THE SCIENTIFIC AND TECHNOLOGICAL REVOLUTION: SOCIAL EFFECTS AND PROSPECTS

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The present collection, prepared jointly by the Soviet Academy of Sciences Editorial Board of *Social Sciences Today* and Progress Publishers, deals with the social aspects and prospects of the current revolution in science and technology. The collection contains articles by prominent Soviet scholars specialising both in social and natural sciences. They deal with problems of current interest, such as the role of science in society today, the impact of scientific and technological progress on the development of social relationships, and in different social formations. The book is a completely up-to-date review of the key tendencies of research being carried on in the Soviet Union, where all-round application of the results of the technological revolution is a matter of major importance for the state, the Communist Party and other mass organisations. Some articles of a comparative nature show the effect of the scientific and technological revolution on the development of socialist society and on socio-political processes in the capitalist world and the developing countries as well. Several special contributions are devoted to a critical analysis of the Western latest conceptions of social development.

НАУЧНО-ТЕХНИЧЕСКАЯ РЕВОЛЮЦИЯ:
СОЦИАЛЬНЫЕ АСПЕКТЫ И ПЕРСПЕКТИВЫ

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FOREWORD

The current scientific and technological revolution, its social aspects and prospects, already command world-wide interest. Its problems are of concern not only to scientists but to the public at large. It is actively invading the social, economic and other spheres, affecting all classes, government systems and mass organisations. It is exerting an ever greater influence on the destinies of nations, an influence that will ultimately be felt by every human being on this planet.

This is in no way surprising, for the current rate of technological advance betokens a qualitative leap in our understanding of the laws of objective reality and in the development and use of the means of production, a leap which is attended by sweeping economic and social change. The progress of science and technology and their practical applications have become a major field of competition between the two world systems. In the course of the scientific and technological revolution the fundamental distinctions between socialism and capitalism stand out yet more clearly and the present age is revealed as one of a world-wide movement from capitalism to communism.

In the Soviet Union and other socialist countries, the introduction of science in diverse spheres of social life and the increasing utilisation of scientific and technological progress to provide for rapid economic development and a

higher standard of living for the people is an objective law of social development. Such harmonious and purposeful use of science and technology in the socialist countries for the sake of general prosperity is in contrast to the acute social conflicts that technological advance breeds in the capitalist world. One cannot but agree with Academician M. Millionshchikov who observes in one of the contributions to this book that "in the final analysis, the scientific and technological revolution is incompatible with social injustice; it will emerge as the crucial test in the great school of human history which, in our profound belief, socialism alone is able to pass" (p. 28).

Soviet social scientists are deeply involved in the study of various problems advanced by the current scientific and technological revolution. What are the general theoretical and methodological problems that it raises? What are its specific features? Its social aspects? The prospects of its development in the socialist, capitalist and developing countries? From what, and how accurately, is it possible to forecast its direction and results through different social formations? What general and specific social conditions work in its favour? How and with what intensity does it effect the development of social relationships, social progress? What effect does it have on culture, on the development of the individual? What factors determine the increasing social role of science under contemporary conditions? Examination of these and similar problems is a most urgent task for Soviet scientists. And this task has not only theoretical but practical implications, since the building of communist society in the Soviet Union is based on all-round utilisation of the latest achievements of science and technology.

The present book, prepared jointly by the Soviet Academy of Sciences Editorial Board *Social Sciences Today* and Progress Publishers, is designed to show how Soviet scientists

are going about this task. The articles have been contributed by a representative team of experts, including philosophers, economists, historians and sociologists, thus providing a comprehensive discussion of the issues involved, and presenting a full-scale picture of the social effects of the advance of technology and science as a whole.

This collection purports to show, above all, how Soviet scholars understand the interrelation between technological and social progress, the social and political headsprings of the scientific and technological revolution. The authors proceed from the fact that this vast process is a natural outcome of the development of the productive forces and international social development in the present historical epoch of transition from capitalism to socialism. The class struggle, the race between the two socio-economic world systems are, as Soviet scientists see it, the social groundwork which has caused, and which explains, the distinctive features of the rapidly developing scientific and technological revolution. It engenders essentially different processes in socialist society, on the one hand, whose social progress is integrally linked with the progress of science and technology, and in capitalist society, on the other, in which such progress results in a polarisation of society, intensification of the class struggle, extension of the social base of the anti-monopoly movement and, in the long run, precipitates the necessary and inevitable revolutionary transition to communism.

For this reason the book includes works of a general theoretical nature, such as "The Crucial Test for Mankind", by Vice-President of the USSR Academy of Sciences M. Millionshchikov and "Leninism and the Scientific and Technological Revolution" by S. Trapeznikov, D. Sc. (Hist.). The former discloses the basic and specific features of the scientific and technological revolution, throwing light on the interaction between applied and basic research. It

stresses the decisive significance of Marxist-Leninist methodology in dealing with acute problems of the development of science and sets forth the outstanding achievements of Soviet scientists and the singularly favourable conditions that socialism provides for advancing science and promoting its role in every sphere of the life of society. The article by S. Trapeznikov describes the fundamental changes in the relation between science and production, the relation between technological and social progress, and the role of progressive social science in the revolutionary transformation of the world. This article substantiates the essential idea that the scientific and technological revolution sharpens all social collisions in bourgeois society, and shows that scientific analysis of the problems advanced by this revolution bears out the conclusions of Marxism-Leninism on the inevitable change from capitalism to socialism.

Like any other new major development, the scientific and technological revolution, its nature, its social effects and future prospects has become an object of acute ideological struggle. The critics of Marxism strive to use this complex, contradictory phenomenon to indulge in all kinds of theoretical speculations glamourising capitalism, veiling its antagonistic contradictions, belittling the decisive historic role of the working class, and denying the need for a revolutionary remoulding of capitalist society. Trapeznikov emphasises that the heightened activity of the bourgeois theorists charges all Marxists-Leninists with new responsible tasks.

Professor Y. Chekharin investigates the acute ideological struggle being waged over the vital problems raised by the technological leap forward. In his article "The Scientific and Technological Revolution and Social Progress", he explains the fundamental idea that the accelerated progress of science and technology is a major objective law of the development of socialist society, the condition and basis of

further development of socialist democracy. This article shows the unsoundness of a number of contemporary bourgeois ideological conceptions, such as the theories of "convergence", "technological determinism", and "end of ideology".

In a general methodological article "Marxist Dialectics and Scientific Discovery" Academician N. Semyonov takes the example of a discovery in chemicophysics to show the definitive role of dialectical-materialist epistemology in exploring nature and its objective laws, thus demonstrating the part played by Marxist epistemology in the development of the natural sciences which form one of the components of the current scientific and technological revolution. Another such article is "The Scientific and Technological Revolution and Guidance of Social Development" by A. Akhiezer, C. Sc. (Phil.) which throws light on some of the philosophical problems in this field arising from the rapid progress of science and technology.

The social role of science in the context of the present day is discussed in the article "Specific Features and Social Consequences of the Scientific and Technological Revolution" by V. Marakhov, C. Sc. (Phil.) and Y. Meleshchenko, D. Sc. (Phil.). The authors emphasise that the current revolution embodies two revolutions, one in science and one in technology, taking place concurrently. Is this a "second industrial revolution", as some people maintain? The authors come to the conclusion that this is the final burst of speed in a process of socialisation of production that began with the industrial revolution of the 18th and 19th centuries. Their article also sheds light on the mounting conflict between the biosphere and technosphere under the onslaught of technological innovation.

The role of the scientific and technological revolution in socialist society and the prospects of a further impressive economic upswing of the world socialist system are dealt

with in the article by State Planning Committee Chairman N. Baibakov, D. Sc. (Techn.), entitled "Socialist Planning and Soviet Economic Development", and in the articles "Socialist International Division of Labour" by G. Sorokin, Corresponding Member of the USSR Academy of Sciences, and "New Horizons of Scientific and Technological Progress in the CMEA Countries" by K. Mikulsky, C. Sc. (Econ.). Using varied past and current data, N. Baibakov shows how socialist planning in the Soviet Union has come to be a major factor in accelerating its economic, scientific, technological and social progress. The article supplies detailed information on the Soviet economy, its urgent problems and the ways of handling them, on further improvement of planning and on the role of scientific forecasting. Proceeding from Marx's definition of the "division of labour", G. Sorokin considers the current social situation, pointing out the essentially new features of the division of labour that have emerged in the process of building socialism on an international scale. G. Sorokin's article is supplemented by K. Mikulsky's article, which turns to the prospects of extending economic, scientific and technological co-operation between the socialist countries.

The articles "The Scientific and Technological Revolution and Aggravation of the Contradictions of Capitalism" by S. Dalin, D. Sc. (Econ.), and "The Scientific and Technological Revolution and the Social Structure of Capitalist Society" by N. Gausner, D. Sc. (Econ.), deal with the concomitants of the scientific and technological revolution in the capitalist world, demonstrating, among other things, that this revolution runs counter to the very nature of the exploiting system of society. Dalin and Gausner show that, far from being swept away by the scientific and technological progress, social conflicts and class contradictions become sharper under state-monopoly capitalism. They analyse the new forms which such conflicts assume owing to the

increasing involvement of diverse sections of society in the anti-monopoly movement.

In discussing the effect of the scientific and technological revolution on the developing countries V. Kollontai, D. Sc. (Econ.), comes to the conclusion that it tends to aggravate the developing countries' social and economic problems. He examines the solutions that may be found in the present changed conditions, citing the experience of the socialist countries and showing that the non-capitalist path has every prospect of success because it is consistent with the new revolutionary tempo of scientific and technological progress.

The three concluding articles take issue with the latest Western bourgeois theories of social development. I. Dvorkin, D. Sc. (Econ.), in his article "The Scientific and Technological Revolution and Bourgeois Economic Theories of Socialism", shows how bourgeois political economists are using the scientific and technological revolution to justify capitalism. He examines and lays bare the essence of various technological conceptions, dwelling especially on that of the "industrial state" theory. In his article "Two Economic Systems: Theory of Convergence" E. Bregel, D. Sc. (Econ.), demonstrates that this theory reflects some actual features of the modern capitalist economy. Is the capitalist system coming nearer to socialism? Indeed, it is. But not as the proponents of the convergence theory allege. In the situation created by the scientific and technological revolution, capitalism, its technology and organisation of production bring nearer the revolutionary transition to socialism. This does not mean, however, that capitalist society is developing any socialist features within its own framework. The author, facts in hand, successfully refutes assertions to the effect that socialism, in its turn, is moving in the direction of capitalism.

The concluding article in this collection, "Man in the 'Industrial Society'" by Y. Zamoshkin, D. Sc., and N. Mo-

troshilova, C. Sc., deals with H. Marcuse's conception. The authors come to the conclusion that this conception fails, in effect, to give any scientific substantiation to the future of radical social reform.

The articles presented here do not claim to be exhaustive. Besides confronting scholars with many new and complicated problems, objective reality calls for reassessment of traditional problems, such as the relation between society and nature, between man and technology, between the individual and the collective, and so on. Soviet scientists study all such problems and phenomena in the context of the cardinal social processes developing in our times, subjecting them to comprehensive examination in co-operation with natural scientists and technologists and drawing on the rich experience of building communism.

The present collection does not claim to be a comprehensive and systematic account of all the social problems of the scientific and technological revolution. Its primary aim is to show the main trends and scope of studies being conducted in the Soviet Union by the combined efforts of practical as well as theoretical workers at all levels. In making their selection the editors have given priority to general comparative studies, discussing the impact of the scientific and technological revolution on the development of socialist society and on the socio-political processes taking place in the capitalist world.

THE CRUCIAL TEST FOR MANKIND

Academician Mikhail Millionshchikov,
Vice-President, USSR Academy of Sciences

> "In order to build communism we must take technology and science and make them available to wider circles."
>
> *V. I. Lenin*

Present-day scientific and technological development, which is now proceeding at a pace that has no parallel in history, is a social and economic factor of the utmost importance. This scientific and technological revolution is no mere background to the struggle being waged to make the world a better place for man to live in; it is more and more becoming a means of that struggle, an effective instrument of social progress.

Therefore, as was stated in the Main Document passed by the International Meeting of Communist and Workers' Parties in Moscow in 1969, "An important requisite for the development of socialist society is to give full scope to the scientific and technological revolution, which has become one of the main sectors of the historic competition between capitalism and socialism."[1]

The practical task set down in the Directives on the Five-Year Economic Development Plan of the USSR for 1971-75, adopted by the 24th CPSU Congress, is "to make broader use of the potentialities, created by the scientific and technological revolution in order to accelerate the development of the productive forces".[2]

To comprehend the tremendous historic significance of this revolution, the great importance of the problems it

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[1] *International Meeting of Communist and Workers' Parties, Moscow 1969*, Prague, 1969, p. 22.

[2] *24th Congress of the CPSU*, Documents, Moscow, 1971, p. 248.

raises in the technological, economic and social fields, we must first take into account the relative historical novelty of this phenomenon and its rapidly increasing role in all spheres of life. This feature of the scientific and technological revolution is directly observable because the changes it brings about are now occurring within periods shorter than the average human lifespan.

Social studies and detailed statistics bear out this intuitive impression of ours. Thus, we learn that 90 per cent of all scientists known to history are our contemporaries. Expenditures on science and technology, the volume of scientific information and other parameters of scientific and technological advance are growing at an even faster rate. This enormous burgeoning strikes us as the more amazing because it has begun in relatively recent times, a mere 30 or perhaps 50 years ago.

How did it all begin? From what origins? A full reply to this question will probably be provided only by the future philosophers and historians of science; yet even now we can take stock of a number of causes that have given rise to this phenomenon.

The most outstanding feature of present-day scientific and technological progress is the establishment of much closer ties and much more rapid interaction between man's activity in getting to know the deeper laws of nature and his activity in producing socially useful goods, that is, between science and industry. In the past, these two areas of human activity were completely or almost completely independent of each other. It took so long for links between them to be formed that many decades would elapse between the appearance of a scientific idea and its industrial application. As a result, science was at times regarded merely as a means of satisfying man's curiosity, as something beyond society's vital interests.

Driven on by their immediate needs engineering and industry developed, for the most part, independently of science and amassed a vast store of experimental data, practical devices and inventions which formed the basis for a gradual improvement in methods of production. The specific methods and even the language of engineers, technicians and technologists who were guided mainly by experience, intuition and tradition, had, it would seem, little in

common with the purely logical, abstract methods and phraseology of the science of earlier days.

It was only when each of these two spheres gradually proved its ability to exert a positive influence on the other, and when the tremendous benefit of that influence was realised, that the rapid process of interpenetration of science and industry began and the common language and common methods which we witness today were established.

The further development of science and the inclusion of industry in the general process of the technological revolution have in great measure been linked with the emergence and extraordinarily wide adoption of a new type of scientific research designed to close the gap that existed between science and industry in the past. This new type of purposeful research, which has come to be known as "applied research", plays a tremendous part in technological advance, converting the new ideas and fresh knowledge about nature provided by science into the projects and designs for new technical devices, which are then realised in industry, transport, communications and other branches of the economy.

Applied research is also exerting an enormous influence on science as a whole, through the development of new measuring and technical devices that scientists now stand in ever greater need of. The steadily mounting role of applied research in science is reflected in the fact that it now accounts for about half of all research being conducted.

This in no way belittles the role of so-called basic research, i.e., research directed towards gaining new knowledge of nature and new forms of the organisation of matter. On the contrary, the history of science has proved beyond dispute that progress in all other scientific research, in technology and industry as a whole, stems in ever greater degree from basic research, providing, as it does, the theoretical foundation of all scientific and technological progress. This is where new ideas and principles are brought forth from which all lines of scientific and technological advance draw strength.

It is now recognised that the farther we penetrate into the structure of matter, and learn, at all levels, the laws of its organisation, the greater the practical results we obtain. Thus, basic research is among the leading areas of human

activity and a source of future radical changes in the life of the world.

Although individual scientific discoveries frequently do not occur just where they are expected, it may be safely said, that at present the most revolutionary advances in our ideas of nature are to be expected in such fields of science as astrophysics, the physics of elementary particles, and biology. Basic regularities as yet unknown to us lie concealed in the vast concentrations of matter located millions and thousands of millions of light years away from us, in the world of elementary particles that are infinitesimally minute in scale and lifespan, and in the marvellously intricate organisation of biological systems.

Of course, nobody can foretell exactly when decisive discoveries in these sciences will be made. However, the rates at which new facts that do not fit into the framework of existing theories are being amassed along with the concentrated efforts of a huge army of scientists using unique equipment—all provide ground for optimistic hopes.

In the last few decades tremendous progress has been made in the development of astronomy and astrophysics, and discoveries of fundamental significance have taken place under the influence of new concepts of the structure of matter obtained in the study of elementary particles, the atomic nucleus and plasma, and also thanks to the creation of powerful means of astronomic observation such as radio telescopes. Thus, a few years ago radio telescopes helped to register intensive sources of cosmic radiation which scientists managed to link up with rather faint stars. A thorough examination of the nature of such radiation led to the conclusion that the objects discovered are located almost at the boundary of the observable region of the Universe, at a distance of 5,000 million light years, and the radiation power exceeds anything hitherto known. To explain the gigantic energies radiated by them from the standpoint of thermonuclear synthesis—the most powerful energy-producing mechanism yet known—it would be necessary to assume that its source must be a synchronous thermonuclear explosion of a hundred million stars, each equal to our Sun in size. Other explanations of this phenomenon lead to even bolder surmises that contradict all existing concepts. This provokes the thought that here we

encounter certain new laws of the behaviour of matter under exceptional conditions.

