CHINA'S TECHNOLOGICAL LINE DURING THE CULTURAL REVOLUTION

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I. THE FORM OF TECHNOLOGY PECULIAR TO SOCIALISM

ONE OF MY VIEWS of technological history is that each society has its own special form of technological development. This was as true of feudal society as it is of capitalist society. New technology germinates within the old society and begins to develop in earnest once the old society collapses and the new society emerges. A special characteristic of the form of technology peculiar to capitalist society is that there is an attempt to make systemization as permanent as possible and to have concentrated control from above and division of labor. Manufacture, which emerged within the feudal system and was the first manifestation of thinking along the lines of systemization, began to develop fully through the medium of mechanized industry in the course of the industrial revolution that resulted from the bourgeois democratic revolution. In what I call the second industrial revolution, which extended from the nineteenth into the early twentieth century, it rounded out its entire system by adding the system of division of Nature and of division between Man and Nature and in the present day has reached full maturity [5, Chap. 4] [1].

If socialism is to be the society that succeeds capitalism, it will have to manifest a form of technology different from that under capitalism. In the 1930s, about twenty years after the Revolution, there appeared in the Soviet Union the gasification of underground coal which in itself involved a fluid system; the Stefanov Movement, which aimed at solidarity of labor; and Lysenko's theory, which was an attempt to overcome the contradiction between the theory of evolution and genetics providing the eco-system with an impulse toward new development [6]. After World War II there was an attempt to realize a system of natural cycling, as seen in Stalin's so-called plan to remodel Nature. Each of these systems had characteristics that contrasted with those systems under capitalism, although, of course, they did appear in part under the capitalist system as well: the idea of converting to underground gases began with Ramsay and Mendeleev; Lysenko's theory was a direct carryover from Michurin's theory of breeding; and the United States' Tennessee Valley Authority project is an outstanding example of a plan to remodel Nature. The kind of labor solidarity seen in the Stefanov Movement, too, is often seen in individual enterprises. What matters is the extent to which such systems can be developed in earnest under socialism.

There is no doubt but that the Soviet Union continued to give a great deal of attention to such new technology beginning in the 1930s. After Stalin's death, however, there was a sharp change in the situation. And by 1959, when a new

seven-year plan got underway, there emerged a clear trend toward Americanization in the entire system of Soviet technology: the relative importance of petroleum and natural gas in the energy balance rose sharply; the chemical industry committed itself to "petrochemicalization"; and the electrification and dieselization of railroads became another important task. At the same time, the idea of planning to remodel Nature faded away, developmental efforts for conversion to underground gases thereafter slackening off in terms of importance in national planning, even though they were supposed to be reinforced during the seven-year plan. It is also a well-known fact that in the very year that the seven-year plan ended, 1965, Lysenko was discharged from his post as head of the Genetics Research Institute. Other matters which presented themselves but which apparently did not materialize were the construction of a giant steel base depending primarily upon large-capacity (750-ton) electric furnaces and, with conversion to underground gases, putting large-capacity gas turbines of about the size of steam turbines into practical use.

Of course, increase of the relative importance of petroleum in the energy balance, development of petrochemical industry, electrification and dieselization of railways, and so on are welcome trends even in socialist society, but what interested me was what the Soviets would do next in the way of action confined to socialism alone. Since the seven-year plan, however, signs of such action have been becoming increasingly weak with each new year. It is fair to say that there is no essential difference today between the entire system of Soviet technology and that of capitalist countries.

II. CRITICISM OF THE IDEOLOGICAL CONTENT OF CHINESE TEXTBOOKS RELATING TO SCIENCE AND ENGINEERING

Now then, what is happening in technology in the case of Chinese socialism? First of all, in 1958, only nine years after the Revolution in China, a form of technological development peculiar to China began to emerge in the so-called Great Leap Forward, and since 1965, with the Great Proletarian Cultural Revolution spreading throughout China, it has come to evince extremely sharp characteristics.

The Great Proletarian Cultural Revolution, which started out with basic criticism of bourgeois literature and art, developed further into revolt by the Red Guards in the universities and seizure of power by the working class in the large factories. Since, during this process, a great deal of emphasis was placed on the basic policy of "putting more effort into the revolution and stimulating production," the leadership of the workers in the factories with respect to technological development was established not only politically but also in terms of technology. There unfolded in the factories a turbulent struggle between the two technological lines. This development also affected engineering, with primary emphasis being placed on forceful promotion of socialistic remodeling of engineering and natural science universities. Thus, in the universities, too, there unfolded the struggle between the two scientific and technological lines. One gets the feeling that since

1968 the socialistic remodeling of culture in the Great Proletarian Cultural Revolution has concentrated on the problem of technology. And it has been inevitable that in the struggle in the universities over the scientific and technological lines, basic criticism should be directed at conventional textbooks and that the ideological basis of such components of the superstructure as the natural sciences, engineering, and technology should also be reexamined.

