not easy to recognize the unity of scientific regularity. Despite the fact that this science and human interests are very closely linked, there is little research on it, and even less white consciousness. If we take a closer look at the scientific content of security, it is not difficult to see the safety conditions (i.e., safety equipment) with the science of white, safety mechanisms and human science and thinking science; safety management and systems science and social science, etc.. Therefore, safety science is a typical cross-cutting science that is cross-disciplinary and comprehensive [12].

4.1. The essential features of safety science

Safety science is the science of studying the contradictory laws of motion of safety and danger. The study of the essence of the laws of things safe, reveal the objective factors and transformation conditions corresponding to the safety of things; study the theory and technology of predicting, eliminating or controlling the safety of things and dangerous influencing factors and transformation conditions, the study of safety thinking methods and knowledge systems. From the scientific definition of safety can be seen, with the continuous improvement and enrichment of safety theory, the essence of the characteristics of the content is summarized as follows.

(1) safety science to reflect the essence of safety, that is, from the essence of things or systems to achieve the safety of the most appropriate. Today's safety science should be distinguished from the traditional safety science, which is characterized by, change the scattered for the whole; change the post-incident induction for the prior deduction and prediction, change the passive static subject to active dynamic control, in short, safety science, must adapt to the

requirements of human technological development, improve the effectiveness of human safety activities.

(2) safety science to reflect theoretical, scientific is not simply a summary of experience and predictions, to have a scientific rationality, not only to study the technical methods and means to achieve safety goals, but also to study the theory and strategy of safety.

(3) safety science to reflect the intersectionality. The emergence and development of various disciplines to adapt to the tendency of human social stability and prosperity, and now safety science is to integrate the theories and methods of the relevant disciplines to form a systematic theory that truly serves the ultimate goal of human pursuit of safety, which should include not only engineering science and technology, scientific level of knowledge also includes basic scientific theories and epistemological and methodological understanding.

(4) safety science should reflect the comprehensiveness of the object of study, now the object of safety science research is mainly the application of human technology resulting in disasters or accidents, with the continuous development of science and technology, all aspects of human life, including the content of science and technology, so the object of study of safety science should include some of the negative effects faced in the process of human survival and development.

(5) The purpose of safety science should reflect the optimization of human, economic, environmental and technological functions [13].

4.2. Relationship between security science and related disciplines

Security science is an emerging comprehensive intersection of science and science, systems theory, epistemology, human-tense view, social theory, military philosophy, and should be regarded as an independent scientific sector. According to the different attributes of the three elements of security and their interaction mechanisms, the following security science and technology system structure is proposed for vertical scientific classification or horizontal theoretical stratification of security.

(1) the philosophical level is the philosophy of safety, that is, the concept of safety, safety epistemology, safety methodology. It is the highest theoretical overview of safety science and is a way of thinking to understand the nature of revealing safety [14].

(2) The scientific level is the science of safety, which studies the scope of safety, basic concepts, definitions and their relationship with other scientific systems, and determines the connotation of safety science.

(3) The level of basic science is safety science, which includes the basic principles of safety science and research methods, revealing the basic laws of the safe movement of things.

(4) safety technology, the scientific level is safety science combined with different branches of engineering and the formation of specific technical principles and methods, and through continuous practice testing and correction, the formation of the branch of engineering disciplines specific to the safety technology.

(5) Engineering technology level is safety engineering, which is the use of Safety science and safety technology science directly serve the technical methods of safety engineering, including safety prediction design, construction operation, monitoring and other engineering technology.

5. Conclusion

This paper is guided by science, cross-science, dialectical materialism, the object of study of safety science, the scope of research in safety science, the essential features of safety science, safety science and related disciplines, such as the relationship between the line of expression summary concluded that.

(1) safety science is the study of the essence of the laws of things safe, revealing the objective factors and transformation conditions corresponding to the safety of things; research prediction, elimination or control of things safe and dangerous impact factors and transformation conditions of the theory and technology, research safety thinking methods and knowledge systems.

(2) Safety science is to study the flow of safety and danger - mutation process, reveal the causes and consequences of things safety and danger, and their unique interrelationship, the use of basic disciplines, engineering disciplines and other related disciplines, the loss of things or systems integrated function of the mechanism of analysis and research as a means to predict the prevention and evaluation of disasters and accidents as the goal of research.

(3) The objects of safety science research include: the philosophical basis of safety science, the basic theory of safety science, safety engineering and technology, and the economic laws of safety science.

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