THE INTEGRATION OF HIGH-TECH PRODUCTION AND OPTIMIZATION OF PUBLIC OWNERSHIP: AN ALTERNATIVE APPROACH TO NUCLEAR ACCIDENTS

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Abstract: Nuclear utilization and nuclear leaks reveal the merits and demerits of different types of enterprise ownership. The Fukushima accident is typical of the fatal defects of private capital, while the Chernobyl accident demonstrates the disaster a state-owned enterprise can cause. By contrast, an optimized public sector in China can combine full utilization of nuclear power with accident prevention. In an era in which high technologies are increasingly applied, private capital is becoming less dependable. On the other hand, state-owned enterprises must engage in competitive elimination through reform. This is determined by the checks and balances mechanism in the development of science and technology and especially by the laws of socialization. Evaluation of the merits and demerits of private and public ownership should be conducted from a comprehensive, historical and evolutionary perspective and through specific analysis of categorical comparisons. We should understand the trends (laws) of the interconnection and interaction of the large-scale application of advanced technology and optimized public ownership. In a new historical period, interconnections between rapid scientific and technological advancement and the socialist system are being created and reinforced.

Key words: nuclear accident; private capital; superior state enterprises; laws of socialization

The Fukushima nuclear accident (rated 7 on the International Nuclear Event Scale [INES]) and the accompanying earthquake and tsunami teach us a serious lesson. Discussion of this topic has mainly been carried out from a technological perspective

and only rarely from the angle of the economic system. In fact, the latter may also offer us deep and far-reaching lessons. This article tries to analyze the issue from the perspective of the interrelationship between large-scale utilization of advanced science and technology and optimized public ownership in an attempt to reveal something of the laws underlying it.

The Checks and Balances Mechanism in Scientific and Technological Contradictions Selects the Superior Economic System

From the point of view of objective process, scientific and technological progress and development have their own laws while at the same time they are closely associated with human social and economic life. The more advanced the technology is, the closer the association becomes. In general, the development of science and technology involves five mechanisms: original creation, transformative application, checks and balances for contradictions, social security, and intellectual talent. Among these mechanisms, that of checks and balances is most closely linked to nuclear use and nuclear accidents as it tends to effectively select the superior social and economic system.

In the process of technological innovation, advancement, application and dissemination, the checks and balances mechanism is a double-edged sword that always functions both positively and negatively. Everything in the world is full of contradictions, and so is technological advancement. Technological accomplishments may bring benefits, but they may also bring disasters. Such disasters are often unforeseen, but in fact they occur in accordance with laws. In the application of a new type of advanced technology, its positive effects are generally dominant. However, when its negative potential is neglected or it is inappropriately applied, its negative effects may be dominant. As Engels puts it, "each advance in organic evolution is at the same time a regression" and this is a "basic law" (Engels 1987: 583). Especially in terms of the application of advanced technology in promoting economic development, more attention should be paid to the coexistence and transferability of positive and negative effects. However, the negative effects of advanced technology are often neglected, and the more effective a technology is, the riskier its application. Nuclear accidents occurring in the application of nuclear energy exemplify precisely this contradiction in the advance of science and technology. In short, science and technology, especially new high technologies involving both rich rewards and high risks, always develop along an arc of success and failure, triumph and tragedy, and advance and retreat.

This contradiction in the development of science and technology exists because, on the one hand, the process of development is full of innate contradictions and involves both positive and negative effects. On the other hand, such contradictions

are related to human cognitive capacity and human action. It takes time for human beings to gain full in-depth cognizance of any natural law. For example, in the effort to eliminate insect pests, Dichlorodiphenyltrichloroethane (DDT) exerted a positive effect. However, people stopped using it when they recognized its negative effects of severe environmental pollution and damage to human health. This example illustrates that there are twists and turns in the process of human recognition of the positive and negative effects of technological advances. Furthermore, there are human factors involved. A technology may be operated ineptly or in breach of the rules, or its negative effect may be used intentionally, such as using poisons to kill people or nuclear power for genocide. Another example is unethical behavior such as the use of advanced technologies to carry out information fraud in pursuit of illegal profit. Under these circumstances, the action may be conscious and intentional, or unconscious and unintentional as for example in environmental pollution and over-use of drugs.