It seems that up until the Great Cultural Revolution the ideological nature of science and technology rarely became an issue. I, however, number among those who have maintained that with a revolution in education this problem would not fail to be taken up. Allow me to quote what I have said in the past concerning the technological innovation movement in China:

> If, as is true in China's case, the technological innovation movement in actual production unfolds as one link in the process of the three great revolutionary movements, the connection between the universities and actual production will be all the more effective. If, however, the students limit their field of vision to within the framework set by some particular production situations, it will be difficult to train competent technicians capable of serving the people even more effectively in the future in spite of the immediate service that might be rendered. If basic and systematic instruction is to be given concerning the characteristics and logic of each of the systems in the various fields of technology, the close connection between these various technological systems, the systems of engineering laws or natural laws upon which these technological systems are based, and other such problems, a considerable amount of time must be allotted to classes for that purpose. . . . Just how far Chinese universities can go toward surpassing the technological level of capitalist countries in spite of their limited class room time remains to be seen, but it should be noted that therein lie some as yet unchallenged and difficult questions concerning science and technology. One cannot help but think that in the process of its development higher technological education in China will face this problem. [2, pp. 420–21]

Sure enough, an all-out campaign critical of textbooks in China's new science and technology universities has begun to unfold. The following is a quotation from the beginning of item 5 of a report by the Worker's and People's Liberation Army Men's Mao Tse-tung Thought Propaganda Team at Tsinghua University entitled "Strive to Build a Socialist University of Science and Engineering":

> The transformation of teaching material is a serious political struggle. It is a question of vital importance to the bringing up of a generation of new people. The slavish comprador philosophy and the doctrine of trailing behind at a snail's pace constitute the very core of the old system of the teaching material for colleges of science and engineering. They pervade every line of the teaching material. Till this day, they are still the yoke shackling the minds of a small number of intellectuals. Thus, the destruction of the slavish comprador philosophy and the doctrine of trailing behind at a snail's pace is the key link in thoroughly transforming the teaching material. [10, pp. 12–13]

The report goes on to say:

> Though they deal with natural sciences, the textbooks in science and engineering in the imperialist and social-imperialist countries are stamped with the brand of exploiting classes, because they are summings-up of the development of science and

technology made according to the bourgeois world outlook to meet their needs in politics, economy and military affairs. [10, p. 13]

And the following criticism in the report is made concerning electronic engineering teaching materials:

Take a series of old textbooks on electronics for example. The much advertised "compact" system for subjects in this branch of learning is nothing but an epitome of the development of electronics technology in the capitalist society. However, the textbooks claim that this system is an eternal and absolute truth and if one is to develop the electronics industry and master electronics technology one can only trail along this old road at a snail's pace. This fully reveals the enslaving character and backwardness of the old teaching material. [10, p. 13]

Although I am not familiar with Chinese textbooks on electronic engineering, I can say that, in general, textbooks on the subject are indeed an epitome of the process of development of electronics technology in capitalist society and that, without doubt, that process is stamped with the stigma of the exploiting classes. Furthermore, the tendency of such textbooks to play around with pedantic theory and formulas reflects the fact that they are completely divorced from actual production. It is claimed that unless each and every one of these arguments and formulas is thoroughly mastered, the student cannot hope to become an expert in electronic engineering. If criticism that gets at principles is made of the capitalistic development of electronic engineering, pruning away superfluities and reexamining electronic engineering from the basis of productive practice and natural laws, it should be possible to produce textbooks which are both concise and to the point, effective in actual practice, and having a high degree of thought value. I definitely want to learn more about new Chinese teaching materials.

The report states, moreover, that the revolution in teaching materials is unfolding as a broad popular movement:

The transformation of the teaching material is a deep-going ideological revolution. It is imperative to attach great importance to changing the stand and feeling of the teachers so as to help them move their feet over to the side of the proletariat and solve the question of for whom to write and how to write textbooks. The propaganda team led the teachers and students in going to the three great revolutionary movements of class struggle, the struggle for production and scientific experiment, organized teaching material compiling groups composed of workers, poor and lower-middle peasants, Red Guards and teachers, launched revolutionary mass criticism and took the compiling of teaching material as part of the living study and application of Mao Tse-tung Thought and of deep-going reeducation of the intellectuals. People came to realize that it is a manifestation of slavish ideology to preserve intact the old system of the teaching material for science and engineering. One who divorces himself from the labouring people is bound to worship and be servile to things foreign; one who refuses to remould his idealist and metaphysical world outlook is bound to trail behind foreigners at a snail's pace. [10, p. 13]

Well, then, how should teaching materials be reformed? Mao Tse-tung says that "the teaching material should be thoroughly transformed, in some cases beginning with simplifying complicated material" [10, p. 13]. Since the number

of years of education has been reduced and students now work as well as study, for the time being it is absolutely necessary, and at the same time possible, for textbooks to be simplified. However, since mere pragmatic simplification would preclude broad, deep-reaching service to the people, reliable methodology must be used and the problem of the creation of new ideas about science and technology must be faced.