Another outstanding event in the world of astronomy was the discovery of pulsars, stars that emit radio impulses, light and X-rays. The importance of this discovery lies in the fact that pulsars have a very short period of impulse repetition, which means that their dimensions are minute as compared with the energies they radiate. Astronomy has never had to deal with objects possessing such an immense concentration of energy. The most generally accepted explanation of this paradox is that pulsars are what is known as neutron stars, i.e., each of them is made up entirely of a huge atomic nucleus. The degree to which the physical conditions in such a star differ from anything hitherto known to science can be seen from the fact that a single cubic centimetre of a neutron star on earth would weigh 1,000 million tons. Research into such phenomena, which are linked with insufficiently studied processes of the emission of huge energies, holds out promise of ample new material for an understanding of as yet unperceived basic laws of nature and their possible future application.

In recent decades the world has witnessed an impressive demonstration of the global significance of nuclear-physical research and its profound influence on technological progress. Nuclear physics has served as the starting point of many radical changes that have taken place as a result of harnessing nuclear energy, not only in science and technology but even in international relations.

The results of nuclear research have found application in controlling and automating various industrial processes, in prospecting minerals and in finding new supersensitive methods of analysis, and in other areas of science and technology. Entirely new scientific branches have emerged and developed on the basis of nuclear research, such as radiation chemistry and radiation genetics.

All the past achievements in nuclear physics—advances made at the stage of semi-quantitative ideas of the properties of the atomic nucleus—were merely results of the first discoveries in the study of elementary particles and their interaction. A striving to attain greater accuracy in this approximated picture of nuclear structure and to explain the nature of nuclear forces has brought in its train such a

series of new problems and discoveries in the field of elementary particles that their significance has far exceeded the framework of the targets originally set.

It is generally accepted by experts that the solution of problems which have accumulated since the development of the physics of elementary particles must be accompanied by a revolution in the fundamental views concerning the structure of matter, a revolution whose significance will be commensurable with the appearance of the theory of relativity and quantum mechanics. However, each new step in this field requires highly complex experiments which call for heavy expenditures. In the first place, progress in nuclear physics is now determined by the available giant accelerators of elementary particles (like the proton accelerator in Serpukhov, with a power of 70,000 million electron-volts), many miles long, whose power consumption runs into dozens of megawatts.

The impending revolution in biology is becoming more and more tangible, especially in one of its main lines, dealing with uncovering the mystery of life mechanics, heredity and evolution. The characteristic thing about the present-day condition of science is that the greatest advance towards the solution of these problems, which are of vital importance to all people, is linked with the utilisation of quantitative methods based on the achievements of physics and chemistry and with the penetration into the very structure of living cells and the processes in them. Such major achievements in this field as the cracking of the DNA code, the elucidation of the role played by desoxyribonucleic and ribonucleic acids in transmitting heredity features, and a number of other outstanding discoveries, give reason for hoping that the time is not far off when biologists will find the key to controlling life processes and purposeful changing of living nature. All this holds out a promise of unparalleled opportunities in the fight against disease and hunger in the world.

Of special significance to progress in the main areas of natural science and to all present-day scientific and technological development as a whole are the achievements in cybernetics, which works out the general methods of analysing the logical processes and nexuses existing in nature and society. A great stimulus to the development of cybernetics

was provided by the appearance of computers, which have marked a new stage in raising labour productivity in many spheres of human endeavour. Various functions which were once considered the prerogative of the human brain may now be entrusted to electronic machines. Today no country can successfully develop its economy, technology or science unless it possesses up-to-date computers for purposes of management, information, and so on. Owing to this new branch of science mankind is entering a new stage in controlling a variety of processes.

The overall trend in scientific and technological progress reflects a kind of division of labour between the stages of basic and applied research, technical development and industry. Each stage must ensure continuity and speed in the general scientific and technological advance—from the discovery of new laws and phenomena in nature to technological and industrial innovations.

The sharp decrease in the time required for circulation of the stream of ideas and methods of production has greatly increased the dependence of the general rate of scientific and technological progress on improvements in the entire system of its lines of advance and the rapidity with which work is carried out at each stage. Indeed, since the links between the individual components of this process are becoming the decisive factor, their development should be studied in total. This approach reveals a number of characteristic and qualitatively new features that arise as a result of the greater complexity and the mutual influence of science, technology and industry. The development of each of the components of scientific and technological progress stimulates the development of many other components and, at the same time, is stimulated by the other components.

Thus, research into the structure of solids, which among other things has led to the discovery of superconductivity, has recently made it possible to build magnets with windings made of superconductive alloys which completely eliminate heat losses. It is now practicable to obtain magnetic fields of tremendous tensions in small devices. The creation of such superconductive magnets has given an impetus to many branches of science and technology, including solid state physics.

Other conditions being equal, the overall rate of devel-

opment in individual branches of scientific and technological progress hinges, in considerable measure, on reduction of the time spent on the achievement or introduction of any new advance in each of these fields. The avalanching, geometrically progressive nature of this factor's influence is of great significance. It is this feature that gives such great importance to the optimum planning of scientific and technological development, since within a very short period any substantial errors may cost far more to rectify than modifications introduced at the proper time.

Hence another characteristic of scientific and technological progress—the need for advance along the entire front and the elimination of blank spots on the map of scientific and technological progress.

The highly ramified nature of the connections between individual branches of present-day science, technology and industry, as well as the unexpectedness of new and promising discoveries, means that all branches of science and technology must be maintained in a condition conducive to the acceptance, development and utilisation of new ideas and discoveries.

There have been many instances of new discoveries converting areas of science previously regarded as unpromising, and even forgotten, into arenas of intensive progress.

Thus, the discovery of the principle of coherent radiation generation within the radio and optical bands with the aid of masers and lasers has led to rapid progress in creating perfect crystals, and also in the wave theory of light, although the latter was considered a completed science in the early years of this century; and in a number of other traditional fields. The same discovery has also provided a powerful impetus to further application of the wave theory of light which, for instance, has found expression in such a splendid achievement as holography, i.e., genuinely three-dimensional photography, which is leading up to the three-dimensional films and television of the future.

Although, at each stage of scientific advance, the efforts of scientists and industrial personnel are concentrated on certain major fields, an analysis of scientific development over a lengthy period shows that no concentration of forces and means in individual spheres can substitute for a general

high level of a country's scientific and technological potential, for overall and deep-going progress in science and technology.

Consequently, it is a vital condition for the rapid development both of science and industry that harmonious development be achieved along the entire front of scientific and technological progress—ranging from basic research to production.

Mention may be made of a number of fields where the influence of science has had maximum effect, and where its technological application has been of great practical significance. The complex of scientific research connected with the development of power engineering, for example, provides a vivid example of extensive and deep-going research applied to practical purposes.

The development of power resources, characteristic of most countries and expressed, in particular, in the ever mounting consumption of electrical energy, has created favourable preconditions for progress in large-scale nuclear power engineering. Here the efforts of technologists to design sufficiently advanced, safe and economical types of nuclear reactors and develop sources of fuel for nuclear power installations should provide a solution to the major problem of nuclear power engineering—making nuclear electric power stations economically competitive with conventional power stations. The most promising solution of this problem at present is work on the so-called breeder reactors that reproduce or extensively reproduce nuclear fuel. The use of such reactors will multiply the natural reserves of nuclear fuel about a hundred times, reducing its cost to a fraction of the value of the electricity produced.

The development of effective methods of transforming heat energy into electrical energy is of considerable significance to the future of power engineering. Here the greatest prospect is held out by the magneto-hydrodynamic method of transformation, which is based on a current being excited in hot ionised gas moving across a magnetic field. The successful solution of this problem will be of tremendous importance both in the creation of a fundamentally new type of generator and in increasing the efficiency of conventional power stations. As higher working-gas temperatures

and ever more heat-proof materials are created, the role of this method of obtaining electrical energy will grow continuously, and it may be expected that in future a large share of electric power will be provided by MHD-generators.

The special significance of research in solid state physics is connected with the demands of technological progress and, in particular, the problem of creating new materials required by numerous branches of engineering and industry. The fundamental task in the development of new and advanced construction materials is the achievement of a whole range of properties, such as strength, corrosion resistance, plasticity and so on. The solution of these problems calls for profound theoretical research into the structure of the electron, defects in crystals, the influence of admixtures and the like. Thus, research into superrefined ideal monocrystals has already produced materials with unprecedentedly high mechanical properties which give them many advantages over metals.

No country today can exist without a variety of means and devices for communications and navigation such as radio, television, radar and telemetry. This branch of technology, perhaps, most vividly reflects the latest scientific achievements, particularly in solid state physics. The revolution in radio engineering brought about by the discovery of semi-conductor devices, which have replaced electron valves, is developing towards the utilisation of film elements, entailing further miniaturisation, higher operating speeds, reliability and efficiency in electronic circuits.

These improvements are especially important in computer technology since, when applied to each of the thousands of components, they signify a qualitatively new level of development. The role of computers in science, technology, industry and other spheres of human activity is common knowledge. Hardly a single important scientific experiment or theoretical calculation is conceivable today without the use of computers. Space studies, gas- and hydrodynamic calculations, meteorological research and economico-mathematical studies now depend to a considerable degree on progress in computerisation. It would be hard to find any branch of the economy in which computers were not being used.

In our times of breath-taking scientific and technological progress, due heed should also be given to the rational exploitation and restoration of the natural wealth which is the foundation of mankind's future development. Great attention is now being paid to working out the fundamental principles for the economic and geographical assessment of the development and complex utilisation of natural resources in various parts of the world, including the seas and oceans. One of the main problems, on whose solution advance in agriculture hinges, is that of the study of the soil resources, of increasing fertility on the basis of irrigation, land reclamation and employment of scientifically grounded methods of tilling and fertilising the soil.

The need for biological resources to be more rationally utilised demands further work on the problem of the conservation and reproduction of natural animal and plant populations. Research now being conducted into their number and dynamics, as well as the interrelations between various species of animals and plants, makes it possible to evolve effective measures to counter agricultural pests and carriers of diseases.

When considering the tremendous socio-economic role played by science in human progress, we cannot but take pride in the fact that in the Soviet Union—the first land of victorious socialism—scientific development has become a matter of state importance.

This turning point in the development of Soviet science is closely bound up with the name of Lenin, who constantly insisted that communism and science must go hand in hand, and that communism can be built only on the basis of scientific knowledge. Lenin's confidence in the boundless possibilities of discovering the laws of nature, in the unlimited possibilities of science, is expressed in his words written as far back as 1909 in *Materialism and Empirio-Criticism*: "The electron is as *inexhaustible* as the atom."[1] This confidence exerted a tremendous influence on the shaping of the CPSU's policy towards science.

Lenin considered technological progress and the reorganisation of the country's entire social and economic life on a scientific basis as one of the main conditions for the

[1] V. I. Lenin, *Collected Works*, Moscow, Vol. 14, p. 262.

triumph of socialism. He thought it essential that "learning shall really become part of our very being, that it shall actually and fully become a constituent element of our social life".[1]

A utilitarian approach to the significance of science was alien to Lenin, who did not restrict his attention only to those fields of science that could make an immediate contribution to the development of the economy and to improving the working people's well-being. He showed concern and gave support to all other lines of scientific advance even at a time that was most difficult for the Soviet republic.

This profound understanding of the role of science has ensured the development in the Soviet Union of a broad front of scientific research, ranging from the most abstract fields to concrete technical projects. This approach to scientific development has shown itself to be the only correct one and is in accord with the objective development of the productive forces and of science, which is drawing ever closer to them. It is thanks to such a policy that the Soviet Union has become a pioneer in technological progress, with scientific research attaining an unparalleled sweep. In the USSR today there are almost 5,000 scientific institutions possessing such unique equipment as powerful accelerators of charged particles, nuclear reactors, optical and radio telescopes, ocean research vessels, and highly complex experimental installations for the study of technological processes.

A first-class basis for research into the physics of elementary particles, including the world's largest proton accelerator in Serpukhov, has been established in the USSR. Work is approaching completion on the world's largest, six-metre optical telescope; unique radio telescopes are being built and extra-atmospheric astronomy is developing. The basis for research into all the fundamental areas of physicomathematical, chemical and biological sciences, and sciences that study the Earth and the Universe is being ever more rapidly improved. The intimate links between science and the life of the country—a characteristic feature of Soviet science—have led to the establishment of new branches of technology

[1] V. I. Lenin, *Collected Works*, Moscow, Vol. 33, p. 489.

and industry, which are playing an important part in today's scientific and technological revolution and have exerted a beneficial influence on the development of science itself.

Soviet scientific achievements in a number of fields of aerodynamics and other departments of mechanics, and also in the theory of combustion and explosion made it possible to lay the theoretical foundation for the development of present-day aviation and rocketry. Successful definition of the theoretical fundamentals of chemistry, petrochemistry, and non-organic and element-organic chemistry had provided the theoretical basis for advances in various branches of the chemical industry and metallurgy. Theoretical research conducted by geologists has provided the groundwork for what can indeed be described as a fantastic extension of the country's mineral and raw material resources—one of the essentials of rapid progress in industry.

Work done by Soviet scientists in radiophysics and electronics, optics, solid state physics, the physics of cryogenics, the theory of automatic control and other branches has paved the way for the solution of major scientific and technical problems.

The results of biological research have helped to raise the level of agricultural production and the food industry and have provided the theoretical basis for solving public health problems.

Research by Soviet physicists, chemists and mathematicians has created the necessary preconditions for the speediest harnessing of nuclear energy. A powerful atomic power industry has been established in the USSR, and nuclear weapons that are vitally necessary for the defence of the Soviet Union and other socialist states have been built. The USSR pioneered the peaceful use of nuclear energy and initiated research into the problem of controlled thermonuclear synthesis.

The alliance between science and industry has found splendid embodiment in Soviet successes in rocketry and in one of the most outstanding achievements of our era—man's penetration into outer space. Space studies have not only opened up vast opportunities for research in geophysics, astronomy and other sciences, and enriched our knowledge of the Earth and the Sun, but have also made it possible to solve many important problems of telecommunications,

navigation and meteorology. They have opened up a real prospect of human flight to other planets.

The enormous attention paid in the Soviet Union to the natural sciences and their technological application is in keeping with the rapid growth of their role in society's development which we have been witnessing during recent decades. This in no way belittles the significance of sciences that study society, the individual and various forms of social consciousness. Marxist-Leninist theory is the guideline in the development of socialist society and a powerful instrument for cognising and transforming the world.

The front of research is exceptionally wide in the Soviet Union—from the study of nature's profound laws and phenomena to the work that is directly linked with the concrete tasks of the national economy. Each of these areas is ultimately directed towards getting the knowledge of nature and subordinating it to man, consolidating the economic and defensive might of the Soviet state and enhancing the well-being and culture of the people.

The scientific and technological revolution is making a vital contribution to the world-wide triumph of socialism, a scientifically grounded social system. Its role stems from the dialectical nature of the changes in the material life of society. Indeed, on the one hand, the results of the scientific and technological revolution are too attractive not to be sought after. On the other hand, participation in scientific and technological progress inevitably brings in its train a conflict between all-pervading scientific ideas of the world and the unreasonable, outmoded and unjust social institutions of a society based on exploitation.

Our faith in the future and our confidence in the ultimate victory of socialism and communism are based on the major scientific conclusion drawn by Marxism-Leninism: technological and social progress is incompatible with the system of exploitation of man by man and the principle of private ownership of the means of production, which inevitably give rise to antagonistic contradictions in society. The historical experience of the Soviet Union as well as that of a number of other countries whose economies are organised on socialist lines have fully borne out this proposition. The balanced and purposeful utilisation of the results of scientific and technological progress for the benefit of the people's wel-

fare in the socialist countries leads to a continuous growth of their economic power and to the improvement of social and cultural life.

In bourgeois countries, however, the scientific and technological revolution runs counter to the very nature of the capitalist system, which hampers the establishment of a planned and co-ordinated economy. The course of this revolution will undoubtedly exacerbate such contradictions and increasingly expose the historical obsoleteness of the principle of private enterprise in the age of nuclear energy, electronics and cybernetics.

In the developed capitalist countries, the process of the scientific and technological revolution prepares, on the one hand, the material and technical basis of the socialist society of the future in the form of large-scale industry based on automation. On the other hand, capitalism increasingly discredits itself in the eyes of the working people, since the activities of huge monopolies, dictated by the drive for maximum profits, come more and more into conflict with the national interests, thereby creating the fundamental pre-conditions for the triumph of socialism in the countries concerned. Of course, the concrete forms of that transition depend on a number of causes and cannot be foretold in detail.

At present, the swiftly growing gap between the developed capitalist countries and the developing countries stands out among the contradictions resulting from the domination of the capitalist mode of production. In view of the rapid rate of scientific and technological progress, this gap is growing at the technical, economic and social levels, thus fostering greater exploitation of the developing countries by the big capitalist powers. The natural and legitimate striving of the developing countries to escape the fate of becoming new colonies and to protect their economies from domination by foreign monopolies makes them realise the unacceptability of the capitalist road of development and broadens the basis of socialism in the world.

Although in capitalist countries the scientific and technological revolution is developing in conditions of ever mounting contradictions, it has not ceased to stimulate progress in technology, industry, transport, communications and

other branches of the economy. This fact should not be neglected.