When we recognize the contradictions in the progress of science and technology, we must apply checks and balances so as to obtain positive effects and values while reducing or blocking negative ones, either by turning them around or by taking measures to avoid them. This is an enormous task. First is the issue of the technology itself. Deepening our research, identifying causes and taking further steps to check and control contradictions takes a long time. At the same time, it requires the help of an appropriate social system, mechanisms and management. Take nuclear energy for instance. When the German scientists Otto Hahn and Fritz Strassman discovered this new energy, they intended to make positive use of it for serving mankind, but later the requirements of the imperialist warfare turned it into a killing machine that still threatens our existence today. Beginning from the 1950s, people have used nuclear energy to serve society, but technological, institutional, systemic and management problems remain which may lead to the breaching of the mechanisms and laws of checking and controlling with respect to technological contradictions. As we embark on an era of large-scale application of advanced technologies, we must duly respect the objective laws of science and technological development and their selection of social and economic systems in a spirit of seeking truth from facts. Otherwise, science and technology will take their revenge and bring about major disasters.

The Fukushima Accident Reveals the Fatal Defects of Private Capital

Some large private enterprises can never be fully suited to the large-scale application of high-efficiency, high-risk advanced technology. The fundamental reason for this lies in their pursuit of private interest without regard to public safety and public interest. The Fukushima accident, for example, was caused by three factors—natural

disasters (a magnitude 9 earthquake and a gigantic tsunami), technological defects, and systemic defects. Although we cannot stop natural disasters, optimal systems can prevent them from doing so much damage. If the technology has defects, they can be remedied by good systems. However, a profit-driven system magnifies the disaster. The *Financial Times* (quoted in Zhao 2011) criticizes the poor performance of the Tokyo Electric Power Company (TEPCO) in this nuclear crisis, summing up the six deadly sins it committed. Based on Zhao's summary, we can list nine sins that the company committed.

(1) Selecting the wrong sites. Japan is one of the most earthquake-prone countries, yet over 70 percent of its nuclear reactors are located in earthquake-prone areas. According to the report by the *Financial Times*, when choosing the site for the Fukushima nuclear plant, some scholars said it should not be built in such a location, but the company boss and his academic henchmen insisted that the plant could withstand earthquakes and tsunamis. In fact, two nuclear leaks had occurred before the earthquake. In one, in August 2005, a magnitude 7.2 earthquake caused the overflow of nuclear waste storage in two of the company's nuclear plants. The company refused to move the plants for fear of economic losses (in Zhao 2011).

(2) The facility was aging and below standard. It was pointed out in the report by the *Financial Times* (in Zhao 2011) that the plant's Dai-ichi reactor, supplied by US General Electric, had a problematic design. Although some people in General Electric claimed the reactor was a time bomb, TEPCO insisted on using it for reasons of cost. The designed life of the reactor was 30 years, but the company extended that to 40 years and even planned to extend it for another 20 years. What is more, the reactor had already shown a series of signs of aging. Despite this, the company refused to replace parts or carry out necessary servicing. It was originally designed only to resist earthquakes of a magnitude of 6.5. As early as 2007, some researchers had warned that the Dai-ichi nuclear plant was at risk in a tsunami event, but the warning was ignored.

(3) Double standards were constantly applied in recruitment. Zhao (2011) referred to the *New York Times* of April 9, 2011, and revealed that to save money the plant employed numbers of casual workers without the necessary training or adequate knowledge of self-protection. In recruiting, they chose people without sufficient education, professional training, literacy and age limitation. Right now, many casual workers are among those dealing with the emergency on site. Some nuclear experts have pointed out that this practice is hazardous not only to operatives' health but also to the safe operation of the plant. This lays bare the exploitative nature of the capitalists.