The report, after quoting this basic directive of Mao Tse-tung, goes on to say:

> This is a complicated and difficult task. It requires us to have both revolutionary enthusiasm and scientific approach, strive to put politics in command of professional work, scientifically analyze and penetratingly expound the laws of natural sciences with dialectical materialist viewpoint and adhere to the principles of integrating theory with practice and of getting teaching material condensed and concentrated, thus making it revolutionary, practical and advanced. [10, p. 13]

Although this basic policy is a good one, there is no mistaking the fact that it is also a "complicated and difficult task." It is worthy of notice, however, that under the Great Proletarian Cultural Revolution this basic policy was by no means merely paid lip service to, but rather was stubbornly and resolutely put into practice. And this was done by practical means that took into consideration one's own strength and objective conditions.

The report says the following about the problem of carrying over the legacy of the past:

> As for the present old teaching material and the scientific and technical achievements of foreign countries, we have kept to the principle of critically taking over and to the policies of "making the past serve the present and foreign things serve China" and "weeding through the old to bring forth the new." In criticizing the system of the old teaching material as a whole, we laid stress on which line it was guided by, which class it served and which world outlook ran through it, instead of simply negating the specific content of natural sciences. As for the useful part, we did not just take it over and apply it, but checked it with a critical eye and took over what was scientific, discarding the dross and selecting the essential, eliminating the false and retaining the true. [10, p. 13]

Next, the report gives an example of reform of mathematics textbooks:

> We divided "higher mathematics" which bourgeois experts lauded as being "tested and flawless" into the essential and the dross, criticizing its idealistic and metaphysical "axiomatized" system while assimilating those useful theorems and formulae. For instance, proceeding from productive activities and taking as clue the struggle, development and transformation of the differential and integral, the two aspects of a contradiction, we created a new system and compiled new teaching material on "calculus." In the past, the concepts of differential and integral calculus were derived from piles of axioms and theorems and were very mysterious and unfathomable. Now the concepts are illustrated by familiar instances in production. For instance, when a bench worker processes a metal piece into a round shape with a file, every single movement forms a short straight line and finally the lines combined result in curves. This process of turning a whole into parts and parts into a whole vividly presents the concepts of differential and integral calculus. Worker students commented after studying: "After all, there's nothing mysterious about

calculus. A mere file pierces the myth. Higher mathematics comes back into the hands of us labouring people." [10, pp. 13–14]

Of course, I myself have not seen this textbook on differential and integral calculus. Even in the case of an objective mathematical truth, the interpretation of that truth can vary according to the person, the manner of approaching the objective truth and the way in which individual theorems and axioms are grasped as a system being different in each case. Some textbooks are written keeping production technology constantly in mind; others unfold their argument pedantically, from theorem to theorem and nothing in between. Still, I do not know of any textbooks which on the one hand are rooted in actual production technology and on the other hand are strongly conscious of philosophy. Such methods should be effective since students are full of revolutionary fervor, provided that they are workers by background.

In any case, if teaching materials are thoroughly reformed by such methods, criticism will not stop at just the educational field but will have to extend all the way to research theory in the natural sciences and engineering. Besides literature and art, there was also criticism of reactionary viewpoints in natural science theory in the Eighteen Articles that were adopted concerning the Great Proletarian Cultural Revolution. The criticism was not forthrightly directed at natural science theory as such but rather was expressed in terms of factory training of former workers as technicians or toward the reform of systems and teaching materials in natural science and technology universities.

The following is a quotation from an article by Li Ssu-kuang, vice-president of the Chinese Academy of Sciences, entitled "Developing Science and Technology with Chairman Mao's Philosophical Thinking," which appeared in the January 1, 1971, edition of the *Peking Review*:

> Having solved the question of serving the workers, peasants and soldiers and following the mass line, scientific workers must have correct methods of thinking. In the field of the natural sciences, there is a constant struggle between dialectical materialism and idealism or metaphysics. Whatever their subjective wish may be, scientific workers will inevitably be under the influence of a certain kind of philosophical thinking consciously or unconsciously once they take up research work. They will be guided either by materialist and dialectical concepts or by idealistic and metaphysical concepts. Departure from dialectical materialism inevitably leads to idealism or mechanical materialism. If this were the case, no science could develop. [8, p. 13]

As far as this quotation goes, Li's views coincide with those of Mitsuo Taketani and Shōichi Sakata in Japan, both of whom have consciously applied dialectical materialism in developing pioneering arguments in the area of elementary particles, including nuclear force theory, two-meson theory, and the Sakata model. To my knowledge, there was very little in the way of such a tradition in China up until the Great Proletarian Cultural Revolution. One feels, however, that this quotation from Li Ssu-kuang is a clear indication that the natural sciences in China will also begin to actively use dialectical materialism as a methodology or world outlook.