As L. I. Brezhnev said in his speech at the International Meeting of Communist and Workers' Parties in Moscow in 1969, "We have no desire to underrate the strength of those with whom we have to compete in the field of science and technology."[1]

The attainment in a socialist state of a level of labour productivity higher than capitalism's (which is impossible without the all-round development of science and technology) is an important condition of the new system's uninterrupted progress.

The socialist countries still have very much to do for the development of science and technology, for the greater application of their achievements in these spheres.

In the final analysis, the scientific and technological revolution is incompatible with social injustice; it will emerge as the crucial test in the great school of human history which, in our profound belief, socialism alone is able to pass.

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[1] *International Meeting of Communist and Workers' Parties, Moscow 1969*, p. 142.

MARXIST DIALECTICS AND SCIENTIFIC DISCOVERY

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Marx enriched science by his discovery and elaboration of materialist dialectics. Since it is a method of cognition, a method of reasoning, materialist dialectics is equally applicable to the development of all sciences, whether social or natural. Dialectical materialism is fundamental to any conscious attempt to change society, its industry and culture.

Engels was instrumental in developing and applying the Marxist dialectical method to the problems of natural science.

Lenin made an original contribution to Marxist theory by relating it to the new conditions of social life, that is to say, by putting Marx's concepts into practice.

Lenin's behest that we should establish and consolidate an alliance between philosophy and natural science, an alliance equally necessary for both sciences, calls for a clear conception of how they can and must enrich each other.

Further reflection upon this question inevitably suggests the conclusion that the Marxist dialectical method of reasoning is philosophy's most valuable achievement, an achievement it can and must share with natural science. It is from this standpoint that philosophy appears above all as Logic with a capital L, as a theory of knowledge that corresponds with the present level of development of the 20th century natural and socio-historical sciences and their current needs.

Lenin regarded this as the main principle of dialectical materialism. Agreeing with Engels, he stated this concept most emphatically in the following words: "Dialectical materialism 'does not need any philosophy standing above

the other sciences'. From previous philosophy there remains 'the science of thought and its laws—formal logic and dialectics'. Dialectics, as understood by Marx, and also in conformity with Hegel, includes what is now called the theory of knowledge, or epistemology."[1]

Obviously, only such a conception of philosophy can justify the notion of an alliance, of voluntary and fruitful co-operation between philosophy and natural science for the purpose of understanding and transforming the world. Indeed, all the unfavourable tendencies which have variously overshadowed the relations between philosophers and natural scientists may well have been due to the abandonment of Lenin's conception of philosophy, of what philosophy's subject-matter and, consequently, its role in developing a scientific world outlook should be.

Philosophy can play an active role in developing a scientific world outlook only if it is treated like all the other sciences, that is, as a distinct science with its own clearly defined subject-matter, to be studied in the same thorough and specific way as the subject-matter of any other science.

It is quite clear that, contrary to the assertions of some philosophers, philosophy's subject-matter cannot be the "universe", because the universe is cognised by the entire system of natural and social sciences. Such an approach virtually deprives philosophy of its subject-matter.

The conception of philosophy as a distinct science concerned with the "universe" was understandable and justifiable at a time when the natural and social sciences were in their infancy, and had not yet produced, or even tried to produce, any definite view of the world and of man himself. Under those conditions, philosophy was forced to find means to compensate for the inadequate development of the specific sciences, and to construct a special, "philosophical" world outlook which stood *side by side* with specific scientific knowledge and even *above it.* That time, however, is long since past.

During the second half of the 19th century the natural and social sciences matured to a point where they could, with their own resources, produce an integral, coherent concept of the universe and man's role therein.

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[1] V. I. Lenin, *Collected Works*, Vol. 21, p. 54.

Some philosophers occasionally voice the apprehension that if Marxist-Leninist philosophy is identified with Logic and with the theory of knowledge it may lose its significance as a world outlook and come to play a lesser role, and that a break may even result between philosophy and natural science.

No such consequences need be feared if we take a truly Leninist view of Logic. On the contrary, our sciences, our entire culture are being developed through reasoning based on human practice, and the science of reasoning, therefore, retains its universal significance and primary role in the development of a scientific understanding of the world.

The categories of materialist dialectics are meaningful; they reflect the objective world with all its contradictions and interrelations. They are not stagnant concepts, but continue to develop and acquire greater meaning. That is why the application of the system of dialectical categories, dialectics as a method of cognition, to various spheres of science stimulates and develops thinking in these sciences and thus leads to the practical transformation of objective reality.

The proletariat's revolutionary class struggle became meaningful and purposeful only after Karl Marx laid the foundation of scientific communism by applying the method of dialectical materialism to the economic sciences and thus initiating the scientifically grounded ideology of the revolutionary movement.

The concept of the "universe" as the subject of philosophy has impelled some philosophers to invent universal abstract schemes and to produce a slightly renovated natural philosophy. This, as Engels pointed out in his day, is an absolutely useless and in certain circumstances even harmful occupation, because it occasionally leads to attempts to impose upon natural science not only a preconceived pattern of development but even conclusions.

I have no wish to accuse Soviet philosophers, most of whom adopted sound views. Some of them, however, and some others who were not philosophers, rejected, and rather strongly as a matter of fact, the principle of relativity, cybernetics, and the concept of resonance in chemistry. There were also attempts to provide philosophical substantiation for the erroneous general biological theory

propounded by Lysenko, Prezent and others, who wished to dictate to science.

I think this was due to a misunderstanding on their part not only of natural science, but of the very essence of Marxist-Leninist dialectics.

Scientists can finally shake off their superficial positivist interpretation of the results of their own work and the rubbish of nature philosophy and its influence only by accepting dialectics in the Leninist sense of modern materialist logic and the theory of knowledge.

Some natural scientists reason as follows. Our task is to observe and describe empirical facts and to establish their interrelationships, formulating these in the language of mathematics. The important thing is to construct a formally non-contradictory system of equations; how that system is interpreted in respect of a world outlook is entirely immaterial and can well be left to the philosophers, who love "pseudo-problems". Such positivist attitudes are sometimes the result of philosophical naiveté, sometimes of lack of faith in the power of dialectical thinking and man's ability to understand the external world.

But natural science itself has to pay a high price for this attitude. Already at the dawn of the 20th century, the positivist orientation of Mach and Ostwald had begun to interfere with the promising trend in science towards studying the basic causes of phenomena, their intrinsic essence, and their common basis, which is connected primarily with the structure and properties of the atom. It will be recalled that in the 19th century Boltzmann's great discovery of the nature of entropy and its connection with probability evoked a sharply unfavourable reaction from positivist thinkers.

Logic with a capital L (which is, as I have said, Lenin's definition of logic, dialectics and the theory of knowledge as a unity) takes account of the legitimate rights of formal logic. But dialectics, like logic and the theory of knowledge, brings out the true role of formal logic in the development of scientific cognition. The role of formal logic in the advance of cognition is most clearly revealed in mathematics, especially when applied to the processing of data supplied by the other sciences. That is why the relation between logic and mathematics has attracted the attention of both mathematicians and philosophers specialising in logic.

It is rather widely accepted that mathematics is in general identical with formal logic: both mathematics and logic are regarded as a purely formal apparatus of reasoning, as a "language of science" (its "vocabulary" and "syntax"). This view was given its most consistent expression in Bertrand Russell's dictum that logic is the youth of mathematics, and mathematics the maturity of logic. This would be an incorrect view of mathematics, taken as a whole, as a distinct science in its development. But of this more below.

However, in the application of the available mathematical apparatus to the processing of data supplied by other sciences mathematics is indeed a formal-logical apparatus. The apparatus of mathematical logic—precisely because of its purely formal character—has served as the theoretical basis for the creation of modern computing techniques. In principle, all the automated and strictly formalised operations of the human brain without exception can be transferred to a machine, thereby relieving man of a mass of work which requires time rather than intelligence and creative ability. Thus, despite (and, to some extent, thanks to) the circumscribed character of formal logic, its application has had tremendous consequences, which are already engulfing the social sphere as well.

But it is already safe to say that machines will prove powerless in every case involving contradictions which cannot be resolved by purely formal means.

For all the importance of formal logic, it is, however, by no means the main part of Logic with a capital L. Here is the opinion of a group of French mathematicians: "The mode of reasoning which consists in building a chain of syllogisms, is only a transforming mechanism which can be applied regardless of premises. . . . In other words, it is only the external form . . . a language, you might say, which is proper to mathematics and no more. To regulate the vocabulary of this language, to make its syntax more precise, is to do a very useful thing. . . . But—and we insist—*this is only one side* and the least interesting one at that."[1]

The limited role of formal logic in the development of the sciences springs from its "indifference" both to initial

[1] Nicolas Bourbaki, "L'Architecture des mathematiques. Les grands courants de la Pensée mathematique", *Cahiers du Sud*, 1948, pp. 35-47.

premises and to the composition of the "concepts" subjected to demonstrative exposition (that is, to the "content" side of the matter in general, to the "extralinguistic factors"), and this allows it to be used for the most diverse purposes, some unscientific and essentially retrograde. Let us recall, for instance, that the scholastic interpretation of Aristotle's logic has served theologists as a formal apparatus of reasoning and has been used by them for their unscientific purposes (especially in the Middle Ages). One need give no other examples than the scholastics' struggle against the concepts of Giordano Bruno and Galileo.

These premises, and the concepts of the natural and social sciences which reflect them, arise through the interpretation of experiments, the experience of real human activity, and the practice of transforming nature. In certain cases this becomes quite obvious even in mathematics.

Euclid's famous *Elements*, which laid the foundations of geometry, rest on premises (axioms or postulates) which are clearly non-formal. Euclid's axioms are based on reality, that is to say, on the practice of surveying, architecture, road-building, shipbuilding, military science and other similar branches of material culture in antiquity. In other cases it is not so easy to trace the roots of theoretical premises and concepts in mathematics, and it is therefore no accident that the neo-positivists appeal to modern mathematics in their effort to prove that our knowledge has in general nothing in common with objective reality and is purely a mental contrivance. It would be highly important for Marxist philosophers, working in close contact with mathematicians, to elaborate this important epistemological and ideological problem.

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The natural sciences study the properties of matter and set themselves the immediate task of helping man to understand the material world. In the past, this entailed improving the active, purposeful, and clearly reproducible contact between man's thinking and the objects of the surrounding world. Only such contact could lead to formation of the basic postulates and concepts in theoretical mechanics, physics and chemistry, and determine the advance of natural

science as a whole. By the close of the Renaissance conscious, purposeful contact between thinking and the surrounding world, expressed in the shape of experiment, had developed into the definitive instrument of scientific cognition.

Experiment differs essentially from the contemplation and observation of nature to which the thinkers of ancient Greece mostly confined themselves. Experiment must be purposeful, if it is to wrest from nature the answer to a question formulated according to strict theoretical principles. (The result, admittedly, is sometimes quite unexpected, and instead of an answer, nature sets the scientist another problem.) This means that experiment can play a revolutionary role only where it is closely linked with the development of theoretical thinking. It was this close contact between the development of theoretical thinking and the development of scientific experiment that marked the birth of the natural sciences in the modern meaning of the word. Experimentally verified premises were systematically put into the basis of scientific knowledge. And the subsequent development of science assumed the form of a dramatic dialogue between the existing system of concepts and the data yielded by new experiments.

Theory usually develops in such a manner that a new experiment (or more precisely, the old one, now interpreted) causes, or, rather, brings out and reveals the contradictory situation inherent in the existing system of concepts. This necessitates creative thinking of a kind that formal logic no longer provides, namely, dialectical thinking.

Experiments are usually staged to clarify some particular aspects of theory within the framework of the existing concepts. Such inquiries are very useful for the verification and expansion of theory, and for establishing the conditions for its application in practice. However, they do not go beyond the framework of existing concepts; nor do they lead to revolutionary advances in science. Substantial advances in science follow discoveries that come into conflict with existing systems of concepts. The resolution of such contradictions leads to the emergence of new scientific concepts, which are sometimes epoch-making and revolutionise science as a whole. But much more often experiments are of limited significance, ensuring a substantial advance only with reference to some particular scientific question. Nevertheless,

taken together, all these discoveries, major or minor, do in the main determine the revolutionary advance of scientific knowledge.

The Marxist-Leninist theory of knowledge objectively reflects the process of creative scientific endeavour even when that endeavour is spontaneous. When this theory is applied consciously by the scientist, natural science tends to develop at a more rapid rate. This relationship between the scientist's work and the theory of knowledge is much more clearly expressed in the brilliant, though rare works of epoch-making significance.

At the moment, however, I should like to go into this matter with reference to some of the very common "minor" discoveries, confining myself, of course, to those that entail the emergence of a new, albeit specific concept. I intend to cite a concrete example from the history of those "minor" discoveries, and to follow closely the train of thought that leads from the contradiction brought out in the experiment to the emergence of a new concept. As a rule, scientists, in their treatises, never deal with this preliminary process of reasoning. Purely because of this (and not because I attach any special importance to the experiment), I have chosen as an example one of our early studies, namely, the discovery, between 1925 and 1928, of what is known as limiting phenomena in chemical kinetics and the establishment of the concept of branched chain reactions. This discovery was made by myself and my closest pupils, then very young (among them are the present Academicians Y. Khariton and V. Kondratyev and Corresponding Members of the USSR Academy of Sciences A. Kovalsky and A. Shalnikov).

We were to study the phenomenon of chemiluminescence that occurs during the oxidation of phosphorus vapour by oxygen. To detect optimal light emission, the experiments were carried out under low oxygen pressures. Quite unexpectedly we discovered that with the reduction of the initial pressure of the gas mixture down to a certain pressure P_1 (we called this pressure the lower limit), the mixture completely failed to react and, therefore, to emit any light. In that state it could be kept for days without any signs of a reaction. When the pressure was slightly above this limit, the reaction was very rapid, with intensive emission of light.

The rapid reaction at pressure above the limit came to a complete halt as soon as the pressure of the reactive mixture fell to a certain residual level, slightly below the lower limit.

We observed the same phenomena with various other mixtures of oxygen and various combustible gases. The value of the lower limit proved to be dependent on a number of other parameters besides pressure, such as temperature, the radius of the vessel, dilution of the combustible mixture with the inert gas argon, and the number of active admixtures slowing down the reaction. Each of these parameters, when varied smoothly under constant pressure and constant other parameters, has its own limiting value, separating the region of the very rapid reaction from that of chemical inertness.

A phenomenon outwardly similar to our discovery was already known. This is the spontaneous explosion of combustible gases when the temperature rises above a certain critical point. We found it necessary to make a special study of this phenomenon. It turned out that the mixture reacted mildly at a slow, but entirely measurable speed, which increased with a rise in temperature. When the temperature reached a certain critical value an explosion followed. It was found that at a constant temperature there is a critical pressure and even a critical vessel size. In other words, everything looked very much like the discovery I have described.

Our group then began to study the causes of this phenomenon and so arrived at the theory of thermal explosion. It showed that this type of explosion had nothing in common with the limiting phenomena we had observed in the phosphorus oxidation type of reaction. An attempt to dismiss our phenomenon as a thermal avalanche failed (although the thermal explosion theory paved the way for the general theory of combustion and explosion).

Consequently, in our work on phosphorus oxidation we had discovered some absolutely new and unusual phenomena in chemical kinetics which could be called "all-or-nothing" phenomena, with a marked boundary between them. These phenomena were in basic contradiction to all the fundamental propositions of chemical kinetics of the time, which held above all that the rates of all chemical

reactions varied smoothly with temperature and pressure, in accordance with certain universal regularities.

Our first report, published in early 1926, was sharply criticised by the eminent German Professor Bodenstein, then the doyen of chemical kinetics. He wrote that our results were impossible theoretically and contained gross methodological errors experimentally.

We had to go back to our experiment and eliminate all the methodological errors pointed out by Bodenstein. In 1927, we published another and longer article which confirmed and enlarged on the 1925 experiments. Bodenstein thereupon withdrew all his objections, first in a private letter, and then in a public statement. The new facts could be considered well established. The contradiction between them and the existing concepts in chemical kinetics stood out with ample clarity.

Since we had no idea how to resolve this contradiction, we turned to experiment once again to establish with the utmost precision the empirical regularities of limiting phenomena, mathematically expressed. We discovered that all these regularities fitted into the rather simple formula $\Phi\delta = 1$, where δ is the value characteristic of each type of reaction, and Φ is any given, fairly simple combination of the parameters mentioned above (pressure, temperature, vessel radius, etc.). At first, this provided no explanation of the phenomenon in question.

In our case, the molecules of oxygen and phosphorus below the given pressure limit were inert in respect of each other. This could naturally be attributed to the high energy of activation and the low temperature of the experiment. But this implied that such a reaction ought not to occur even above the limit. Consequently, the rapid reaction above the limit, which we had actually observed, had an entirely different mechanism. At this point, we recalled Bodenstein's remarkable discovery, made between 1913 and 1916 in his study of the photochemical reaction producing HCl from the gaseous H_2 and Cl_2. He had demonstrated that for each quantum of light absorbed by a Cl_2 molecule there was produced up to one million HCl molecules (known as the quantum yield), instead of a pair of molecules, as Einstein's formula had suggested and as had frequently been confirmed in experiments with other photochemical reactions. Boden-

stein had called this remarkable phenomenon a "*chain* reaction". After three years of search and failure, Nernst and Bodenstein produced a correct reaction mechanism, which was a brilliant description of all the experimentally discovered kinetic regularities. It introduced into chemical kinetics for the first time the concept of particles with a high reactivity—free atoms and radicals—which are produced when one of the bonds of a molecule is ruptured.