(4) The optimum time for emergency action was missed because the company wanted to preserve its assets. TEPCO did not report the accident to the government immediately after the accident took place, nor did they take the measure of cooling

the reactor with seawater in the very beginning, and consequently failed to minimize the impact of the disaster. Reportedly, the company hesitated to use seawater for cooling because it feared that this might result in abandonment of the reactor, affecting company profits. When it was finally compelled to use seawater, the opportunity was gone.

(5) Tampering with data and covering up the accident. TEPCO customarily filed false reports, tampered with data and covered up accidents, leaving the Fukushima plant riddled with hidden safety problems and making the Japanese suspect the company's data. On March 27, 2011, it lost the trust of the people with its announcement that "radiation is 10 million times higher than normal," whereas the actual figure was 100,000 times higher.

(6) Company leaders were absent from the accident site. The head of the company, Masataka Shimizuwas, was not seen in Fukushima until a month after the earthquake, where he was received with harsh reproaches from the disaster victims.

(7) Rashness and beggar-thy-neighbor behavior. According to Zhao (2011), on April 4, 2011, TEPCO dumped 11,500 tons of lower-level radioactive waste water into the sea without informing neighboring countries in an effort to empty out space for storing waste water with a higher radiation level. It is estimated that the radioactive material in the waste water will reach North America via ocean currents in five years and diffuse to almost the whole of the Pacific in 30 years.

(8) Teaming up with the government in an "iron triangle." The Japanese government's response to the nuclear accident was weak, hesitant and lacking in specific measures. This is because an interest group had formed around TEPCO, consisting of a bureaucratic and academic clique who colluded with and sheltered each other. The government ignored its monitoring and control role and could not respond decisively to the emergency.

(9) Refusal of international aid. At the outset, experts from the manufacturer of the nuclear reactor arrived quickly at TEPCO headquarters hoping to help. However, they were not accepted by the company, which only started to liaise with external experts three days after the earthquake, when the situation was out of control. According to some Japanese government officials, the US offered help immediately after the nuclear leak, but TEPCO refused the offer because they were afraid the US experts would suggest cooling the reactor with seawater and thus damaging the plant (Zhao 2011). When TEPCO was forced to make the decision to use seawater, the time had passed.

Japan is very earthquake-prone. It is also the only country in the world to have been struck by two atomic bombs (with a death toll of 150,000–250,000). As such, it should have been in the vanguard of preparing for earthquakes and preventing nuclear accidents. Also, given the precedents of the nuclear accidents at Three Mile Island and Chernobyl, the Japanese government should have been well aware of

the dangers. However, greed and parsimony led to this disaster, revealing the true nature of private capital. TEPCO is a big private company producing, delivering and distributing electric power for Tokyo and eight counties around it. It produces nearly one-sixth of the national output of electricity, and its income is the highest of its kind in Japan. It is also the largest private nuclear energy producer in the world. The total market value of its capital assets exceeds 14,000 billion yen (173.6 billion US dollars), and its sales volume amounts to 50,000 billion yen (620 billion US dollars). As Zhao pointed out, it has 52,000 employees, and rich as it is, the company totally ignored society's welfare and that of the whole world. Experts estimate that it will take around half a century to eliminate the effects of the radiation (Zhao 2011). The World Bank speculates that the disaster will cost Japan 122–235 billion US dollars, or 2.5–4.3 percent of national GDP (Xu 2011). Now, under pressure, TEPCO is going to compensate the victims. However, in order to avoid the company's bankruptcy, the government has established a relief agency, meaning that taxpayers' money will be used to back up the company.

The above summary indicates that the institutional cause of the expansion of the effects of the Fukushima nuclear leak lies in private ownership and the maximization of profit to a point where it jeopardizes the welfare of the whole society. Private ownership is incompatible with the socialization of production and cannot be adapted to the large-scale application of high-efficiency, high-risk advanced technology aimed at benefiting the people.