Li Ssu-kuang only discusses in simple terms how the metaphysical world outlook has been a barrier to the solution of important problems in geology and how it has driven that science into a cul-de-sac. He has not given any detailed description of an unfolding of some other new kind of geology. Nevertheless, it will be interesting to see how the natural sciences develop in China in the years to come.

III. THE PROBLEM OF REFLECTION OF CLASS ATTRIBUTION IN TECHNOLOGY

When I visited China at the end of 1966 and the beginning of 1967, during the Great Cultural Revolution, I always broached the subject of class attribution of technology with the many people I met. All of them replied, however, that although technicians have class attribution, technology does not. That appears to have been the viewpoint held in common by all Chinese at that time. I argued against it, saying, for instance: "In Japan technicians are struggling. One succeeds in designing a pollution-free plant; another, trapped in conventional technological preconceptions, puts up no fight at all, content to design a plant which—you guessed it—pollutes. Is one not justified in saying that the former has designed a plant oriented toward serving the people, and the latter one oriented against the interests of the people?" They all agreed with me. Still, there was no change in their view that technology is free of class attribution. This view, which holds that technology is neutral, first appeared in *Hungch'i* in June 1962. At that time *Hungch'i* argued that neither the natural sciences nor technology have class attribution and that the opinions of scientists and technicians in their capacity as specialists should be respected.

However, as the Great Proletarian Cultural Revolution raged along on its unrelenting course, caustic criticism began to be directed against the mistaken technology line along which China had been led by technicians wielding "authority" as experts. Although it is doubtful that the opinions of experts are now easily refuted and it is probable that in most cases experts are still respected, it is nevertheless clear that the situation has changed considerably. One should particularly interpret the fact that since Mao Tse-tung's directive of 1968 there has been an urgent need to criticize science line and technology line along "the counterrevolutionary revisionist line of China's Khrushchov" as being an indication that the very content of natural science and technology that has been produced by experts who have not yet rid themselves of the remnants of bourgeois thought is starting to be questioned on a national scale.

At first the focus was on differences of opinion between workers and technicians with regard to individual instances of technology in individual factories, and on disagreement about how to proceed with the job at hand. At that stage there was no systematic emergence of the thought and class attributions of technology. Technicians, on the one hand, divorced from production practice, tried to force on the workers preconceptions founded on foreign books; workers, on the other hand, making full use of the abilities they learned through daily

experience in production labor, made possible what the technicians said was impossible. There was the possibility that this criticism against the experts might have gone no farther than argument about which was more productive or more practical. However, once the stage of radical overhaul of the bourgeois educational system and of attempts to train workers as technicians was reached, it became necessary to question not only the university system but also the very content of teaching materials and to criticize fundamentally the whole system of natural sciences and technology as reflected in these teaching materials. Thus, as we have already mentioned, the problem of the thought and class attribution of textbooks on natural science and engineering came to the fore. And, again as we have already mentioned, the thought attribution of research theory in the natural sciences and technology began to be criticized as well.

Considering this development in relation to the Great Proletarian Cultural Revolution, one feels justified in thinking that the view previously held by all Chinese that "technicians have class attribution, but technology does not," has already in effect been negated. One reason why this view in China held sway for so long lies in the fact that the revisionist line of control of factories by the experts was stubbornly rooted in the Chinese scene. Also, there was the assumption that the natural sciences and technology serve both the ruling classes and the people—a kind of double-edged sword. As a matter of fact, it was the latter that formed the basis of the arguments I encountered during my trip to China whenever I brought up the question of the class attribution of technology.

There is no denying the fact that the natural sciences and technology have the character of double-edged swords. From the Chinese point of view, nuclear weapons, while serving the Chinese people, also serve U.S. imperialism. Microbiology, through application to antibiotics, serves the medical treatment of the Chinese people but at the same time serves U.S. imperialism through application to biological weapons. This is primarily because in the natural sciences and in technology attention is first and foremost directed toward Nature's conformity with natural laws and not society's conformity with social laws; differences in thinking due to differences in social class are not immediate products of study of natural sciences and technology per se. Hence, the question of what classes use the results obtained from the natural sciences and technology and for what purposes must be forcefully posed.

If some areas of natural science, like Newtonian mechanics, for instance, are already considered to comprise a perfected system, there would seem to be scant opportunity for thought and class attribution to get a foot in the door. However, in a field such as elementary particle theory in which consistent fundamental laws have not yet been grasped and all knowledge about the subject is still in a state of flux, thought as to how the essence of Nature should be grasped can determine the direction that scientific inquiry takes when deciding how to strike at the problem and make further progress in the face of the wall of the unknown. In an area such as evolution theory, which encompasses a whole array of sciences, including ecology, physiology, embryology, and genetics, and in which for the time being, at least, experiments per se remain impossible and knowledge is in

a state of flux and confusion, it is only natural that one's view of Nature plays a prominent role. The earth sciences are somewhat similar in this respect. In these areas the very content of scientific theory is enormously dependent upon one's view of Nature; and one's view of Nature, whether one is conscious of the fact or not, is very much dependent on whether one's world outlook is metaphysical and mechanical or based on dialectic materialism. Even the process of formation of Newtonian mechanics saw a heated struggle between Ptolemaic and Copernican as well as Aristotelian and Galilean views of Nature.