Mechanism of $H_2 + Cl_2$ Reaction

Cl_2 + quantum of light $\longrightarrow$ Cl + Cl } generation of chain

$Cl + H_2 \longrightarrow HCl + H$
$H + Cl_2 \longrightarrow HCl + Cl$ } chain propagation
$Cl + H_2 \longrightarrow HCl + H$

etc.

$Cl + Cl \longrightarrow Cl_2$
Cl + active admixture } chain termination

$H_2 + Cl_2 = 2\,HCl$

Fig. 1

. om the kinetic regularities developed by Bodenstein, it is easy to determine the length of the chain ν, i.e., the value proportional to the rate of the reaction, which is made up of the number of elementary reactions in the chain from its generation to its termination. Both experimentally and theoretically, this value varies smoothly with the variations of all the parameters, and that is why it was of no direct assistance to us in explaining our limiting phenomena, which were characterised by a sharp difference in reaction rates. Nevertheless, we were haunted by the idea or rather, a vague feeling, that the phosphorus oxidation reaction was somehow connected with the concept of Bodenstein's chain reaction.

In our experiments, we were amazed by the fact that the limiting pressure depended on such parameters as the vessel diameter or the pressure of the inert gas admixture, which, seemingly, should have nothing to do with the elementary

steps of reactions. According to our experiments, the limiting pressure P_1 was inversely proportional to the square of the vessel diameter. Here one could make the purely mental experiment of enlarging the vessel ad infinitum. In that case the limiting pressure would tend towards zero. In other words, the limiting pressure would disappear, and the rapid reaction would occur under negligible pressures. This meant that the development of the reaction was hindered by the walls of the vessel. It then occurred to us that the vessel diameter might exert a similar effect on Bodenstein's chain reaction as well. If Bodenstein's chains could be terminated as a result of the capture of atoms and radicals by active admixtures, there was the probability—greater or lesser—that they would be captured by the vessel's walls, through chemosorption. This type of termination of Bodenstein's chains should naturally appear under reduced pressures, when termination in the gas phase was less intensive. This called for an experiment to study the dependence of the rate of the photochemical reaction of hydrogen and chlorine on vessel diameter and pressure. In 1928, these experiments fully bore out our hypothesis. The termination of chains on walls later turned out to be common for all chain reactions.

Towards the end of 1927 we adopted our hypothesis as a basis, without waiting for the results of these experiments. Under this assumption it was not hard to find a mathematical expression for Bodenstein's length of chain. It was at this point that we unexpectedly realised that the combination of parameters Φ in our empirical expression for limiting phenomena was identical with the expression ν, provided the chains were terminated on the vessel walls. A connection between our discovery and Bodenstein's chain reactions became increasingly probable. Our empirical equation $\nu\delta=1$ could thus be rewritten as $\nu\delta=1$. This, as I have said, did not, of course, directly lead us to the solution of the main question. For the length of chain in the Bodenstein-type reaction varied quite smoothly with the diameter, whereas we had a critical diameter d_1 (P_1 remaining constant) below which the reaction did not occur at all, while developing very rapidly above it.

Psychologically, the benefits, however, were very great. The contradiction had become even more precise and acute. If earlier we had had to discover the reason why the reac-

tion could reveal limiting phenomena, we were now faced with the question: why was it possible for a chain reaction, capable of termination at the vessel wall, to show limiting phenomena? The sum of our reasoning and experimenting suggested a one-way path at the end of which, and nowhere else, lay the answer.

At this point, we had a flash of inspiration, seemingly intuitive, though in the light of what had gone before we cannot call it a revelation, for it had been prepared by everything I have described above. When a scientist writes about his discovery he is usually hesitant about revealing the personal aspects of the quest which led to the emergence of a new basic concept. He usually begins with that concept. Hence the myth about intuition, in which he himself may later come to believe.

The really important thing in epistemology, however, is the description of the scientist's preparatory mental work, for that is based on a study of the whole history of thought, beginning with the ancient Greeks. But the Greeks were much less inhibited about describing their process of reasoning than our modern scientists are. Perhaps we should change this; at least, I shall now try to do so. What interests me particularly is the meaning of the vague concept of intuition in the light of dialectics.

I wish I could recall what I was thinking just before that flash of inspiration. I may have been thinking that the properties of the free atoms and radicals in Bodenstein's chains were analogous to the actions of bacteria, which, so to speak, swallow up the original molecules, turning them into the products of the reaction. Suddenly it occurred to me that bacteria were able not only to eat but also to multiply. Just a minute, I said to myself. What if the free atoms and radicals were also capable of multiplying? There it was: there was the answer!

This culminating point set me arguing with myself. Why, I asked myself, should they be capable of multiplying at all? That would call for the appearance of more than one radical in the given elementary act of development of Bodenstein's chain. There should be at least one more or, rather, two more, because in the final count the whole thing comes to dissociation of a molecule into two free radicals. But dissociation requires sufficient energy. Where does that

come from? Well, coincident with the elementary reaction there could be a release of a large amount of energy which some time later, a very short time later, it is true, is diffused into heat. But before that happens it could be used, like a quantum of light, to dissociate a molecule of the initial substance, thereby causing a branching of the chain. But how, precisely? That, I decided, could wait. I was sure that the answer to the contradiction lay in the possibility of the chain's branching.

I do not recall exactly how it was; it may have actually been by analogy with bacteria. In Newton's case we are told it was a falling apple. In other cases it was something else. That is not so important. If a gun is loaded and you play about with it long enough, something will cause it to go off. What mattered was the long train of thought that came before, which clearly brought out and sharpened the contradictions, and not what actually triggered that flash of inspiration.

Now that we had our answer, the task was to formulate our hypothesis properly. Let us assume, then, that each link of Bodenstein's chain may produce with probability δ a branching, giving a secondary Bodenstein chain. In that case, over the whole length of the Bodenstein chain, consisting of ν links, there will appear $\nu\delta$ new chains. This will apply not only to the primary but also to the secondary chains generated in the branching. The expression $\nu\delta = 1$ which determines the limit, means that each Bodenstein chain with a length ν, when terminated, produces an average of one branching which starts a secondary chain, etc. Every termination of the chain is compensated by one branching, making the chain as a whole infinite, so to speak.

Let us assume that we inject into each cubic centimetre of gas one primary free radical to start such an infinite chain. Taking τ to designate the time of the radical's entry into each elementary reaction, we find that we have $\frac{1}{\tau}$ reactions a second. In t seconds we shall have $X = \frac{t}{\tau}$ = molecules of the initial substances reacting. Owing to the great reactivity of atoms and radicals, τ is usually small.

Let us take, for example, $\tau = 10^{-3}$ sec. Assuming further that the pressure $P_1 = 1/100$ atm., i.e., $3 \cdot 10^{17}$ initial molecules in a cubic centimetre, let us calculate the time it will take to bring the reaction up to 30 per cent of conversion: $X_{30\%} = 10^{17} = 10^3 t$; hence, $t_{30\%} = 10^{14}$ sec $\approx$ 3 million years (see Fig. 2).

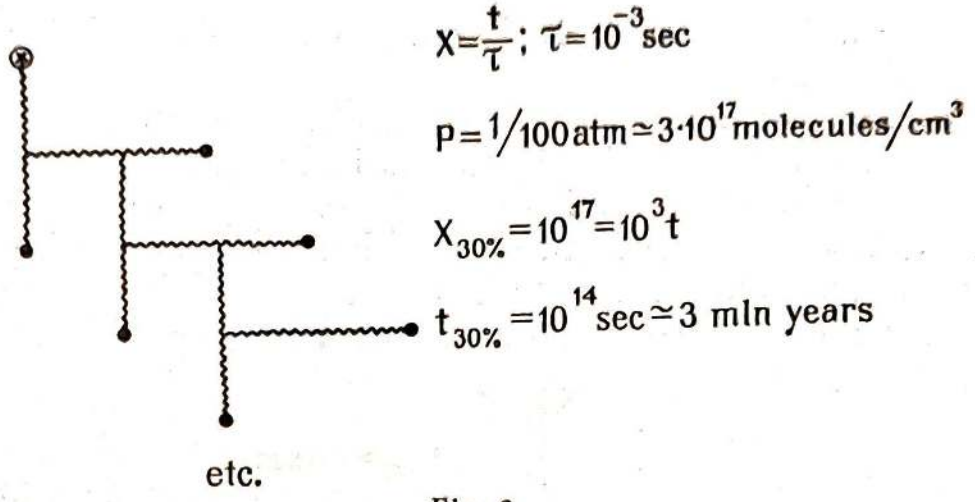

Fig. 2

Let us now assume the initial gas pressure to be above the limiting pressure. In that case, more than one branching will arise on each section of Bodenstein's chain. More chains will originate than are destroyed. As a result, one primary free radical admitted into the gas will produce a chain avalanche, in accordance with the $Ae^{\varphi t}$ law, where the reproduction coefficient φ is proportional to the difference $\delta\nu - 1$ and inversely proportional to the length of Bodenstein's chain ν and time τ.

Even with a minor change in the initial pressure of the mixture, say, by 1 per cent, above the limit and respectively with $\nu\delta - 1 = 0.01$, the avalanche will develop so rapidly, that 30 per cent of the substance will react in roughly 4 minutes (see Fig. 3).

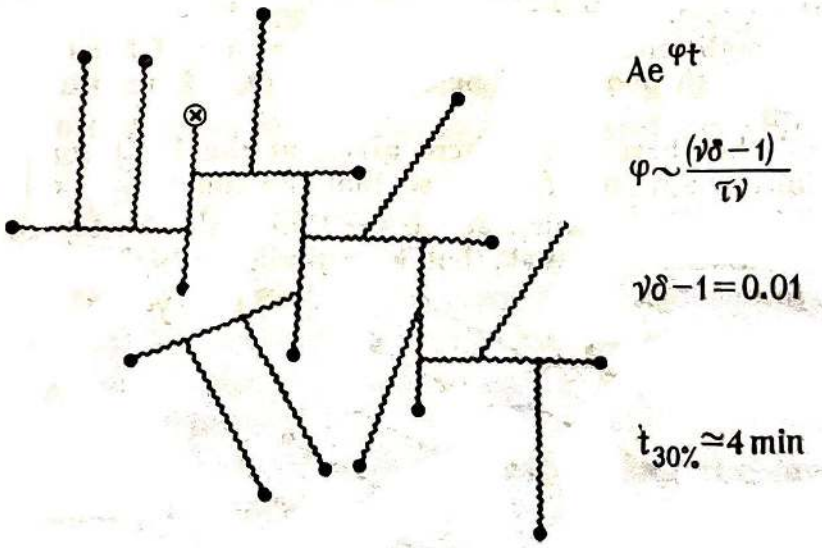

Fig. 3

Naturally enough, below the limit, when $\nu\delta < 1$, and the number of terminations is in excess of the number of branchings, the admission of one radical cannot result in a reac-

tion at all and the incipient chain will quickly be extinguished.

However, in most cases, the reaction above the limit proceeds even faster. After all, the majority of rapid branching chain reactions proceed quite differently from the long Bodenstein chains with rare branchings. The branchings take place virtually on every link of the chain; the chains turn out to be almost continuously branched (see Fig. 4).

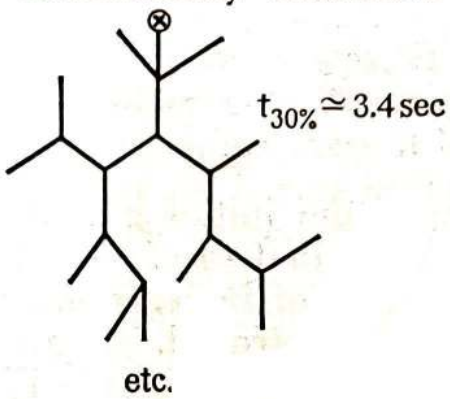

Fig. 4

In fact, the concept of Bodenstein's chain disappears altogether. The amazing thing is that this concept, which was such a great help in solving the contradiction we had discovered, turned out in the end to be irrelevant.

In the continuously branching chain reaction the propagation of the chain is automatically connected with its branching. Each free atom or radical is capable either of disappearing (termination of chain) or propagating the chain, as it enters the reaction. This being so, it is simple to find the conditions for the limits and the rate of the chain avalanche development, both above and below the limit, where pressure varies by $\pm$ 1 per cent.

We find that here again there arises at the limit something like a single infinite chain (see Fig. 5), so that the time $t_{30\%}$ continues to be 3 million years. The reaction above the limit will develop in accordance with the avalanche law $e^{\varphi t}$, but here φ will be higher than for chains with rare branchings.

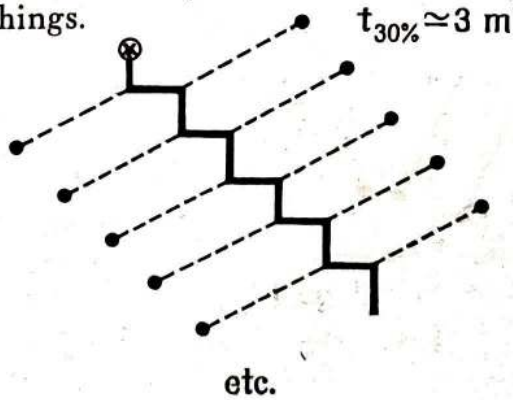

Fig. 5

If in this case we increase the initial pressure by 1 per cent above the limit P_1, the admission of one primary free atom or radical into one cubic centimetre of gas will produce a reaction which takes not 4 minutes, as we have seen above, but roughly 3 seconds, instead of millions of years at the limit.

We have examined an ideal case, where the spontaneous origination of free atoms in a reactive gas does not take place at all, or takes place very rarely, and where the reaction is started by admitting at least one free radical from outside.

If η_0 such primary free radicals appear in each cubic centimetre in a second, it is easy to produce an expression for the rate of the branched chain reaction, and the quantity of molecules X which have reacted in time t, as has been done above. The results are shown in the following table.

	η_0=1 free radical/sec. cm^3	η_0=100 free radical/sec. cm^3
$P=P_1$	$t_{30\%} \simeq$ 1 year	$t_{30\%} \simeq$ 2 weeks
$P=1.01\,P_1$	$t_{30\%} \simeq$ 4 sec	$t_{30\%} \simeq$ 3 sec
$P=0.99\,P_1$	$t_{30\%} \simeq$ 30,000 years	$t_{30\%} \simeq$ 300 years

Consequently, our hypothesis furnishes a good explanation why some chemical reactions are based on the "all-or-nothing" principle.

It would be wrong to assume that once the hypothesis was clearly formulated our work was over. On the contrary, that was when it really began. And it is still going on, in a measure. Step by step the theory has been given increasing precision and clarity, becoming a quantitative theory that has predictive power.

So it was that we succeeded in establishing the occurrence of two types of avalanche-like chemical processes which, in certain conditions, lead to explosion: the thermal explosion, which arises as a result of the build-up of the thermal avalanche, which I have dealt with here in brief, and the chain explosion, which results from the avalanche-like repro-

duction of active chemical particles and free atoms and radicals, whose concentration in the development of the chain avalanche attains, theoretically and experimentally, tremendous values comparable with the concentrations of primary molecules. It later turned out that only these two types of explosion occur in nature. Even in atomic physics, blasts can be only of the chain type (atomic explosion) or of the thermal type (thermonuclear explosion).

I should like to add another remark in connection with my analysis of this discovery. Experiments have shown that the general regularities governing branched chain reactions, notably the "all-or-nothing" limit itself, and the development of chains in time depend very little on the actual mechanism of these reactions. The important fact is that they branch out and that chains terminate. Quantitatively, these regularities also depend on certain constants which can be determined, to their first approximation, from experiments according to the optimal values.

This applies not only to chemical branched chain reactions but also to physical reactions, which include nuclear fission chain reactions and also, in essence, the reactions of multiplication of light quanta in lasers and masers. In the former, the active particles of the chain are the excited compound-nuclei, which arise in the capture of neutrons by the atomic nuclei of active substances, and the neutrons emitted, numbering three for every act of fission of the compound-nucleus. The termination of the chain takes place through the emergence of neutrons beyond the limits of the active body (similar to the termination of the chain on the wall) or the capture of neutrons by certain admixtures. In density, dimensions, admixtures of active substances, dilution with U-238, etc., limiting phenomena are identical with those which are observed in chemistry. The formation of vast quantities of neutrons in the course of the reaction, the exponential growth of the rate of reaction in time during an atomic blast are similar to the corresponding phenomena in chemical branched chain reactions. The "all-or-nothing" principle is here manifested in an especially clear-cut form, and in essence provides the sole basis on which one can build atomic bombs and piles without fear of explosion, and set off an explosion through the insignificant alteration of one of the parameters. The formal relations in our

insignificant-scale chemical phenomena remain true even for these powerful reactions. From the analysis of this discovery it can be seen that it is not so much the confirmation of existing concepts that is of especial importance to scientific cognition as the emergence of concepts contradicting the former. These contradictions are the main stimulus in the development of science. It is a gift of fortune for a scientist to come up against a contradiction, major or minor, and he should seize upon it. Yet, it is so easy to overlook it, to brush it off, especially when a deadline looms for the publication of an article or the presentation of a thesis.