The Three Mile Island nuclear leakage accident in March 1979 also involved private management. The nuclear plant had been built by the private company Babcock & Wilcox on Three Mile Island in Pennsylvania, US. This accident was also caused by operation that breached regulations: some workers forgot to reopen a valve after fixing the cooling system. It took only 120 seconds from the start of the botched operation to the complete melt-down of the reactor in an accident that was graded 5 on the INES scale. The accident shocked the whole country and terrified the neighborhood, with 200,000 residents being evacuated. People in big cities across the country took to the streets in protest against nuclear plants. Western governments had to reexamine nuclear energy projects. In the final analysis, the fundamental cause of the disaster lies in the greed of private capital, which runs contrary to socialized mass production and benefit for the whole of society.

Adapting to the Application of Advanced Technology in Scale Demands Serious and Continuous Optimization of the Economy of Public Ownership

Given that private capital has fatal defects in terms of the scale application of high-efficiency, high-risk advanced technologies, is it safe to say that all publicly owned

enterprises can adapt well to these demands? The Chernobyl accident proves that the public ownership economic system is not omnipotent, and not all forms of it are flawless. History reveals that publicly owned enterprises must undergo a long process of self-improvement and self-optimization. Reality and history present two types of publicly owned enterprises: superior and inferior. It was one of the latter that was responsible for the Chernobyl disaster, the worst disaster ever to have occurred in the history of nuclear energy use in terms of destruction and loss. Although its INES grading (7) was the same, the radiation emitted was ten times higher than in the Fukushima accident, and the area contaminated and sufferers affected were several times greater. However, it should not be concluded that publicly owned enterprises can never adapt to scale application of advanced technology. Any conclusion needs to be drawn on the basis of specific analysis of the actual facts.

The Chernobyl nuclear plant was built in 1970 and the disaster struck in 1986. Its cause lies in at least the following aspects.

In terms of historical background, it was contextualized by the Brezhnev era between 1970 and the early 1980s. The design of the plant was seriously flawed, but it had to go ahead quickly. The Soviet Union prided itself on "applying the most advanced technology," aiming to overpower or at least draw level with the West in political terms. Project management was extremely lax. The accident occurred at the time of "peaceful evolution" after Gorbachev was in power, when enterprise reform was a low priority and economic conditions and the social order were quite unsettled. This situation definitely affected enterprise management. Thus this nuclear plant suffered from both inborn and acquired defects. The top public enterprise leadership gave little thought to nuclear safety at the plant, which had no safety shield and no detailed emergency measures. The leadership were more concerned with their lasting privileges and the "humanism" and "reform" of peaceful evolution (Rizhkov 1998).

The Chernobyl accident was caused by a simple and avoidable low-level error. It has been proved that the management of interpersonal relationships within an enterprise is very important. As early as the 1960s, Mao Zedong said that "After we solve the problem of ownership, the most important question is management, or interpersonal relationships, and in this respect we have a lot to do" (Mao 1999: 314). This statement conforms to the reality of state-owned enterprises. Management optimization is a very important task of our reform. With poor management, even a superior form of ownership cannot exert its advantages. Many problems of publicly owned enterprises derive from poor management. The management of an enterprise includes the negotiation of interpersonal relationships, the rationalization and formalization of rules, improving the quality of employees, strict conformity to operational procedures and disciplines, rational allocation of internal resources, and relations with the market. In the case of the Chernobyl accident, the crisis arose

directly from poor management: contravening regulations, one worker pushed the wrong button, resulting in the explosion of the fourth reactor. This proves that good management is an important indicator of a high-quality enterprise and an important link in giving full play to the strength of the publicly owned economic sector.