A second reason why natural science and technology can be considered double-edged swords is that, first of all, in contrast to the social sciences and social systems, the truth with regard to some perfected system or some partial aspect of an imperfect system can be established beyond a doubt in anyone's mind through experiment and observation; secondly, it is necessary even to the ruling classes to have a positive attitude toward recognizing and utilizing such natural science and technology since without the value of practical use to back it up, this natural science and technology has no commercial value. Furthermore, it is often the case that the ruling classes invest huge amounts of capital and launch great organizational efforts in order to develop new technology, although the same may not always be the case with regard to the natural sciences. The list of technological fields of which this is true is practically endless: atomic energy development, space development, electronics, synthetic chemistry, aeronautics, automobiles, new metals, and so forth. Since the natural sciences create the basis for such technology, both they and technology can even more so be considered double-edged swords.

The reason why the ruling classes must have a positive attitude toward new technological development is that the constant struggle on the part of the people, chiefly workers and farmers, makes their rule unsteady and gives rise to contradictions within the ruling classes, making it necessary for the rulers to get their hands on new technology for the purpose of both exploitation of surplus value and victory in competition and war with other rulers. As I have already said in developing this argument in depth elsewhere, in this case, too, the class attribution of technology is apparent [4]. If one considers nuclear weapons, for instance, alone and separately, they would appear to serve both the Chinese people and U.S. imperialism. If, however, one looks at entire systems of military technology which encompass nuclear weapons as only one component, the Chinese system and the U.S. system are very much at odds with one another, and class attribution in systems of military technology becomes quite apparent. Since Chinese military technology provides material support for operations in people's wars of liberation, not only the small arms and mortars of guerrilla troops but even the sticks and stones the people can get their hands on are important elements of military technology. And in terms of destructive capacity, the whole system of military technology looks like a mountain with extensive skirts made of such extremely simple military technology and a peak which consists of nuclear weapons. In contrast to this, the U.S. system of military technology is definitely centered on nuclear weapons and missiles. The entire system is based on using

this destructive capacity to awe and intimidate the peoples of other countries. If the parts are taken separately, there is no apparent thought or class attribution. If the whole is viewed, however, such attribution is quite apparent. The same kind of thing is true with respect to natural sciences.

A third reason why technology can be considered a double-edged sword is that its application and planning tend to be viewed merely as means of raising production efficiency. Granted, technology is the uses to which given machinery and devices are put in order to accomplish particular goals. There is a great difference in the operation of the machinery, however, between the case in which considerable attention is given to the safety of the workers operating the machinery and to their growth through labor in terms of thought and technical skill and the case in which such attention is lacking, the only goal being to raise immediate production efficiency. If the machinery is operated in a reckless fashion without regard to the safety of the operators, then maintenance and safety technology will be made light of; and if the growth of the workers is ignored, job assignment will simply dictate the stabilization of simple rote labor with no opportunity whatsoever for worker improvement. This can be called the bourgeois application of technology.

The same is true of planning. If no substantial attention is given to devising safety measures and means of disposal of waste, accidents on the job and pollution are inevitable, no matter how much care is taken during actual work operations. This is what I meant when I emphasized during my trip to China the difference between polluting plants and non-polluting plants. Plants which are bound to cause job accidents and pollution ought to be recognized for what they are—technological planning which is against the interests of the people.

Generally speaking, under capitalism it is common sense to attach importance only to accomplishing given production goals with complete disregard to other matters. The revisionist line in China was also, essentially, based on the same kind of thinking. If this "common sense" is accepted, there can be no such thing as two distinct lines in technological development and it makes no sense to talk about class attribution in technology, for by definition, the only technology possible is that which gives the highest production efficiency. It seems to me that the view formerly held by just about everyone in China that technology has no class attribution was a natural conclusion led to by such a revisionist line.

If, in this way, all that is done is to import ready-made systems of technology, make reprints of the same thing, or at most make only partial improvements—all because of the fact that the greatest importance is attached to immediate production efficiency and at the expense of bold efforts to open up new, unknown fields—it is clear to anyone that technology has no thought or class attribution and that such a thing is completely superfluous. This absense of class attribution in technology actually is no more than the product of minds incapable of thinking of other possibilities once such a state of affairs is arrived at.

A fourth reason why technology tends to be considered a double-edged sword is that a formalistic separation is made between thought and matter. Technology

is reflected in the machinery and materials used in actual productive labor and in the workers and technicians themselves. These are the three elements of production capacity. They make up the economic infrastructure. The superstructure —composed of law, scholarship, art, etc.—has class attribution; one superstructure cannot serve two different classes. The infrastructure, however, is different; it can. The conclusion arrived at is that technology can serve both U.S. imperialism and the Chinese people.