* * *

Let us now pass from "minor" to "major" contradictions, which reveal much more strikingly the principal logical components of scientific discoveries at the time of decisive scientific revolutions. When it comes to changes in the basic scientific concepts supporting the whole edifice of a theoretical system, not only the concepts themselves change but also the logic of thinking itself, the very understanding of what is "logical" and what is "illogical". Here is what Max Born says about it: "The situation here (in quantum mechanics—*N.S.*) is so confused that the only option is this: either to rest content with the feeble adaptation of concepts to the system of formulas ... or to modify the rules of thinking, of logic itself."[1]

At such moments, the theoretical physicist begins to work as a pure logician, as a transformer of Logic. He has to work in the sphere of such contradictory concepts as continuity and discontinuity, interconnection and establishment, time and space, probability and necessity; for the specific purposes of natural science he must modify, develop and review the primary logical categories. This is a subtle business and in the absence of sufficient erudition and philosophical training it is very easy to repeat former mistakes. Engels used to say that materialism changes its form with every great new discovery in science. This is where a developed and properly mastered logic of historico-philosophical thinking ceases to be luxury, a mere pleasant supplement

[1] Max Born, "Bemerkungen zur statistischen Deutung der Quantenmechanik", *Werner Heisenberg und die Physik unserer Zeit*, Braunschweig, 1961, S. 106.

to a training in natural science, and becomes a matter of primary and most acute necessity. One such revolutionary logician was Einstein when he worked out his theory of relativity (revising the concept of time as a logical concept). Another leading revolutionary in logic was Niels Bohr, who, to all intents and purposes, was the founder of the modern quantum theory. His quantum theory of the atom emerged as a result of a bold resolution of the contradiction between Rutherford's planetary model of the atom, introduced virtually straight from the experiment, and classical electrodynamics.

Bohr's principle of complementarity went even further in revolutionising the logic of physical cognition, for it tacitly introduced into the very structure of physical theory the idea of contradiction; at the same time, Bohr's conception of the fundamental epistemological importance of the "instrument-object" relationship to some extent corresponded to Marx's conception of the active epistemological role of the instrument in the cognition of things.

The dualism of wave and corpuscular concepts, discovered by Planck and Einstein in respect of light, was taken by de Broglie to be a *universal* contradiction of microobjects and applied to a description of the motion of electrons (which was shortly confirmed experimentally). De Broglie's conception was one of the sources that gave rise to quantum mechanics.

Our last example is Dirac's anticipation of the positron Attempts to unite quantum mechanics and Einstein's relativistic mechanics had run into the difficulty of having to recognise the existence (because there were expressions containing a square root) of particles carrying a plus and a minus sign, i.e., positive and negative energy. But particles with negative energy seemed to be an absurdity, pure nonsense. It was, therefore, necessary to invent a principle which would rule out their existence in nature and which at the ame time would admit the possibility of their existence. The contradiction was formulated with the utmost logical cision. Using Pauli's exclusion principle, Dirac introduced s "holes in a vacuum" concept (a vacuum filled with a ast number of what were virtually electrons in a state of negative energy). This somewhat obscure concept, literally invented on the basis of a most strictly formulated antin-

omy, was then concentrated into the rational concept of a fully material particle, "the electron with a positive charge", i.e., the positron. But the initial vague and even logically contradictory concept was in fact the nutrient medium, so to speak, which produced not only the concept of the positron but modern relativistic quantum mechanics as a whole in its new and even more striking but, I regret to say, not so stringently formulated antinomies.

The example of Dirac's discovery is a very characteristic one and provides a summing up, as it were, of the creative process of theoretical thinking. From this example, or, rather, this food for thought, one can obtain the clearest possible picture of some of the primary concepts of dialectical logic.

As for the significance of these concepts, let us see whether it is possible to define the actual process of scientific endeavour (say, in the aspects dealt with above) as a process subject to the laws of Logic with a capital L. Every scientist knows that theoretical work is anything but a smooth movement forward and only forward. It may appear to be so from afar, just as the Earth, for example, appears to be an ideal geometric sphere when viewed from outer space, but certainly not to a mountaineer climbing Mount Everest.

The harder a scientist tries to recall "how it all actually happened", the stronger is his impression that it is in general quite impossible to discover any "rational" principle or logic in the development of scientific knowledge and that this development is governed by nothing more than the whims of unrestrained will with its "mad notions". Thus Louis de Broglie writes in his *Paths of Science*: "Human science, essentially rational in its principles and in its methods, cannot achieve its most remarkable conquests except by executing sudden and perilous leaps of the mind, involving the play of faculties called imagination, intuition and perception, released from the hard constraints of rigorous reasoning. Let us perhaps say that the scientist carries out the rational analysis and goes over link by link of the chain of his deductions; he is bound by this chain up to a point where he suddenly escapes from it, and the liberty of his imagination, once recaptured, enables him to look out onto new horizons."[1]

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[1] Louis de Broglie, *Sur les sentiers de la science*, Paris, 1960, p. 354.

This, one might say, makes it clear that formal mathematical logic, while being an effective and invaluable instrument for the solution of tasks of a definite type, proves to be powerless when it comes to explaining the actual process of scientific work leading to the production of new concepts.

If we assume that scientific thinking is "logical" and "rational" only insofar as it proceeds in strict accord with the axioms, postulates and theorems of formal mathematical logic, the scientific thinking that actually takes place inevitably seems to be irrational, so that science itself appears to be a madhouse where only superficial order is maintained by the logician-attendants but by no means by the inmates, whose sole aim is to disrupt it.

If this were so, the whole theory of scientific knowledge would prove to be a purely outward and absolutely inexplicable fusion of two different and irreconcilable sciences—formal mathematical logic and the purely psychological description of intuition.

It would appear that there ought to be trends in science that would provide an exact and specific description of certain universal laws governing the process of scientific reasoning. From the viewpoint of dialectics it is clear that these so-called "mad notions" are essential, logical processes of reasoning.

In fact, whenever the result of a new experiment (or a more thorough analysis of a previous experiment) leads to a basic contradiction within the system of existing concepts, that very contradiction constitutes a determination of the conditions engendering a *hypothesis*; that is to say, the contradiction prescribes a vector of reasoning in the formation of the *hypothesis*.

In short, in any given case we may expect to find the following "mechanism". At first the contradiction within the old theory appears to be rather generalised and vague. Clearly, the new experimental fact, if and insofar as it is understood, contradicts the old theory and the old concepts in general; but it is far from clear where the apex of the contradiction is located and *exactly what* old key principle has to be modified. Gradually, as a result of further experiments and of the refinement of the old concepts themselves (no such refinement had been needed before), the contradiction is sharpened and narrowed down until it becomes

apparent *exactly which* old concept must be modified first. The contradiction acquires the acuteness of an antinomy formulated with the utmost stringency. But this is also a formulation, although only implied, of a negative definition, as it were, of the new concept. It then remains to understand the *positive* content of the new concept, to define it not only as a clearly formulated question, but also as an answer, as a new concept. The new concept is usually a qualitative and basic reformulation of the old initial concept, though it is simultaneously the embryonic form of a new theoretical system. Such is the origin of a hypothesis.

At this point the following new logical cycle begins. Parallel with the verification and confirmation of the hypothesis in the course of countless experimental variations and mathematical concretisation (let us assume that our hypothesis is correct) there follows an examination and enrichment, as it were, of the initial concept alone, and its articulation into a series of interrelated, more specific auxiliary concepts, with the result that the hypothesis develops into a detailed, experimentally verified theory.

From the concrete material I have introduced into this article it will be seen that this logical picture is a legitimate idealisation of the specific process of creative reasoning.

The initial contradiction which destroys the old theory is thereby resolved ("removed") within the new, more profound and specific theoretical understanding which includes the old theory as a particular limiting case. Intuition, thus understood, emerges as nothing else but the form in which a perfectly rational process of reasoning takes effect. The contradiction, therefore, destroys not the theory in general, but only the old, limited theory, or, to be more precise, the illusion that the old theory was a final, complete and concrete ("absolutely true") reflection of objective reality. The contradiction brings out the nodal points within the system of the old theory, in which its *growth points* are concentrated and in which its ability to "grow through contradiction" becomes apparent. Moreover, it is the strictest and most formally perfect movement of thought that arrives at those growth points in which the basic (dialectical) contradiction begins to show, a contradiction which confronts intuition with the task of constructing a hypothesis, that is, reaching

a point beyond which any purely formal movement becomes impossible.

We have tried, by analysing the process of scientific discovery, to show how dialectical logic works and how it helps the scientist understand and refine the actual process of creative scientific thinking.

* * *

The birth of dialectical logic is connected with the names of Kant and Hegel. Kant had already demonstrated that the appearance of a contradiction within a scientific concept was not the result of some regrettable error of reasoning, logical carelessness or imprecision, but a very natural state of the human mind at which the mind arrives because it has observed most painstakingly all the postulates and demands of strict formal logic, or definiteness of concepts. Developing this point of view, Hegel began to examine the logical contradiction as an internal motive force of development, as the "motor" of man's cultural development, in the spiritual and theoretical sphere above all.

Marx purged Hegel's dialectics of its idealistic bias and gave it a materialistic interpretation, thereby laying the foundation of materialist dialectics.

For obvious reasons arising out of his life and struggle, Marx did not have time to refute Hegel's dialectics by an equally systematic exposition of dialectics on the new, materialist basis. Lenin wrote: "If Marx did not leave behind him a '*Logic*' (with a capital letter), he did leave the *logic* of *Capital,* and this ought to be utilised to the full in this question. In *Capital,* Marx applied to a single science logic, dialectics and the theory of knowledge of materialism [three words are not needed: it is one and the same thing] which has taken everything valuable in Hegel and developed it further."[1] In *Capital,* Marx did, indeed, demonstrate to the scientific world, using very concrete material, the tremendous methodological power which materialistic dialectics carries within itself.

It was materialist dialectics that enabled Marx to arrive at a scientific resolution of the fatal contradictions which

[1] V. I. Lenin, *Collected Works,* Vol. 38, p. 319.

were inherent in the classic labour theory of value, and, notably, one of the central paradoxes of that theory: the contradiction between the concept (and law) of value and the concept of profit (surplus value and all its derivative forms).

A strictly scientific formulation of this contradiction suggested a scientific way of solving it, made it possible to formulate a hypothesis, discover its confirmation within the system of economic relations and thereby turn the hypothesis into a strictly demonstrated theory, the theory of surplus value. That was the basis on which a theoretical conception was achieved, which embraced not only the whole of the economy of capitalism but also all the remote consequences of its contradictory evolution, including its inevitable collapse.

We find that, on the whole, Marx's theoretical thinking ran on the same lines that we observe in the development of natural science, with the one difference that Marx reasoned quite consciously, whereas in natural science the dialectical movement of thought is still mainly spontaneous. Hence the fact that natural scientists very often have an inadequate conception of the true logic of their own reasoning. Not having mastered the system of concepts of dialectical logic, they consider their own actions in terms of inadequate concepts, and this hampers, at the critical points in the development of natural science, their quest for a way out of the blind-alley of contradictions.

Marx pointed out that already in capitalist society science becomes an immediate productive force. At the same time Engels noted that under capitalism the development of the productive forces is a menace to society.

In 1918, Lenin stressed that by unleashing the First World War with powerful modern scientific and technical achievements being used for the purpose of destroying millions of human lives, monopoly capital had created a situation which could "undermine the very foundations of human society".[1]

The last few decades have seen qualitative changes in science which vastly increase both its creative and its destructive potential. In former times, science, by analysing production processes and facilitating their improvement,

[1] *Ibid.*, Vol. 27, p. 422.

served production directly. Today, it has another and much more important function. As a result of the experimental and theoretical probing of the mysteries of matter and penetration into the original causes of macroscopic phenomena, modern science has begun to produce basically different, unprecedented means of production and new technologies which surpass man's boldest flights of fancy. Over the last few decades, there has been a steady growth in the pace of development and application of science, offering real prospects of providing for the well-being of the world's population in a relatively short time-span. On the other hand, this development of science, this scientific and technological revolution gives rise to basically new types of weapons of unprecedented destructive force.

If science is to serve the interests of mankind, society and the state must make the welfare of all the working people their main aim and do their utmost to attain it. But the capitalist system is fundamentally incapable of setting, let alone achieving such an aim, because it is an aim that clashes with the very basis and essence of the capitalist relations of production.

Capitalism and chauvinism hold the menace of another world war, which with the existence of modern weapons would, as Lenin warned, be disastrous for mankind.

The transition from capitalism to socialism on a world-wide scale must resolve the profound contradiction between the vast productive forces, including modern science with its two different uses, and the relations of production under monopoly capitalism, which breeds the aforesaid potentially catastrophic phenomena.

Capitalism and chauvinism are currently in contradiction not only with the productive forces; they are actually inimical to human existence itself. Sooner or later, the nations of the world will come to see the objective necessity for the transition to socialism and communism. The ideals of scientific communism, substantiated and developed in the brilliant works of Marx, Engels and Lenin, have already won the hearts and minds of a great part of humanity. Eventually, they will be shared by all.

LENINISM AND THE SCIENTIFIC AND TECHNOLOGICAL REVOLUTION

Sergei Trapeznikov, D. Sc. (Hist.)

The amazing progress of science, which has its material roots in the growth of the forces of production, is one of the salient features of our times. It has enormously expanded man's horizons, offering him new opportunities of discovering the secrets of nature and penetrating deeper into the objective laws of society's development. Indisputably, this is the age of a great scientific and technological revolution accompanied by profound upheavals both in industry and social life. Every new triumph of science further increases its influence on the life of society and accelerates technical and social progress.

The purpose to which progressive forces throughout the world bend their will and reason is to master the laws of nature and use them to further social progress, thus preventing reaction from turning them to evil ends.

In the conditions of socialism the scientific and technological revolution concerns the whole people and is an object of constant attention of the Communist Party and the Soviet government as a decisive sector of communist construction. Today one cannot ensure adequate economic growth rates without conducting large-scale research and applying its results promptly to production. The outcome of the economic competition between the socialist and capitalist systems depends in great measure on the most effective development of the forces of production and full utilisation of the achievements of science in the productive and intellectual spheres alike.

1. The Present Is an Age of Great Scientific and Technological Revolution

Today the scientific and technological revolution has reached an important stage of its development. In the titanic scientific and technological competition against capitalism, the world socialist system must not only maintain its positions but win a victory in the name of progress and prosperity for the peoples. What is likely to contribute to the victory of socialism in this contest?

First and foremost, all-round development of fundamental science, on whose results depend qualitative, epoch-making changes in production and intellectual life. Fundamental or "pure" science, as Marx called it, is a mighty, if unostentatious, force which, when it emerges from the stillness of the laboratories, wields its potent sway with undisputed authority. Applied science, on the other hand, is always in the public eye, always in action, yielding results that are obvious and tangible. It is the force that directly promotes technological progress. Yet, primacy belongs to fundamental science.

It is fundamental science that paves the way for the scientific and technological revolution and gives scope to its development. This is the case today as was the case before. To gain victory over the capitalist world in the scientific and technological race, one must carry on with the general line of further advancing basic research, and building up its material and technical basis.

Soviet science has won leading world positions in a number of major fields. Thanks to its achievements, many branches of the Soviet economy have in their turn reached a high level. Extensive investigation of mineral resources has made available every kind of mineral raw material. The founders of scientific communism foresaw that after the revolutionary forces had broken the chains of capitalism and thus destroyed class antagonism, mankind would concentrate its efforts on conquering the spontaneous forces of nature and placing its resources at man's service. It is generally acknowledged in the USSR that science is becoming increasingly part of the labour process as a major productive force. "If the productive process comes to be a field of *applied science*," Marx wrote, "then, conversely, science comes to be a factor, a

function, so to speak, of the productive process."[1] Marx's scientific insight is being confirmed as remarkably accurate. Present-day research is increasingly aimed at tapping fresh sources of technological progress, finding new ways whereby to expand production, step up efficiency and provide for a steady improvement of the people's material and cultural standards.

The modern scientific and technological revolution has fundamentally altered the relationship between science and industry.

First, recent scientific discoveries have given birth to more advanced technological processes, new branches of industry and new lines of material production. Thus, nuclear research has launched nuclear power engineering, while solid-state physics and high-pressure physics have given us semi-conductors, synthetic diamonds and other new materials that are revolutionising radio-engineering, radio-electronics and instrument-making. As other industries are re-equipped, the character of work changes and workmanship and efficiency increase.

The pattern and scope of modern science call for an enormous development of research facilities. A "science industry" has come into being that uses complex installations and highly sophisticated plant and instruments. Advancing industry, on its part, is forever confronting science with fresh practical problems to tackle. This mutual enrichment of science and technology is becoming an indispensable aspect of man's conquest of nature and is a characteristic of the current scientific and technological revolution.