One indication that the Chernobyl nuclear plant was an inferior state-owned enterprise is that it had no emergency plan. An enterprise that applies high-efficiency and high-risk technology must have advance warning, preventive and rescue measures in case of emergency. It also needs to coordinate with local government in the surrounding area. Chernobyl had done no research in this aspect, a typical illustration of inferior state-owned enterprises. Because of this, the managers panicked and lost control in the chaotic situation when the accident occurred. At the same time, the central government concealed the truth from local government and the masses out of so-called political consideration, so that people fleeing the site did not know what had happened even two days after the accident occurred. Clashes and rear end collisions were reported in the hasty exodus. Such a state-owned enterprise failed to put people in first place and give top priority to the interests of the masses. It blocked information and did not hesitate to sacrifice people's lives and property. Furthermore, the problems of the Ukrainian economy as a result of the disintegration of the Soviet Union almost bankrupted the country when the financial crisis broke out. In the meantime, the Ukrainian leadership has been busy contesting elections and seizing power, leaving Ukraine as a state with neither economic resources nor political will. The concrete shield covering the wreckage had a designed life of ten years but has been extended for more than 20 years with no repair for its frequent cracks. Measures taken to further dispel the effects of the disaster have been defective (Piyi Wang 2011).

From the above analysis we can say that the Chernobyl accident cannot be wholly attributed to the functioning of the system of state-owned enterprises, nor can one deny that it is partly attributable to the poor management of a low-quality publicly owned enterprise. Lessons learnt from this accident include the following: (1) it is not true that public ownership will exert its advantages as soon it comes into being, and it is possible that it may change its nature; (2) if the party in power and the state change in their nature, so will state-owned enterprises; (3) state-owned enterprises must be constantly optimized through reform and self-improvement to become high-quality state assets and to be better adapted to advanced technology and socialized production. Of course, this is not a once-and-for-all accomplishment. Unforeseen disasters may still occur and optimization must be sustained.

It may be claimed that other capitalist countries have installed numerous nuclear plants with no major accidents. That is true, but it does not prove the superiority of the private sector. France, for example, has a total of 18 nuclear plants whose output accounts for about 80 percent of the electricity produced. For several decades they

have encountered no major problems. However, further research shows that state ownership in various forms has played a significant role in these enterprises. Their managers may be directly assigned by the government, or the government may be a shareholder, or they may be under strict government supervision. This practice contains elements of socialization, or socialism, unlike TEPCO, which is managed by private capital. This also indicates that the French system is quite different from a privately owned sector, but is rather closer to that of a publicly owned economy. Therefore we cannot draw the general conclusion that private enterprise is fully capable of managing nuclear power facilities successfully.

A more convincing example would be the development of Chinese nuclear power plants. All five nuclear plants in China have been running for two decades, producing cheap and clean energy without incurring any major problems. More importantly, these state-owned enterprises have completed a reform. Their internal management is very strict and they have absorbed the lessons of international experience through self-improvement. For example, their preventive measures against nuclear leakage are the most advanced in the world (regarded as being in its third generation and heading toward the fourth, while the majority of the world is still in the second generation), with three shields instead of one. Three principles were established in response to the Chernobyl disaster—maintaining the development of nuclear energy while learning from previous experience; quality and safety first; and detailed emergency plans to ensure that comprehensive emergency measures can be implemented as soon as an accident occurs (Sun 2011). The most important thing is that China's state-owned enterprises have retained their socialist nature and human-oriented direction. They do not hesitate to assume their responsibilities toward society and they do not take profit as their fundamental aim. A privileged class within and outside the enterprise in opposition to the common workers does not exist. Therefore, from the state to the enterprises and from managers to workers, all can give full play to their enthusiasm and sense of responsibility. Of course, this must keep improving. As Deng Xiaoping declared, "reform is the self-improvement of the system of socialism" (Deng 1993: 142). This mechanism is in fact an advantage which good state-owned enterprises must possess.