Technology, however, is not production capacity per se. It is a basic element in productive practice and also a basic element that develops the productive capacity of natural materials by objectifying and materializing through the productive practice the technical knowledge and consciousness of laborers and technicians which are also factors of production capacity. That is to say, the form of technology that appears in the tools of labor, the objects (materials) of labor, and labor itself (the three factors of production capacity) is the result of the consciousness of workers and technicians having been materialized through practice. Since consciousness, of course, belongs to the superstructure and the superstructure has class attribution, it follows that the form of technology that appears in production capacity, a part of the infrastructure, must reflect class attribution insofar as it reflects the consciousness of workers and technicians [4] [2, pp. 308–11]. It also follows, therefore, that a plant, a material thing, embodies the thought of the technician who designed it and that the plant reflects the class attribution of the thought of the designer.

In China at the present time the bourgeois thought attribution of old textbooks dealing with the natural sciences and technology is being caustically criticized. This thought attribution is nothing less than the thought attribution of technicians in the factories, systemized and totalized. And the thought behind the designing of these technicians is materialized in the form of technology in machinery and devices, which in turn reflect the class attribution of the thought behind the designing.

Already in 1937 Mao Tse-tung had expounded upon the relationship between recognition and practice in his thesis *On Practice*. In 1963 in his short essay entitled "Where Do Correct Ideas Come From?" his analysis of recognition, or epistemology went even deeper to consider the relationship between thought and existence and also spirit and matter. In this essay he says:

> Often, correct knowledge can be arrived at only after many repetitions of the process leading from matter to consciousness and then back to matter, that is, leading from practice to knowledge and then back to practice. . . . [Among our comrades there are many who do not] comprehend that matter can be transformed into consciousness and consciousness into matter, although such leaps are phenomena of everyday life. [7, p. 503]

There seems to me to be a considerable contradiction between this portion of Mao Tse-tung thought and the fact that in 1962 the view that technology has no class attribution was generally accepted in China.

IV. NEW TECHNOLOGICAL DEVELOPMENT BASED ON AGRICULTURE AND GUIDED BY INDUSTRY

If in the course of the Great Proletarian Cultural Revolution in China technology is developed on a national scale under such a line, there is a very great possibility that the form of technology peculiar to socialism that we have herein discussed will achieve real development. In the second edition of my book *Gijutsu kakushin no kompon mondai* [Basic problems in technological innovation] I have already discussed China's own brand of technological development as exemplified by the dual application of modern industrial construction and traditional local construction techniques [2, pp. 363–75]. Nevertheless, taking a limited view of the matter, even if there is endless new development of smaller-sized plants and equipment or indigenous techniques characteristic to China, it is also quite conceivable that economic and technological development will bring modernization and larger scale and a consequent decline in the relative importance of technology based on smaller plants and indigenous techniques and that in the end the same form of technology seen in Western capitalist countries will emerge.

Still, as I have mentioned in the same work, Chinese urban and farm community planning is clearly developing along technological lines quite dissimilar to those of capitalist countries. Having already discussed this elsewhere, I will only make passing mention here of the fact that new cities are being constructed in such a manner as to make them not just industrial cities but also agricultural cities, the two aspects being unified into one. Tach'ing is a good example of this. Then again, the people's communes, while continuing to engage chiefly in agriculture, are at the same time beginning to undertake industrial tasks as well as gradually getting to look more and more like agricultural-industrial cities. Both these new cities and transfigured communes are not easily classified as either urban or farm communities if one's thinking is limited to capitalist preconceptions [2, pp. 396–98].

The next indication of the direction which has clearly characterized China's form of technology is the movement for comprehensive utilization of resources which got started about 1970. What is meant by comprehensive utilization of resources is an effort to use all factory waste materials as new resources. This very same thing is what many people in Japan and other advanced capitalist countries consider to be the only basic way of preventing pollution. In China's case it is not necessarily true that the primary goal here is prevention of pollution. One would probably be more correct in saying that the primary goal is to economize on resources and oppose waste. Naturally, here too, there has been a struggle between the two lines.

In their report of an investigation of the Peking Vinylon Mill entitled "Ideological Revolution Promotes Technical Innovation," the Peking Revolutionary Committee and a survey team of the Textile Industry Department gave such comprehensive utilization of resources a prominent place:

> Before the Great Proletarian Cultural Revolution, the handful of capitalist-roaders

> of this mill laid undue emphasis on things big and foreign and wasted large quantities of materials and wealth, leaving the "waste" gas, "waste" water, "waste" slag and "waste" materials unused. The worker comrades pointed out, hitting the nail on the head: "This is purely the style of a bourgeois prodigal son!"
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> After the initiation of the technical innovation movement, there also was a controversy over whether it was necessary to make multi-purpose utilization. Some people said it was "unprofitable" to make multi-purpose utilization. In view of this opinion, the revolutionary committee of this mill and the PLA's propaganda team organized the broad revolutionary masses to study Chairman Mao's great teaching, "The 600 million Chinese people must make effort to increase production, practice economy and oppose extravagance and waste. This is of great significance not only economically but also politically," and to sharply criticize Liu Shao-ch'i's counter-revolutionary revisionist line of "putting profits in command."
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> This enabled the broad revolutionary masses to see that: Whether it is profitable or unprofitable has two completely different standards and answers. [7, p. 134]