Second, at the present advanced level of applied and technological sciences the industrial development of scientific discoveries has become a highly intensive process. The interval between discovery and its practical introduction is rapidly shrinking. Thus it took 112 years (1727-1839) for the principle on which photography is based to be put into effect; 56 years (1820-76) for the telephone to emerge; 35 years (1867-1902) for radio communication; 15 years (1925-40) for radar; 12 years (1922-34) for television; six years (1939-45) for the A-bomb; five years (1948-53) for the

[1] From the manuscripts of K. Marx, *Kommunist* No. 7, 1958, p. 22.

transistor; and three years (1958-61) for the integrating circuit to go into production. To this we can add the pungent observation of Sam Lilley, who wrote: "When the world learned in 1945 about the atomic bomb, eminent scientists and eminent politicians were nearly unanimous in telling us that it would take at least fifty years to discover how to 'tame the atom' to the peaceful use of producing power. Yet a 5,000 kw nuclear power station started work near Moscow in June 1954...."[1] And still the distance between research and production goes on shrinking. Prompt practical application of scientific achievements is an essential condition of economic and social progress.

Third, science is rapidly developing within the domain of production as such. More laboratories and research centres appear; an increasing proportion of researchers and graduate specialists are employed in industry, agriculture and other parts of the economy. Science is exerting an ever greater effect on the character and organisation of human labour, society's chief productive force. As science and production draw closer together, scientific and technological progress gathers speed. The results of theoretical research pursued along the main lines of science make it possible to increase the efficiency of every means of production, build up the intellectual potential of industry and provide optimal conditions for new, more progressive scientific trends. The forces and resources of nature may thus be used more and more rationally, by altering the environment, reclaiming land, controlling the water regime, and managing plant and animal life and, ultimately, the climate.

Fourth, there is growing co-operation between different sciences, especially those that had previously little connection with each other. The interaction and interpenetration of many lines of science in the course of research and its practical application are determined by the unity and community of natural phenomena that are fundamental to both living and inorganic matter. For illustration one can quote the example of such "end-to-end" sciences as biophysics, biochemistry, and so on. We find a concentrated expression of contact between numerous sciences in cybernetics, which uses mathematics, physics, chemistry, biology, economics

[1] Sam Lilley, *Automation and Social Progress,* London, 1957, p. 92.

and also computers, etc., to develop the theory of control in diverse spheres of human activity. Because of the continuous differentiation and integration of knowledge now taking place, development of science depends on teamwork rather than individual effort, especially when complex problems have to be tackled.

Fifth, science is moving into every sphere of state administration and economic management. In its work of guiding the state and society the Communist Party of the Soviet Union puts the regulation of social processes on a firm scientific foundation. In doing so, it is obeying one of the principal objective laws of social development under socialism. The need for intensive development and extensive employment of scientific methods in national economic management makes the scientists' responsibility all the greater. Elaboration of the theoretical principles of management of the economic, social and intellectual life of socialist society becomes a major task of science. Individual industries and the economy at large have reached a level where it is possible to manage them only on a strictly scientific basis. Simultaneously it has become urgently necessary to train a special force of scientists to manage science itself.

Sixth, under socialist conditions the scientific and technological revolution turns science into an active element of modern material and spiritual culture. Besides altering the nature of production, it exerts an ever greater effect on social relationships. This implies, above all, a change in the nature of social labour, which, owing to all-round mechanisation and automation, takes on the form of technological process control, thus becoming more and more a matter of the intellect, whether in industry or agriculture. Practical solutions are today available for such major problems of social development as the obliteration of any essential distinctions between town and country, between mental and physical work, and complete obliteration of distinctions between the working class and the peasants, which will turn all citizens of this socialist country into workers of a classless, communist society. This is the direction in which Soviet socialist society is advancing.

In a society rent by class antagonisms and based on human exploitation the scientific and technological revolution

produces jarring results, making the negative features of capitalist production many times worse.[1] Under socialism, however, the progress of science and technology is consciously planned and controlled with the aim of benefiting society as a whole and providing for all-round development of each of its members. History has confirmed Lenin's prediction that "socialism alone will liberate science from its bourgeois fetters, from its enslavement to capital, from its slavery to the interests of dirty capitalist greed".[2]

2. Scientific and Technological Progress Must Serve Social Progress

The steady advance of science and technology is but one side of the matter. The other is that now as before it does not proceed in isolation from social progress but is closely bound up with it. In socialist countries, scientific and technological progress is not an end in itself but is pursued to assert and further optimal social relations, to bring profound social progress which rids man of all forms of class oppression and makes him independent of the spontaneous forces of nature; it is pursued for the benefit of society and the individual.

Ever since science emerged as a distinctive sphere of social activity, society and science have usually marched shoulder to shoulder, even through conflicts, cataclysms and wars. European capitalism sprang up with the great geographic discoveries and strides in astronomy, celestial and terrestrial mechanics, hydrostatics and hydrodynamics, which made it possible to summarise and comprehend world experience of scientific and technological development. It was then that the foundations of modern natural science were laid and it became solidly linked with production.

The growth of science in those days went hand in hand with the technical reorganisation of capitalist production

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[1] The prominent West German sociologist René König states that "not only does the development of technology tinge human labour with compulsion. It also gives social relationships a much more material character". (R. König, "Der Einfluß der technischen Entwicklung auf Gesellschaft und Beruf", *VDI-Zeitschrift* No. 10, 1968, p. 383.)

[2] V. I. Lenin, *Collected Works*, Vol. 27, p. 411.

and paved the way for rapid development of the productive forces. This was conclusively demonstrated by the industrial revolution in Britain, which finally established the capitalist mode of production. Since then science had advanced much more rapidly because it has become a profitable sphere of investment. Engels observed that Watt's steam engine alone paid off in fifty years everything the world had ever spent on the development of science. Even so, later on experience was to show that the chief obstacle to scientific progress lay in capitalist social relations.

Let us now consider some of the characteristic features of the scientific and technological revolution and its connection with the social processes going on in the world at present.

First, it is developing in the epoch of revolutionary transition from capitalism to socialism. As one of the most significant factors in revolutionising the modern historical process, it ultimately tends to consolidate the positions of socialism and contributes to its triumph on a world scale.

Second, it is the pivot of the struggle being waged between the two worlds, the two different systems, socialist and capitalist. It thus presents a double-edged weapon which can be used equally by the progressive forces in the name of civilisation and future prosperity, and by the reactionary forces, for the sinister purposes of suppression and destruction. This polarity of results knocks the bottom out of the conjectures of the advocates of the "convergence theory" and the "one industrial society". The titanic contest of the two systems is sharpened by their rivalry in the sphere of science and technology. It is natural, therefore, that each system and country should be eager to lead and prove the strongest. That is what makes the struggle over questions of the scientific and technological revolution so tense and emphasises the close connection between technological and social progress.

The third characteristic of the scientific and technological revolution is its universality. Whereas earlier revolutionary changes were effected in individual fields of science or technology, the present revolution is all-inclusive, embracing the entire productive and economic life of society, each fresh discovery speeding the progress of science and

technology on its way.[1] And at the same time, the revolution in science organically merges with the revolution in industry and society into one revolutionary process whereby science exerts a mounting influence on every aspect of socio-economic development.

As the social results of the scientific and technological revolution grow more tangible, the significance of Marxist-Leninist theory to all other spheres of knowledge and to people's practical activities increases accordingly. The need for correct social theory and for a more rapid development of the entire complex of social sciences, including philosophy, has come to be more strongly felt not only in socialist but in capitalist countries as well.

Which, it may be asked, is the pre-eminent aspect of the phenomenon—technological progress or social progress?

Marxists-Leninists approach this question dialectically, as interrelated and interacting with other phenomena, and necessarily from a class standpoint. There is only one class in the world, the working class, which, owing to the very conditions of its existence is interested consistently and to the last in making technological progress contribute to social progress, to the cause of the workers' emancipation from exploitation and oppression. This class remains, as before, the best organised and the most revolutionary class.

The bourgeoisie is extremely egoistic in this respect. It also favours technological progress but the one that should not entail any deep-going social reforms. Even in its heyday it had the same conservative approach. Today it has not only become still more conservative but is turning more and more reactionary. Witness the behaviour of the imperialist bourgeoisie in Africa and Asia, where it does not want to part with a fraction of its class interest or privileges. And not only there, but everywhere and always, openly or secretly, the imperialist bourgeoisie has been a strangler of freedom, progress and liberation of peoples.

History shows conclusively that harmonious progress of science is only possible if combined with social progress, and that wherever it is not accompanied by social progress

[1] According to John Bernal, the volume of scientific knowledge doubles every seven years, and according to D. Price, it doubles every ten-fifteen years. (See *The Science of Science*, Moscow, 1969, pp. 269, 289—in Russian.)

it becomes warped and peters out for want of room. And, conversely, whenever technological and social progress have concurred, science has developed swiftly, and society moved ahead. Just as the progress of science and technology combining with social progress produced the changes in the socio-economic system that resulted in capitalism, so did these phenomena subsequently lead to the breakdown of the old, capitalist relations and the emergence of new, socialist relations which prevail today among a third of the world's population.

In the capitalist countries, the scientific and technological revolution is accompanied by a further consolidation of the working class and all the progressive forces as they apply powerful pressure against imperialism and continue to shake its socio-economic foundations. The objective conditions and subjective factors which facilitate the victory of the revolutionary forces are maturing more rapidly. The processes accompanying the scientific and technological revolution in the capitalist world have a marked effect on social patterns and the alignment of class forces in society; on the one hand, certain conditions promote the consolidation of the workers' anti-imperialist alliance, while, on the other, there appears a certain base for the spread of opportunism and greater ideological influence of the bourgeoisie on the working class.

Scientific and technological progress leads to a mass change of professions and skills. Modern technology requires knowledgeable, well-trained workers. In the capitalist countries it results in a proportion of workers, particularly of the older age groups, being ousted from production. There appears a section of "redundant" people who find themselves at a dead end. An appreciable proportion of young people, too, have no chance of receiving proper training and so enter life jobless, without any prospects for the future. Chances are equal that they may be drawn into conscious revolutionary activities or will become just rebellious.

In the Soviet Union the progress of science and technology goes hand in hand with the general social progress that is leading Soviet socialist society to the heights of human civilisation. It contributes to the building of the new, unprecedented type of society that is communism. Socialism

gives unlimited scope to science and technology so that they can advance at a faster rate than under any pre-socialist system. This explains how a country but recently among the most backward in Europe in almost every respect has been able under Soviet government to arrive so quickly at forward positions in science and technology, which, in turn, greatly facilitates the advancement of all social relationships.

But however great the triumphs of Soviet science and technology and however strong their positions in some major fields of modern science, the Soviet Union still has to tackle fresh big problems posed by the scientific and technological revolution. It has to raise standards of labour and management sufficiently to meet its demands. It has to increase the efficiency of socialist production and outstrip capitalism in productivity, which, as Lenin said, is decisive to the triumph of the new social system on a world scale.

It would be an unpardonable mistake to oversimplify the tasks to be tackled in this sphere. One should be fully aware of the extreme complexity of the great scientific and technological revolution now under way. It should be borne in mind that while advance in science and technology may promote social progress and the cause of communism, the imperialist states use this advance to build up their economic and war potential[1] and to accomplish their reactionary anti-humanitarian ends. It is, therefore, vital to progress and communist construction that all branches of natural science and technology should forge ahead even more rapidly and their discoveries be applied more promptly and efficiently for the benefit of the productive forces of socialist society. Hence the need for a clear scientific conception of all aspects and results of scientific and technological advance, for its scientific organisation and management.

3. Marxism-Leninism—the Most Progressive Social Theory

Scientific discoveries and technological advances directly affect social processes by altering people's notions of nature, society and the development of the productive forces, i.e..

[1] It is a fact that 80 to 90 per cent of US Government expenditure on research and development is directly or indirectly connected with war.

by altering social consciousness. History shows that progressive social ideas are central to this process. Forming the front line of society's advance, as it were, they pave the way for the progress of science, technology and social relations, speeding it on its course. Mankind's transition from capitalism to socialism calls not only for a scientific and technological revolution but for an ideological revolution as well. The conflict between the growing productive forces and obsolete relations of production engenders new, progressive ideas which prompt people to fight those obsolete relations.

Lenin observed that "large-scale machine industry, by concentrating large masses of workers, transforming the methods of production, and destroying all the traditional, patriarchal cloaks and screens that have obscured the relations between classes, always leads to the directing of public attention towards these relations, to attempts at public control and regulation".[1] As the scientific and technological revolution goes on, all that is old and conservative in the life of classes and nations collapses, while their mode of thinking, psychology and culture undergo a change.

New social ideas and doctrines precede social revolution, and are among its requisites. The emergence of new social theories and their effect on people's minds, the realisation of science in the sphere of material production and reform of social relations, are merely different aspects of a single process, different ways of speeding up social progress.

Marxist-Leninist theory, the scientific world outlook, which has synthesised and critically digested all that has been achieved by man in culture and science as well as knowledge throughout history, is the summit of progressive social thought, a natural outcome of the entire past and present development of the natural and social sciences. Since dialectical and historical materialism emerged as a science, all the social and natural sciences have increasingly felt its fructifying influence.

Dialectical and historical materialism shines like a powerful searchlight into the yet unfathomed depths of the material world. The conclusions of materialist philosophy are as indispensable to contemporary natural science as they ever were. Elevation of science to new levels of cognition of the

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[1] V. I. Lenin, *Collected Works*, Vol. 3, p. 246.

secrets of nature, integration not only of various branches of natural science but often of the humanities too, co-operation between various sciences on problems of great social significance—all these things entail more extensive and detailed philosophic studies involving a wider range of problems. The interests of further progress of the natural sciences require that Marxist-Leninist philosophy, which is constantly developing and creative in itself, should increase its leading methodological role in their development. According to Engels, true science has always been wholly revolutionary, wholly transforming and ennobling. These are notable characteristics of Soviet science and scientists.

Marxist science, based on dialectical and historical materialism, has existed more than a hundred years now. It reveals to mankind a new society, the most humane society in the world. Those who try to prove, in defiance of facts, that Marxism-Leninism has outlived its usefulness, are beginning to look ridiculous. Such theorists must be blind to the great developments of our own times, so complex and yet so breath-takingly bright with promise.

Of course, as long as imperialism exists in the world, the menace of a catastrophic war remains real. The imperialists seek to keep nations in a state of constant fear. They exploit the achievements of science and technology in their class interests. The bourgeoisie spares no efforts to maintain a climate of amorality, decadence and lack of faith in man's good qualities. It uses the scientific and technological revolution against man, dooming him to slavery and spiritual emptiness.

With the appearance of atomic and hydrogen weapons bourgeois propagandists, eager to distract public attention from burning social problems, have started to breed an atmosphere of fear by alleging that atomic war is inevitable and that all will perish in it. They put their stakes on "atomic diplomacy", intimidation, blackmail and moral corruption. Today the bourgeoisie has started another bogey, trying to suggest—to youth in particular—that science will finally make the human beings superfluous by substituting cybernetic machines for them. Such pessimistic predictions purporting to shift the blame for the conflicts and social ills of "Western civilisation" from the capitalist system to science and technology, far from being confined to science

fiction, are plentiful in many bourgeois sociologists' writings. A few examples will suffice. Professor Kurt Schilling of Munich University writes: "Technology of the third projection, industrialism, transcends the limits of technology altogether. It is fraught, at the least, with a real danger that technology will have the ascendancy of man, instead of the opposite being true."[1] To Jacques Ellul, a French sociologist, the prospects look equally black. Addressing the International Conference on Science and Technology, he said: "In the presence of technology, civilisation cannot develop. All repentance is futile; all hope of being restored to the former state is unreal."[2]

Certainly, when such forecasts come from serious scientists, not from bourgeois propaganda experts, it merely shows that they (the scientists) are bound up inextricably in bourgeois social realities. It also indicates the pressing need for a correct, Marxist-Leninist interpretation of all the significant new phenomena the modern scientific and technological revolution has given rise to.

Scientists are under a growing obligation to preserve the individual from the corroding influence of bourgeois ideology, to uplift him spiritually and morally. Such is the task facing the progressive people everywhere. Of course, bourgeois demoralisation can be wiped out completely only through radical revolutionary social reforms, through a materialist comprehension of social development, on the basis of the Marxist-Leninist world outlook.

Social progress is the watchword of our times, resounding in the hearts of millions of workers, peasants and all the oppressed on all continents. The striving for social progress that has swept broad social strata signifies that the millions reject the bourgeois social order with its discredited economic and political systems and the eternal "pie in the sky" of bourgeois democracy, and that they are looking for paths leading to a more equitable social order founded on socialist ideas.

In other words, the objective world situation is such that all the progressive forces, one way or another, consciously

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[1] K. Schilling, *Philosophie der Technik*, Herford und Bonn, 1968, S. 210.

[2] *Technology and Culture*, 1962, Vol, III, No. 4.

or spontaneously, tend towards socialism. The significance of this objective fact cannot be overestimated. The main thing now is for progressive scientific opinion to show in what direction and by what least painful methods it is possible to attain the cherished goal of building socialism and communism on a world scale.

4. The Collapse of Capitalism and Triumph of Socialism Are Inevitable

Marxism discovered the intrinsic and objective necessity of the continuous historical process of socio-economic formations superseding one another. It was established that no social system could exit before it had begun to drag back the development of the productive forces and, similarly, that no new social system could make its appearance until its prime requisites, economic, political and ideological, had matured in the womb of the old social system.

At the same time, besides objective material conditions, the replacement of one socio-economic formation by another requires the presence of subjective factors, i.e., of mature social forces ready to change radically the entire social and economic pattern of a society. We must note, however, that history provides many instances of an old society having run its course without furnishing any opportunity of further progress, so that no revolution ever took place in it. Such was the case of the Greek and Roman slave-owning societies. What was the reason? It was that in these obsolete societies there was no new class, strong enough to overthrow the slave owners and inaugurate a new social system. Slave revolts merely unsteadied the old system and paved the way for its fall. In feudal times, too, there was not always a new class ready at the right moment to overthrow the feudal lords and clear the way for progress. Such was the case of Russia in the middle of the 19th century.