Based on the above analysis, we can arrive at the following conclusions (which also apply to some mine disasters). First, public ownership, especially state-owned enterprises, should be divided into two types: superior and inferior. Stagnant ossification and deviation from the right path can result in a change in the nature of public ownership. Second, the fundamental difference between the public ownership economy and the private ownership economy is whether to put social responsibility or profit first. Third, the fundamental difference between superior and inferior state-owned enterprises lies in whether they are sincerely oriented toward and capable of serving the society. Therefore, socialist state-owned enterprises

must give full play to their advantages in self-improvement. Their reforms must focus on at least the following issues: (1) ensuring that the party in power and the state do not change their nature (if they do, the enterprise will also change); (2) optimizing the ownership and governance structures (implementation forms); (3) optimizing and reinforcing the internal management; (4) improving the quality of leadership and eliminating corruption and privilege; (5) taking advantage of the central role of scientific research organizations and centers of technological innovation within enterprises to explore scientific and technological issues that need further research; (6) maintaining and strengthening their connection with the masses and subjecting themselves to the supervision of the people (including open and prompt information disclosure); (7) always adhering to scientific development and speeding up the transformation of economic development modes. In short, state enterprises must deepen their reforms, but the reforms must not lead to their weakening or disappearance.

Recognizing the Laws of Socialization through Comparative Analysis

There is a long-standing theoretical debate over whether public or private ownership is superior. With each holding its corner, the debates are likely to last another 100 or 200 years. Apart from differences in their views based on interest relationships (standpoints), there is also the question of using a correct methodology based on facts. A valid methodological viewpoint requires that we observe things from a multi-angle perspective. This perspective is the one that unites efficiency and justice, namely, we cannot rely on profit making alone with no regard for justice, or social costs and benefits. This viewpoint also requires that we observe things from a historical perspective, in that we should focus not only on short-term but also on long-term efficiency and the whole historical process. We should also adopt a developmental perspective, which means that we should consider the possibility and feasibility of future improvement and optimization, and not just the present weaknesses or strong points. Furthermore, our analysis should apply categorization and comparison, such as the distinction between superior and inferior enterprises within the general category of state-owned enterprises. We hear all these in the old sayings with regard to not seeing the wood for the trees, not seeing the falling flowers but only those in blossom, and not seeing the long-term positive prospects but only the immediate defects. We have now entered an era of massive application of advanced technology, and how to choose a correspondingly optimum system is a matter affecting the destiny of a nation, society and all of humanity. Recent history has many examples of the large-scale use of advanced technology for the benefit of humanity, but also of some major accidents brought about by this kind of use, such as the nuclear accidents at Fukushima, Three Mile Island and Chernobyl. Table 1 compares these accidents in terms of the types of enterprises involved.

Table 1 Comparison of operating condition between different types of enterprises in applying industry of high-efficiency, high-risk, and advanced technology

Enterprise types	Private capital (with Tokyo Electric Power Co. as an example)	Inferior state-owned enterprise (with Nuclear Power Co. during the meltdown of USSR as an example)	Superior state-owned enterprise (with Chinese Nuclear Power Co. as an example)
Management objective	Profit-oriented, lack of social responsibility.	Regard social service as the slogan, yet not clear.	Human-oriented, put social responsibility first.
Relationship with interest group	Private monopoly as the main sector + bureaucratic power + scholar tyrant.	Being controlled by bureaucratic privileged power, social interest was affected.	Steer clear of any private group or bureaucratic group.
Construction proposal	Being unable to form optimal proposal due to unconvincing argument, underestimate of disaster, it has inborn defects.	Having not designed optimal proposal due to insufficient argument, underestimate of disaster, it has fatal inborn defects.	To form optimal proposal based on sufficient argument, repeated examination, constant optimization and prevention of various risks.
Internal management	Comprises internal management for the sake of private interest, covers up accident and ignores equipment maintenance.	Slack management together with remiss leaders and employees' lack of training.	Adopt strict scientific internal management, constantly improve employees' quality, stress responsibility to the people, strengthen supervision, and consider equipment maintenance of vital importance.
Employee relationship	With severe inner class opposition, seeks to lower the wage of employees.	Due to excessive income disparity, it cannot give full play to employees' enthusiasm.	Adopt pay for performance system, dispense reward and punishment impartially with constant optimization, give full play to employees' enthusiasm.
Emergent response program	No emergent response program in advance, underestimates the disaster.	No emergent response program in advance, takes a vain pride.	With detailed emergent response program and measures to ensure that comprehensive emergency measures can be implemented as soon as an accident occurs.
Relationship with the government in disaster	Being so near and yet so far, weakens the effect through bribing and does not exert national efforts to take emergency measures.	Controlled by bureaucratic group and does not exert national efforts to take emergency measures.	Establish national emergency response system and be ready to exert all efforts to take emergency measures at any time.
Information disclosure transparency	Low information disclosure transparency and attempts to tamper with data.	Covers up the truth and misses the optimum time for emergency measures.	Subjecting themselves to the supervision of the people with open and transparent information disclosure.
In-depth study	With the interest relationship of scholar tyrant and enterprise owners, ignores in-depth study while assists enterprises to cover up accident.	Being fearful to face up to the contradiction and reluctant to do intensive study.	Assemble masses of elites for constant in-depth study and improvement, to detect potential risks in time and produce highly efficient mechanisms to avoid, defuse and deal with crises.
General benefit	The annual interest rate amounts to over 20%, with social cost taking 4% of national GDP or over US$200 billion and exceeds ten times the micro-benefit.	Huge social cost which amounts to over 40 times the micro-benefit, of which the exact number is not clear, accelerates the meltdown of USSR.	Unit cost being lower than average cost of electronic power, the macro-benefit is significant while social cost is low.