The question of what profitability means and what the criteria of profitability are is a basic one with regard to the economics of treatment of waste materials. It is at the same time a basic question of economic thought in connection with the anti-pollution struggle in capitalist countries. In production cost accounting, capitalists have always held down the cost of anti-pollution measures as much as they could. Were it not for popular protest movements, the cost for treatment of waste materials would be practically zero. In other words, factory effluents would be entirely unchecked. If production costs are determined under such a premise, these costs become the company's criteria of profitability, and since production costs would naturally exceed these criteria if, for instance, waste materials were subjected to concentration treatment, the conclusion is that such treatment is unprofitable. The criteria of profitability themselves are the result of the relative power of the two classes.

Now then, is treatment of waste materials really unprofitable? The answer is: not necessarily. When capitalists are forced to tackle seriously the task of concentration treatment of waste materials because of the popular struggle against pollution, they have no choice but to develop technology that will make such treatment relatively cheap as well as marketable products which make use of the waste materials. As a result, it sometimes happens that they make unexpected profits. Such technological development in connection with treatment of waste materials, again, should be recognized as being the result of the relative power of the two classes.

What follows is a further quotation from the report on the Peking Vinylon Mill telling what happened there:

> In the eyes of the bourgeoisie, whatever makes money is profitable; the more money it makes, the more profitable it is. They do not hesitate to waste a great deal of social wealth in order to make money. We the proletariat must not act in this way in running a factory. We should strive to do whatever can create wealth for socialism and increase the state's accumulation. We should take good care and make every possible use of every bundle of silk, every lump of coal, every kilowatt-hour of power and every drop of oil the people have given us.
>
> They extensively roused the masses to adopt indigenous methods and to make use of crude and simple conditions. Within a very short period of time, they suc-

> ceeded in realizing 24 items of multi-purpose utilization, re-collecting large quantities of used sulphuric acid, methyl alcohol, oil, surplus heat, clean water, waste gas, coal slag, etc., creating a wealth of more than 600,000 *yuan* a year for the State. [7, p. 134]

To the Peking Vinylon Mill, as well, raising current production efficiency and securing profits is an important matter, for such profits are necessary for the mill's subsequent construction and development, for the welfare programs for its workers, and for financial contributions levied on it by the state. However, if the vinylon mill alone succeeded in raising its current production efficiency and realized large profits while the production efficiency of other plants in related areas remained at a neglected low level, while perhaps the production of other plants and even of agriculture was adversely affected by pollution from this mill, or while resources were being wasted, in the end the production activity of society as a whole would be held to a low level. Such a state of affairs is unacceptable in a socialist planned economy. If the productivity of plants making sewed products is low, vinylon thread and cloth will pile up as unused stock and the high productivity in vinylon will be cancelled out. If agricultural production is hampered, the plans for assistance to agriculture by industry are worse than nullified. If resources are wasted, future development of society's production activity is obstructed. In a planned economy, therefore, giving first consideration to current production efficiency and profits does not make sense. Furthermore, since under socialism enterprises do not go bankrupt, personnel curtailments are very rare, and there is no stimulus to make profits in order to avoid the collapse of the enterprise, the enterprise does not find itself in a situation in which it is forced to raise productivity regardless of the concomitant effects this will have. If it were in such a situation, it would find that its operations were successful in terms of neither socialist nor capitalist standards. It would not be able to overcome bureaucratism and would find it impossible to surpass capitalist enterprises in terms of current production efficiency. Soviet socialism has fallen into this predicament. To enterprises under socialism, there is only one road to development: to serve the people and contribute to the national effort to achieve the revolutionary transition from socialism to communism (the Great Proletarian Cultural Revolution is a milestone in that transition) and eventually the world revolution.

Since the Peking Vinylon Mill probably summoned its entire personnel, economic, and technological capacity in attacking the problem of multipurpose utilization of waste materials, no doubt its profits declined at the outstart. I do not know whether the stated figure of 600,000 yuan of wealth is the total price of the products obtained through the treatment of the waste materials or that price minus the cost of materials used in the processing and labor costs. Even if it is the former, it doubtlessly exceeds the cost of the material and labor input. In any case, one is certain that the vinylon mill has, at the cost perhaps of immediate profits, achieved multipurpose utilization of resources and furthermore headed out in the direction of improving both the quantity and quality of its

products through new technological innovation born of the creativity and ingenuity of the masses.