It often happened in human history that a nation, a society living under certain historical conditions could not continue developing on its old economic basis but still underwent no social revolution for the reasons just described. The result is well known: such a nation or society gradually lost its independence, falling under the domination

of other states or disintegrating. Thus mankind has not always been moving along an ascending line. It has known lengthy periods of stagnation, decline and even decay, when the basic conditions which made possible the existence of society as such were destroyed. Mankind does not stand still; it is in a state of unstable equilibrium. If a society cannot move upwards, it falls down, and if there is no class able to lift it higher, it disintegrates, loses its independence, falls into decay, and perishes.

Objectively speaking, the situation prevailing today in Europe, and practically all over the world, entitles one to state with perfect assurance that the capitalist system—in the broad social sense, not touching any particular phases of development —has exhausted itself.

In bourgeois society, the productive forces develop in a conflicting manner, by fits and starts. Unmistakable signs of disintegration and decay of bourgeois society are becoming more and more manifest all along the line. Of course, the productive forces have not come to a standstill. They continue developing, swinging up and down. But by and large, the curve of the socio-economic, moral and political development of capitalism, fluctuations or no fluctuations, is sagging rather than rising.

By continually revolutionising production methods and investing work with a social character the capitalist mode of production has already created the material prerequisites of socialism. On a world-wide historical scale, the productive forces of the more developed capitalist countries have, in the process of the scientific and technological revolution, gone far beyond the bounds of capitalism, and, in this regard, society is quite ripe for socialism. The fusion of monopoly capitalism and state power has discredited both the bourgeois economic system and the political superstructure in the eyes of the peoples. In other words, capitalism as a socio-economic system has become obsolete and can only go on by resorting to brute force, militarist policies, bribery, blackmail and violence, by manipulation and deception, by taking advantage of the lack of solid unity among the anti-imperialist and revolutionary forces.

Bourgeois ideological and cultural principles have suffered still greater damage. Cultural degradation, intellectual lethargy and amorality sown by the bourgeoisie all come

home to roost. Progressive people refuse to put up any longer with dispiriting emptiness and amorality, and are making every effort to protect world culture, civilisation, and the best traditions of the previous generations. Today all roads lead to social progress, to the triumph of socialism. The future belongs to these forces.

Does this, however, mean that the bourgeoisie will meet its doom automatically, that it is predetermined? Not at all. Noting that the material prerequisites of socialism were quite mature in the epoch of imperialism, Lenin still emphasised that without the subjective factor, i.e., without the revolutionary struggle of the working class and the mass of the working people, capitalism would linger on, rotten as it was. The working class alone, supported by the broad mass of the working people and led by a truly revolutionary party, can overthrow capitalism and bring about the triumph of socialism on a world scale.

This is not an easy thing to do, of course. The bourgeoisie is an active historical force, not a passive product of socio-economic development. Though outdated and a drag on progress, this class is still powerful. Moreover, it knows how to bring the entire pressure of political deception, strong-arm methods and provocation to bear when threatened with ruin. The triumph of socialism in a number of countries of Europe, Asia and America and the mounting popular movements round the world have confronted the bourgeoisie with the prospect of catastrophe. This naturally has sharpened its instinct of self-preservation. So the bourgeoisie does not weaken and sicken as the working class grows and strengthens. It rallies all its forces—the army and police, science and schools, the church and the parliament, the venal press, fascist gangs, renegades and demoralised elements in the workers' movement—and prepares to resist the working class to the bitter end.

Should the bourgeoisie, a class doomed by history, manage to muster enough strength to get the upper hand over the working class, to abolish socialist gains of peoples, the inevitable consequence would be total economic and cultural ruin, such as befell many countries, nations and civilisations in the past. Experience tells us beyond any possible doubt that socialism is the sole force capable of preserving mankind, its civilisation. Modern society must no longer expose

itself to deadly peril. It is as if history itself is saying to the working class and its vanguard, the Communist Parties: "Indeed, the future of mankind is in your hands. Unless imperialist activities are thwarted by the organised strength of the masses, civilisation will be in danger."

Now, the question is how to bring nearer the triumph of socialism, and what forces are to do it. Such forces, indeed, exist. And Marxists-Leninists see them clearly. That is why they take steps to immobilise Right-wing reformist ideology and adventurist leftist ideology, to overcome ideological and political differences in the world communist movement, to organise, stimulate and consolidate the working class, the working people and all the progressive anti-imperialist social forces throughout the world. This done, the movement for social progress will gain momentum, the establishment of socialism on the planet will be facilitated, and lasting peace will be achieved on earth.

The peoples can no longer allow the means of production and the enormous wealth of any nation to stay in the hands of a small privileged class, dooming millions of people to poverty, ignorance, starvation and extinction. The working class, all working people, all far-seeing progressive forces of society are coming to realise ever more clearly that it is private ownership of the means of production that puts the future of mankind in peril. This is the original cause of society's division into classes and the epicentre of intense class antagonism and class struggle; this is the chief source of war, of social and military conflicts. Consequently, the answer lies in waging a struggle for the abolition of private ownership of the means of production, i.e., in waging a struggle for the rule of the working people.

By what methods should it be done? While the advocates of Right-wing reformism delete the point from the agenda altogether, ideologists of the leftist, adventurist trend maintain that it can be settled only by violence, by armed struggle or, to use their own phrase, by a "simultaneous act of world revolution or world war". That this doctrine is purely adventurist and fraught with ruinous consequences is self-evident.

Genuine Marxists-Leninists certainly have never dismissed the question of world revolution and the use of force, including armed struggle, but nor have they ever viewed them

as an end in itself or universalised such methods of struggle. The collapse of capitalism and the triumph of socialism are made inevitable by objective laws. But one cannot tell precisely either when it will happen or by what means it will be achieved. Most probably it will be brought about by various means, depending on the concrete situation and the balance of class forces in each country.

The scientific and technological revolution sharpens all social collisions of the modern world. On the one hand, it raises hopes in the bourgeoisie and its ideologists that the collapse of capitalism may be postponed and social revolution averted[1]; it supports the illusion of the omnipotence of the exploiting class, which has concentrated in its hands enormous productive forces and a powerful state machine. On the other hand, the undivided rule of state-monopoly capitalism and the clearly emerging dangers of mounting militarism and the destructive power of bourgeois society provoke ever stronger opposition from all workers and all honest-minded people.

There is a growing awareness of the indisputable truth that socialism alone offers a way out of the impasse of the contradictions of the bourgeois system, and that radical social reform alone can make the achievements of science and technology serve mankind, not the fiendish forces of destruction and decay. And then, "no forces of darkness can withstand an alliance of the scientists, the proletariat and technologists".[2] Socialism is the safeguard of civilisation, the path to a new and glorious future for mankind.

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Ours is an age in which the ideas of Marxism-Leninism are spreading triumphantly all over the world. Millions of the oppressed and exploited are marching under its victorious banner. It is safe to say that in our times the world progressive forces increasingly rally under the socialist

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[1] West German technicist Kurt Mauel, for instance, believes that the "threatening social revolution can be avoided solely through social development, which is now taking place ... and that technology will play a great role in this evolutionary movement". (See Kurt Mauel, "Technik steht nicht isoliert", *UDI-Nachrichten* No. 22, 1969, S. 18.)

[2] V. I. Lenin, *Collected Works*, Vol. 30, p. 402.

banner of the working class. The peoples fighting against imperialism, for their freedom and independence, are turning away from capitalism. The bourgeoisie itself uses the compromised banner of capitalism less and less, preferring to camouflage it with quasi-popular, quasi-democratic phraseology.

Imperialism has compromised itself on the principal and vital issues of peace and war, of peoples' freedom and independence. The imperialists are rushing about the world, unleashing war now in one place, now in another, adding fuel to the fire. But as history keeps the record of time so do peoples keep the register of imperialism's murderous crimes.

The ideology of militarism which the monopoly interests have adopted among their weapons expresses their true character and inner nature. Imperialist ideologists and propagandists are preaching the aggressive doctrines of "preventive war", "escalation of war", the "balance of fear", "megadeath", etc. Such is the logic of imperialism which is unleashing bloody aggression and hatching a nuclear world war. In this light Lenin's warning that the secrecy in which war is born must be destroyed acquires particular significance.

The irreconcilable struggle between communist and bourgeois ideologies, now more than a century old, shows that universal social progress inevitably leads to the collapse of capitalism and the triumph of socialism and communism. It is evidently their dread of what must inevitably come that causes prominent capitalist statesmen and politicians to make repeated appeals for a "global attack" on communism and a "global barrier" to prevent the spread of communist ideas among the masses.

Having failed to destroy socialism by armed force and having learned from experience that it is impossible to stifle the socialist nations economically, the capitalist leaders pin their hopes on ideological subversion of communism. Never particular about their methods of fighting communist ideas, bourgeois ideologists now display extreme moral degradation. Vile anti-socialist forgeries become instruments of bourgeois ideology. An ever larger number of radio stations, press publications and institutes are throwing their weight into the propaganda drive. Persistent efforts are made to

co-ordinate anti-communist propaganda on a national and international scale.

Under the circumstances it would be wrong to underestimate the enemy. Rising activity of the bourgeois ideological forces poses fresh responsible tasks before all Marxists-Leninists. It is necessary to organise a strong offensive all along the front against contemporary bourgeois ideology, to subject bourgeois views and concepts to detailed, well-substantiated criticism, to expose the class character and reactionary content of bourgeois ideology in whatever shape and form. Communists, social and other scientists have no task more important than to fight tirelessly and consistently for the purity of the great ideas of Marxism-Leninism and creatively develop theory on the basis of historical and contemporary experience, including the achievements of science. The very spirit of revolutionary theory prompts us to follow this line of action. Lenin's ideas lead us onward, to indefatigable creative work and struggle.

SOCIALIST PLANNING AND SOVIET ECONOMIC DEVELOPMENT

Nikolai Baibakov,
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Chairman, USSR State Planning Committee

In the economy of the USSR planned development is the key to progress of the productive forces, to utilisation of the achievements of the current scientific and technological revolution and to the advance, on this basis, of the material and cultural standards of the Soviet people.

The founders of Marxism gave theoretical proof that only the victory of socialist revolution and the establishment of social ownership of the means of production make it possible to create a planned economy, to develop social production according to a single preconceived plan. Lenin developed and concretised all aspects of this proposition and indicated the practical ways of translating it into reality. Since the victory of the October Socialist Revolution in Russia, the creation of a planning mechanism for state guidance of the economy has been a major factor in the advancement of socialist society.

Lenin regarded the planning of the national economy as a function of the Soviet state, of the Communist Party, which heads the building of the new society. He stated at the Eighth All-Russia Congress of Soviets that the political programme of the Party should be supplemented by a programme of economic development, by "a plan of work aimed at restoring our entire economy and raising it to the level of up-to-date technical development".[1]

Lenin conclusively showed that the need for state

[1] V. I. Lenin, *Collected Works*, Vol. 31, p. 515.

guidance of the economy stems from the very nature of social property, based as it is on large-scale machine industry demanding unity and proportionality in the development of all sectors. Proceeding from this premise, he formulated the principles of planning and socialist management of the economy which have fully preserved their importance to this day and serve as guidelines for the economic policy of the Communist Party of the Soviet Union, which creatively applies Lenin's great legacy in the new historical conditions.

Here it is relevant to note the principles which determine the tremendous part played by planning in the development of the Soviet economy. These are:

first, combining the labour of millions of people and the economic resources for accomplishing major economic and political tasks, the centralisation of large-scale production throughout the country;

second, ensuring the proportional development of the national economy at high rates;

third, the ability to determine correctly the prospects and sequence of tasks, orientation on the latest scientific and technological achievements, on advanced know-how;

fourth, the most efficient use of society's material, manpower and financial resources, the ability to find the main link of a plan at any given moment.

The Communist Party and the Soviet Government, guided by these principles, consistently define the main economic and political tasks of the five-year and annual plans, and employ the country's economic resources accordingly for building communism.

Principles Translated into Reality

Soviet society has passed through various historical stages in its development, and each of them has been marked by definite progress in the system of state economic planning. A long path has been traversed from the first annual plans for individual industries to comprehensive programmes interlocking all sectors of the economy.

The first plans of individual industries were drawn up as early as May-June 1918, and were examined by the First All-Russia Congress of Economic Councils. In the exceptionally difficult conditions of foreign military intervention and

Civil War, the state allocated food, fuel and major materials on the basis of centralisation. In that period Lenin regarded the mobilisation of all economic resources for defeating internal and international counter-revolution as a paramount task of planning.

With the transition to peaceful socialist construction the state plan for the electrification of Russia (known as the GOELRO plan) became the basis of all economic activity. Drawn up on Lenin's initiative in 1920 and approved by the Eighth Congress of Soviets, it was designed for 10-15 years. It was the first long-term economic plan in the world on the scale of an entire country. Electrification was the core of the plan. Under a decree of the Council of People's Commissars, signed by Lenin, a State Planning Commission (GOSPLAN) was set up at the Council of Labour and Defence on February 22, 1921, to ensure the planned development of the economy.

The first plans concentrated attention on the all-round development of the socialist sector, the consolidation and extension of social property, the reform of peasant farming on socialist lines, and the restriction, ousting and eventual elimination of the capitalist elements. Centralised capital investment, channelling of material resources and various other economic measures, including the regulation of wholesale prices and taxes, were widely used for strengthening the state sector.

Since 1928 the economic life of the Soviet Union has been directed by five-year plans. Despite the overall unity of aims, each plan has had its distinctive features stemming from the objective conditions and the immediate tasks of social development.

Under the First Five-Year Plan (1928-32) the economic resources were concentrated on industrialisation and the creation of conditions for the socialist reconstruction of agriculture. A broad programme for the technical reconstruction of all sectors of the economy was carried out in accordance with the principal tasks of the Second Five-Year Plan (1933-37), which greatly reinforced the country's defence potential.

The foundations of socialist society were built in the Soviet Union as a result of fulfilling the First Five-Year Plan and the building of socialism was in the main com-

pleted as a result of the Second Five-Year Plan. By that time the socialist system had triumphed in all spheres of the Soviet economy. Socialist ownership of the means of production had taken firm root and become the unshakable foundation of the new system. A powerful industry had been built up and had ousted private industry. Collectivisation had resulted in the development of large-scale mechanised agriculture; all trade was concentrated in the hands of socialist society and co-operatives; crises, poverty and unemployment had disappeared and exploitation of man by man had been abolished forever. An intelligentsia had been developed from among the workers and peasants. The advance of the Soviet economy during this period was exceptionally rapid. In twelve pre-war years (1929-40) industrial output in the USSR increased 6.5 times and such sectors as the steel, engineering, chemical and power industries developed even faster. The priority growth of these industries made it possible to eliminate the country's economic backwardness and on the eve of the Second World War the USSR held first place in Europe and second place in the world for industrial output.

During the Great Patriotic War of 1941-45, the socialist planned economy was subjected to a crucial test and passed it brilliantly. Planning was highly instrumental in the smooth functioning of the war-time economy. After the war, the five-year plans helped to ensure the successful rehabilitation and the further advance of the economy and culture. Socialism had triumphed completely and finally in the USSR.

Throughout the history of planning, centralised planned guidance has been a key question in the theory and practice of socialist construction. The Communist Party and the Soviet state are always guided by Lenin's precept that "communism demands and presupposes the greatest centralisation of large-scale production throughout the country".[1] This principle, of course, has never signified that all questions must be decided by the centre, while the localities have merely to carry out these decisions. In the practice of planning, centralised state guidance is closely combined with the maximum constructive activity by the people as a whole.

[1] V. I. Lenin, *Collected Works*, Vol. 42, p. 96.

That is why the single economic plan of the USSR sets only the main trends, the major parameters and assignments for a limited nomenclature. Ministries and Union Republics specify the targets of the state plan and they are further concretised by industrial associations and enterprises.

The Communist Party regards planning as one of the forms of participation by the masses in managing social production. This is expressed in the active discussion by the people of the directives for five-year plans, in socialist competition for the pre-schedule fulfilment of state plans, in the mass movements for greater labour productivity, better use of equipment, saving of raw and other materials, introduction of new equipment, improvement in the quality of goods, early commissioning of capacities, and so on. The enthusiasm of the Soviet people and their labour effort facilitate the early fulfilment of plans and make possible a vast expansion in the scale of social production.

Soviet people have now fulfilled the Eighth Five-Year National Economic Development Plan (1966-70). During this five-year period economic growth rates were accelerated and the real incomes of the population rose as compared with the preceding five years; national economic proportions were improved, specifically between industry and agriculture and between the output of means of production and that of consumer goods. Substantial progress was made in implementing major social measures, including levelling up the living standards of the rural and urban population. The Eighth Five-Year Plan signified a further advance of Soviet society towards communism and the strengthening of the country's economic and defence potential.

The following data (see Table 1 on p. 80) attest to the successful fulfilment of the main targets of the Eighth Five-Year Plan. Improvement of the people's living standard is also seen in the consistent solution of the housing problem. Not so long ago, under the Fifth Five-Year Plan (1951-55) over 3,000 million rubles were spent on housing construction annually, while in 1970 the figure exceeded 13,000 million rubles. Altogether in the last 15 years (1956-70) more than 145,000 million rubles were spent on housing construction by all sources of financing (in comparable prices) and about 34 million flats were built to which over 126 million people moved.