All these facts tell us that the private economy is becoming less and less suited to the large-scale (rather than small-scale and short-term) application of high-efficiency, high-risk advanced technology. The same is true of traditional, poor-quality publicly owned enterprises that have not been optimized. Only a publicly owned economy that has undergone self-improvement and self-optimization is conducive to the large-scale application of advanced technology to benefit mankind.

Engels pointed out long ago that the fundamental contradiction of capitalist society is the contradiction between socialized production and private ownership. *The solution to it*

> can only consist in the practical recognition of the social nature of the modern forces of production, and therefore in the harmonizing of the modes of production, appropriation, and exchange with the socialized character of the means of production. And this can only come about by society openly and directly taking possession of the productive forces which have outgrown all control except that of society as a whole. (Engels 1987: 266)

The law of socialized production determines its choice of relations of production, i.e., the realization of socialism. Socialization of production refers to the process by which the narrow individual or small-scale unit of production becomes social production; that is to say, the strengthening of economic relations in society and the interdependence of various activities within it on the basis of the increasing division of labor. The higher the productivity is, the higher the level of socialization. The private ownership of capitalism stands in the way of socialized production and therefore must eventually be cast aside by more and more advanced socialized productivity and replaced by socialized relations, that is, by public ownership. Of course there are still contradictions between socialist relations of production and socialized productivity, which can be solved within the system. Science and technology are the foundation, support and vanguard of advanced productivity. They themselves are also increasingly undergoing socialization. Technological innovations—their applications to production, their achievements and products, and their positive as well as negative effects—will affect the whole of society and all mankind. As such, they inevitably call for the elimination of private ownership and the optimization and perfection of socialized relations of production, or public ownership. This trend is increasingly evidenced by the mass application of nuclear energy and related safety needs.

Entering a new century, mankind is facing a critical turning point in understanding and applying advanced productivity since energy resources, especially traditional ones, are nearly exhausted. Environmental pollution is another problem that should be dealt with. Some people even take the pessimistic view that mankind is on the edge of self-destruction. Therefore, human beings really need to consider the

question of where to look for the necessary resources. To that end, what is most important is reliance on science and technology for further discovery and exploration of new resources and more efficient use of existing resources. Over 60 countries with more than 400 nuclear power plants worldwide are currently producing clean energy, accounting for 16 percent of the total world electricity production (Jianjun Wang 2011). The deepening and widening application of advanced technology inevitably brings with it greater or unpredictable risks. Especially when we are using new forms of high-efficiency, high-risk advanced technology, beneficial effects coexist with potential disasters. History shows that in man's utilization of nature, positive and negative effects are both equally possible in different degrees. Under such circumstances, we must optimize our economic system to secure more rapid development of science and technology. In this process, the issue of safety becomes even more important. Making use of new resources and dealing with the risks involved are two tasks that must be carried out at the same time. We need to strengthen our mechanism of checks and balances with regard to the contradictions in the development of science and technology.