Attention should be drawn here to the fact that within the movement for complete concentration treatment of waste materials with a view to multipurpose utilization of resources lies the possibility of gradually forming a technological system for complete artificial cycling of industrial products and raw materials. There will have to be progress in the development of not only technology for separation of the components of the waste materials but also technology for utilization of those components, and with such progress, great changes in the very principles of the production processes of the enterprise's major products will be possible. Furthermore, moves to build agricultural-industrial cities of the new type in a dispersed fashion and as a rejection of large urban concentration will go hand in hand with such multipurpose utilization of resources. If factories are concentrated in large cities, even with complete concentration treatment of waste materials the limits of disposition through diffusion mechanism of the nature that either surpasses the concentration capability of the individual plants or is for some reason not completely disposed of in the concentration process are overstepped because of the number of factories, and this inevitably means pollution of the environment. Having many smaller cities scattered throughout the country makes effective such natural disposal through diffusion of this kind of pollution and guarantees the possibility of developing artificial cycling of industrial products and raw materials in integration with the natural cycle.

However, concentration of factories has been the result of an attempt to increase current production efficiency substantially by means of concentrated management. Attempts to disperse the factories over wider areas will mean an inevitable decline in production in efficiency if conventional technological thinking is adhered to. For this reason, in order for China's system of technology to develop along these lines, the Chinese will have to address themselves to the problem of development of new technology which will make possible high productivity in spite of such factory dispersion. Furthermore, the fact that Man is ultimately dependent on life resources for the raw materials necessary for his food, clothing, and shelter makes long strides in the development of agricultural, forestry, stockbreeding, and fishery technology imperative, and the development of such technology will be guaranteed by the integrated development of an artificial cycle along with the natural cycle [4] [3, Chap. 4, Sections 4 and 5].

In this sense, too, significance is added to China's basic policy of having its economy based on agriculture and guided by industry. It seems to me that this basic policy is not simply based on the fact that China is a socialist country or that the relative importance of agriculture in its economy is extremely great, but rather that it represents a basic guarantee of new technological development in terms of the whole world. Not only industrialization of agriculture but also "agriculturalization" of industry will be necessary if the integrated development of both an artificial and a natural cycle is to be made possible. It would be a basic mistake to ignore future possibilities of technological development in agri-

cultural, fishery, etc. industries and view these industries as being has-been ones and farmers and fishermen as being has-been people. It seems to me that the Great Proletarian Cultural Revolution is preparing the ground on a national scale for creation of a new system of technology in China. It should not be too long before a new form of technology peculiar to socialism begins to show its face there.

I would like to end this discussion with a quotation from my book:

> If the day arrives that Chinese science and technology completely surpasses the level of capitalist countries, it will be because China's research and educational arrangements will have become completely different from those of capitalist countries, scientists and technicians having become portraits of revolutionary man, the logic of science and technology having been permeated by dialectic materialism, and scholastic discipline and achievement having become quite dissimilar to that of capitalist countries. [2, p. 421]

It would seem that the possibility that such a day will come is being gradually enhanced as the Great Proletarian Cultural Revolution proceeds along its course.

REFERENCES

1. HOSHINO, Y. "Dainiji sangyō kakumei to kagaku gijutsu no hatten" [The second industrial revolution and the development of science and technology], in *Iwanami-kōza sekai rekishi* [Iwanami course series: world history], No. 23 (Tokyo: Iwanami shoten, 1969).
2. ————. *Gijutsu kakushin no kompon mondai* [Basic problems of technological innovation], 2nd ed. (Tokyo: Keisō shobō, 1969).
3. ————. *Gijutsu to ningen* [Technology and man] (Tokyo: Chūō kōronsha, 1969).
4. ————. Introduction to *Taketani Mitsuo chosakushū* [Collected works of Mitsuo Taketani], Vol. 4 (Tokyo: Keisō shobō, 1969).
5. ————. *Gijutsu no taikei 2* [Technological system 2], Iwanami-kōza kiso-kōgaku [Iwanami course series: basic engineering], No. 19 (Tokyo: Iwanami shoten, 1971).
6. ————. "Sengo kagaku gijutsu no shisō" [Thought in postwar science and technology], in *Kagaku gijutsu no shisō* [Scientific and technological thought], ed. Y. Hoshino (Tokyo: Chikuma shobō, 1971).
7. "Ideological Revolution Promotes Technical Innovation: Report of an Investigation in Peking Vinylon Mill" (*Hungch'i*, 1970, No. 6), *Selections from China Mainland Magazines*, No. 684 (1970).
8. LI SSU-KUANG. "Developing Science and Technology with Chairman Mao's Philosophical Thinking," *Peking Review*, 1971, No. 1.
9. MAO TSE-TUNG. "Where Do Correct Ideas Come From?" in *Selected Readings from the Works of Mao Tsetung* (Peking: Foreign Languages Press, 1971).
10. The Workers' and People's Liberation Army Men's Mao Tse-tung Thought Propaganda Team in Tsinghua University. "Strive to Build a Socialist University of Science and Engineering," *Peking Review*, 1970, No. 31.