Some may argue that advanced Western capitalist countries have been able to apply new and advanced technologies on a large scale, and have done so in a more advanced manner than socialist countries. Yes, this is the reality, but more and more insurmountable contradictions have been revealed in this reality. For example, monopolies have created huge barriers for people around the world to exchange and share technologies. Furthermore, capitalist industrial structures are becoming distorted, with the financial economy becoming detached from the real economy and inflating into an enormous virtual or bubble economy, resulting in crises. Compared with the financial economy, the development of the real economy lags behind. More and more nuclear risks and disasters have emerged, while accidents have in fact been covered up. When we claim that socialism is superior, we mean that the socialist economy is catching up with the capitalist economy at an unprecedented pace and with safety guarantees. China is a good example. Starting from grinding poverty, China's development in the last few decades has been catching up with capitalist development over several hundred years. Some of China's scientific and technological achievements can be rated as the world's best. China's application of nuclear energy is the most efficient and safest in the world (Sun 2011). In the long run, the socialist large-scale application of advanced technology will surpass that of capitalist countries. One of the advantages of the socialist system is its ability to rally all the forces of society to succeed in mega-projects such as the Three Gorges hydropower project. Such projects have not been seen in the US. The west-to-east gas pipeline, west-to-east electricity transmission and south-to-north water diversion are all mega-projects that are unparalleled elsewhere. Another

example is the Qinghai–Tibet railway, a highly technology-intensive project that is of high efficiency and high risk and involves huge investment. The fact that China is able to build this railway (the highest and most difficult in the world) without aiming at profit proves that optimized state-owned enterprises can guarantee innovation, application and promotion of advanced technology, remove barriers caused by private ownership, formulate a nationwide strategy and produce a highly efficient mechanism for dealing with crises. This is the best proof that socialized production relations suit socialized productivity.

Others may ask how we should explain the fact that the government is now calling for promoting medium and small private enterprises. And how would we explain the fact that some of those enterprises are also very advanced and very innovative in scientific and technological research and in applying advanced technology? These are all valid questions. Firstly, when we state that optimized public ownership suits the application of advanced technology, we do not mean small projects but the kind of large-scale application that is able to result in massive system engineering and industry chains so as to develop a recycling economy (for example the recycling of nuclear waste) on a larger scale and at a higher level. Key projects such as the production of nuclear weapons and spacecraft and landing on the moon cannot be carried out by medium and small enterprises. Secondly, our country is still, and will be for a long time to come, in the preliminary stage of socialism, where medium and small private enterprises can play an important role in coordination with big state-owned enterprises. Thirdly, even in the future such private enterprises will still play an active role in carrying out small scientific and technological projects, and individual innovation will be encouraged. However, there is one thing that we must always remember: we must firmly retain the undiminished dominance of public ownership, which must expand along with the development of productivity, because the fate of the great cause of socialism with Chinese characteristics is fundamentally determined by superior state-owned enterprises.

Mao Zedong said 62 years ago that "Communists around the world are wiser than the bourgeoisie, since they understand the laws governing the existence and development of things, they understand dialectics and they can see farther" (Mao 1991: 1468). It has been repeatedly proven that objective laws cannot be broken. The processes of the mass application of advanced technology and optimization of public ownership assist and promote each other. Such assistance and promotion accelerate the development of productivity while securing the safety of production and society, and solve many acute contradictions (such as resource, energy and environmental problems). This trend is an indication of the power of objective laws. Basing ourselves on facts, we should grasp the mainstream of human development and consciously recognize and follow this inevitable trend.

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