Table 1

(per cent)

	1961-65, increase during this period	1966-70, increase during this period	
		Envisaged in the Directives of the 23rd CPSU Congress	Actual
National income	32	38-41	41.0
Industrial output	51	47-50	50.0
Group A (output of means of production)	58	49-52	51.0
Group B (output of consumer goods)	36	43-46	49.0
Gross output of agriculture	12	25	21.0
Goods carriage by all types of transport	47	37	38.0
Retail trade	34	40	48.0
Real incomes	19	30	33.0
Average monthly wage	19.7	20	26.0

Relying on the Leninist doctrine of planning, on a profound analysis of the prospects of social development, the Communist Party of the Soviet Union aims to build up the most advanced economy in the world. This purpose is also served by the economic reform which was introduced in 1966. It has put to the fore the tasks of further enhancing the efficiency of production, economising inputs of living and materialised labour and increasing the return of capital investments and fixed assets.

The reform has raised the level of economic performance of the enterprises, and this has helped to increase their accumulations and to reach the major targets of the Eighth Five-Year Plan. Most enterprises that have adopted the new system of planning and stimulation have achieved a faster turnover of goods which the economy needs and have been able to make better use of fixed productive and circulating assets. Under the Eighth Five-Year Plan the new system of planning and economic stimulation became the main method of management in nearly all sectors of the economy. Today, the industrial enterprises working in the new way contrib-

ute more than 93 per cent of the production and sale of goods and more than 95 per cent of the profit. The new system has been introduced on all the railways, in maritime and river shipping lines, motor transport and civil aviation. Over 8,000 state farms of the Ministry of Agriculture, about 80 per cent of the service establishments and almost 250 large construction organisations have been transferred to full cost accounting. The implementation and results of the economic reform show that the economic policy charted by the Party has fully justified itself and created potentialities for successfully coping with the tasks of the Ninth Five-Year Plan.

Raising the efficiency of the national economy is directly linked with further improvement in the structure of social production. The main thing here is to develop the power and chemical industries, engineering, particularly instrument-making, radio electronics and also a number of other sectors which have a bearing on the growth and technological progress in all sectors of the economy, on the volume of capital investments, improvement in the use of manpower, the productivity of labour and the volume of output.

Optimal adjustment of growth rates in these sectors and industry as a whole, and structuring of the fuel and power, engineering, chemical, steel and non-ferrous metals industries are central economic problems. In ten years the share of the chemical industry in total industrial output has increased by 40 per cent, that of the electric power industry almost by 30 per cent, and that of engineering and metal-working by 40 per cent. Progressive types of fuel—oil and gas—accounted for 60 per cent of the total output in 1970 as against 51 per cent in 1965. Such a considerable growth in these sectors has accelerated the pace of technological progress.

The efficiency of the national economy is also enhanced by maximum specialisation of production, especially in engineering where it is one of the main ways for reducing inputs, improving the quality of output and raising labour productivity. Alongside specialisation, in a number of sectors (the chemical, oil-extracting, timber and non-ferrous metals industries) rational integration of production is developing on the basis of a more comprehensive use of raw material

and power and the utilisation of wastes and by-products.

The policy of high efficiency demands a swift and stable development of agriculture. The measures taken in the last five years to strengthen the material and technical basis of agriculture and raise the role of economic incentives have made it possible to increase the production of grain, raw cotton, sugar-beet, potatoes, meat and milk and increase the growth rate of gross agricultural output. The average annual production of grain in 1966-70 amounted to 167.5 million tons as compared with 130.3 million tons in 1961-65. The gross raw cotton crop exceeded the level of the preceding five years by 22 per cent; sugar-beet by 37 per cent and sunflower seed by 26 per cent. The average annual production of meat, milk and eggs increased by 24 per cent, and wool by 10 per cent.

Fulfilment of the agricultural programme demanded a basic change in the distribution of the national income and material resources in favour of agriculture. Capital investments in agriculture are growing faster than in any other part of the economy. The countryside is much better supplied with high-performance machinery and mineral fertiliser. Deliveries of tractors to collective and state farms in the last five years rose by 34.3 per cent as compared with the preceding five-year period, agricultural machinery by 38 per cent and lorries by 70 per cent. Deliveries of mineral fertiliser in 1970 increased by nearly 19 million tons, or 69 per cent, as compared with 1965. The electrification of agriculture was further developed, and was intensified on the basis of chemicalisation, comprehensive mechanisation and land improvement. All this has helped to increase the profitability of both collective and state farms.

The expansion and improvement of the productive apparatus in all sectors of material production made it possible to achieve the main social and economic targets of the Eighth Five-Year Plan. The average annual growth rate of the national income used for consumption and accumulation was 7.1 per cent, that of industrial output 8.5 per cent, of goods carriage by all types of transport 6.7 per cent, and of retail trade 8.2 per cent. During this period per capita real incomes rose on the average by 5.9 per cent annually. All this shows that in the last five years the Soviet economy

has been forging ahead. Its constructive forces have revealed themselves even more fully during these years, enabling it to attain high production efficiency.

Today the Soviet economy consists of a highly developed industry equipped with the latest machinery, large-scale socialist agriculture, a gigantic building sector based on industrial methods, a technically modern transport service and communication system, thousands of scientific and cultural institutions and many millions of skilled workers, collective farmers and the intelligentsia.

In a little more than half a century, of which about 20 years were taken up by wars and subsequent economic rehabilitation, the Soviet land has been turned into one of the world's biggest industrial powers. The following data give an idea of the major results of Soviet development:

Table 2

	1940 as compared with 1913, times	1965 as compared with 1913, times	1970 as compared with 1913, times
National income	5.3	32	44.7
Gross industrial output	7.7	61	89.8
Gross agricultural output	1.4	2.5	3.0
Goods carriage by all types of transport	3.9	22	30
Number of factory and office workers employed in the economy	2.6	6.0	7.0
Labour productivity in industry	3.8	14.0	18.5
Labour productivity in agriculture	1.9	4.0	5.2
Real incomes of workers in industry and construction, taking into account the abolition of unemployment and reduction of the working day (per employed person)	2.7	6.4	7.6
Real incomes of the working peasants (per person)	2.3	7.8	12.0

A huge productive apparatus has been built up in the USSR. At the end of 1970 the value of fixed assets totalled 737,000 million rubles, including fixed productive assets of 461,000 million rubles. In Soviet times about 42,000 large

industrial enterprises have been built and commissioned. All sectors of the national economy now have a modern industrial material and technical basis. The Soviet Union possesses a developed and diversified economy and has attained a high level of the production of major types of goods.

Table 3

	Unit of measurement	1940	1960	1965	1970
Electric power	million kwh	48,300	292,000	507,000	740,000
Oil	million tons	31.1	148	243	353
Natural gas	million cu m	3,400	45,000	128,000	198,000
Coal	million tons	165.9	540	578	624
Steel	" "	18.3	65	91	116
Rolled stock	" "	11.4	44	62	81
Mineral fertilisers	" "	3.2	14	31	55
Resins and plastics	thousand tons	10.9	312	803	1,672
Chemical fibres	" "	11.1	211	407	623
Automobiles	thousands	145.4	524	616	916
Tractors	"	31.6	239	355	459
Timber hauled	million cu m	117.9	369.5	378.2	384
Cellulose	thousand tons	529	2,282	3,234	5,110
Paper	" "	812	2,334	3,231	4,185
Cement	million tons	5.7	46	72	95
Fabrics, all kinds	million sq m	3,300	6,636	7,498	8,851
Leather footwear	million pairs	211	419	486	676
Meat	thousand tons	1,501	4,406	5,245	7,140
Butter	" "	226	725	1,066	960
Whole-milk products	million tons	1.3	8.3	11.7	19.5
Granulated sugar (from sugar-beet)	thousand tons	2,165	5,266	8,924	8,141
TV sets	thousands	0.3	1,726	3,655	6,681
Wireless sets	"	160	4,165	5,160	7,811
Refrigerators	"	3.5	529	1,675	4,140

These and other data again reveal the advantages of the Soviet planned economy which develops at rates much higher than those of the economies of capitalist countries. In 1951-70, the average annual growth rate of industrial output amounted to 10.1 per cent in the USSR, while in the United States it was 4.1 per cent, in Britain 3.0 per cent and in France 5.9 per cent. In recent years the Soviet Union has surpassed the United States for the absolute annual increase in the production of a number of important goods.

High growth rates of industry are characteristic of all the socialist countries belonging to the Council for Mutual Economic Assistance, their industrial production in 1970 being almost 6.8 times greater than in 1950. They are striving to make the best use of the possibilities of the socialist international division of labour by co-ordinating their economic plans. The CMEA countries have now entered upon a new stage in their co-operation. They have undertaken to implement a Comprehensive Programme for further deepening and improving co-operation and developing socialist economic integration, which is to be carried out by stages over 15-20 years. This programme was approved by the 25th Session of the Council for Mutual Economic Assistance held in Bucharest in July 1971.

The deepening and improvement of economic, scientific and technical collaboration and the development of socialist economic integration are a process regulated by the Communist and Workers' Parties and the governments of the CMEA countries consciously and according to plan, a process of socialist international division of labour, of drawing together the national economies and shaping them into a modern highly efficient structure, of gradual bringing together and evening out their economic development levels, of developing deep-going and stable ties in the main sectors of the economy, science and technology, and of extending and strengthening their international market on this basis.

The Comprehensive Programme gives a concrete timetable for introducing measures of collaboration designed to solve the most important economic problems, specifically such problems as providing the national economies with fuel and raw materials and high-performance equipment and also satisfying the needs of the population in manufactured goods and foodstuffs.

Implementation of the Comprehensive Programme helps to consolidate the economies of the CMEA countries, brings them into close interaction and raises the economic potential of the entire socialist community.

Lenin's principles of planning have been developed in Communist Party documents and Soviet Government decisions. Sweeping economic plans are being drawn up and carried out under the leadership of the Party. This unprecedented progress has become possible only thanks to the planned operation of the economy, which has enabled the country to concentrate the available resources in decisive sectors. Socialism has been built in the USSR. Now the material and technical basis of communism is being laid. This is how Lenin's ideas of creating a powerful socialist economy are being translated into reality.

Principal Tasks of the Ninth Five-Year Plan

Examining the fundamental questions of the Soviet Union's economic policy, the 24th CPSU Congress took into consideration the present stage of the country's development, the gigantic scale of the socialist economy and the huge production potential created by the heroic efforts of the people. All this provides real possibilities for coping with the new tasks of the Ninth Five-Year Plan, among which the most important is to secure a considerable advance of the people's material and cultural standards on the basis of high growth rates of socialist production, to raise production efficiency through scientific and technological progress, and to accelerate the growth of labour productivity.

An advance of the people's living standard has been one of the paramount economic and political tasks of every five-year plan. Much has already been accomplished in this respect, especially in the last five years. Nevertheless, the resources allotted for these purposes were limited over a comparatively long period because other pressing economic problems had priority. Specifically, in the pre-war and initial post-war years a considerable part of the increase in resources had to be used for building up the country's industrial might—the foundation of its economic indepen-

dence, defence potential and the material basis for subsequent economic growth. Today, when the Soviet Union has a highly developed economy, the Party has set the task of tying development of the national economy more closely to improvement of the people's well-being. This is not only a task for the next five years but also a guideline for the long-term economic development. A number of important measures for raising the living standard of the people are to be carried out in the Ninth Five-Year Plan in accordance with the Directives of the 24th Congress of the CPSU. The total sum allotted for these measures will amount to 22,000 million rubles in 1971-75 as compared with 10,000 million rubles spent in 1966-70.

For the accomplishment of this cardinal task the Congress Directives provide for high growth rates of social production.

Table 4

	1971-75 growth (per cent)
National income	137-140
Gross industrial output	142-146
Group A (output of means of production)	141-145
Group B (output of consumer goods)	144-148
Gross output of agriculture	120-122
Goods carriage by all types of transport	132-135
Capital investments in the national economy	136-140
Labour productivity:	
in industry	136-140
in agriculture (in collective and state farms)	137-140
in construction	136-140
Retail trade	140

The development of material production in the Ninth Five-Year Plan is also characterised by the following major indicators (see tables 5, 6, 7, 8, 9).

The new five-year period will be an important stage in the further advance of Soviet society to communism, the building of its material and technical basis and the consolidating of the country's economic and defence potential.

To accomplish these tasks it is necessary to attain high rates and proportional development of social production,

substantially enhance the efficiency of all sectors of the national economy, accelerate scientific and technological progress and improve the quality of goods.

Important social measures to raise the living standard of the people are to be carried out in the next five years.

Thorough examination of the different alternatives of the main five-year plan projections brought to light the necessary resources for carrying out a far-reaching programme of further improvement in the well-being of the Soviet people. A tremendous amount of work was done to provide an all-round economic and technical substantiation of the targets planned, to co-ordinate them by systematic computation of balances and by utilising the results of research in all spheres of science and technology.

The national income is to rise by 40 per cent, real per capita incomes by about 30 per cent and the social consump-

Table 5

	Output		Absolute increase of output	
	1970	1975	Eighth Five-Year Plan	Ninth Five-Year Plan
Output of engineering and metal-working industries, million rubles	88,000	148,000	37,000	60,000
Motor vehicles, thousands	916	2,000-2,100	300	1,084-1,184
including motor cars, thousands	344	1,200-1,300	143	856-956
Instruments, means of automation and spare parts for them, million rubles . . .	3,102	6,155	1,684	3,053
Machinery and equipment for the light and food industries, million rubles . . .	771	1,564	263	793
Agricultural machinery, million rubles .	2,115	3,500	619	1,385
Tractors, thousands .	458.5	575	104	116.5
million hp.	29.4	53	8.4	23.6
Grain harvester combines, thousands .	99.2	138	13.4	38.8

Table 6

Output of Major Kinds of Raw and Other Materials

	Output		Absolute increase of output	
	1970	1975	Eighth Five-Year Plan	Ninth Five-Year Plan
Steel, million tons	116	142-150	25	26-34
Output of chemical and petrochemical industries, million rubles	21,100	36,200	9,300	15,100
Plastics and synthetic resins, thousand tons	1,672	3,457	869	1,785
Chemical fibres, thousand tons	623	1,050-1,100	216	427-477
Cellulose, thousand tons . . .	5,110	8,490	1,875	3,380
Paper, thousand tons	4,185	5,560	954	1,375
Cement, million tons	95	122-127	23	27-32

Table 7

Production of Fuel and Electric Power

	Production		Absolute increase of production	
	1970	1975	Eighth Five-Year Plan	Ninth Five-Year Plan
Electric power, million kwh	740,000	1,030,000-1,070,000	233,000	290,000-330,000
Oil (without gas condensate), million tons	349	480-500	107	131-151
Natural gas, million cubic metres . . .	198,000	300,000-320,000	70,000	102,000-122,000
Coal, million tons	624	685-695	46	61-71

Table 8

Output of Consumer Goods

	Output		Absolute increase of output	
	1970	1975	Eighth Five-Year Plan	Ninth Five-Year Plan
Output of light industry, household goods and articles meeting cultural requirements, million rubles	76,500	112,400	27,400	35,900
Output of food, meat-packing, dairy and fish industries, million rubles . . .	78,800	106,600	19,300	27,800

Table 9

Development of Agriculture

	Average annual output 1971-75	Absolute average annual increase under the Ninth Five-Year Plan
Gross output of agriculture, million rubles	96,000-98,000	15,700-17,700
Major products		
Grain, million tons	195	27.5
Raw cotton, million tons	6.75	0.65
Meat (slaughter weight), million tons	14.3	2.7
Milk, million tons	92.3	11.8
Eggs, millions	46.7	10.9
Wool, thousand tons . . .	464	67

tion funds by 40 per cent. The average wage of factory and office workers is to go up by 20-22 per cent and the labour remuneration of collective-farm members by an average of 30-35 per cent. The policy of large-scale housing construction will be continued. In the five-year period houses with a total living floor space of 565-575 million sq.m. are to be built with financing from all sources (state, co-operative and individual). Education, public health services and culture

are to be further developed. Important measures will be taken to improve the organisation of labour and utilise the labour resources more efficiently. Provision is made for the comprehensive mechanisation of the main production processes in industry, construction, agriculture and transport.

The new five-year plan is the result of more than two years' creative teamwork on a grand scale, in which the Union Republics, ministries and departments, big factories and research and designing organisations took an active part.

All this work was accomplished under the direct guidance of the Central Committee of the CPSU, which from the very outset defined the cardinal task of the Ninth Five-Year Plan—tying the development of the national economy ever more closely to improvement of the Soviet people's living standard.

The new five-year plan provides for high growth rates and big shifts in the pattern of the Soviet economy. The change of proportions in social production, outlined for the next five years, is aimed, first, at increasing the resources allotted for the improvement of the living standard of the people, and, second, at accelerating the development and improvement of the material and technical basis of all sectors of the economy, without which it is impossible to carry out a long-term programme for expanding the output of consumer goods.

The policy of the CPSU charted at its 23rd Congress, to achieve a substantial improvement in the well-being of the working people, is being consistently applied. The successes registered in fulfilling the Eighth Five-Year Plan make it possible in the next five years to go ahead ever more fully and purposefully on this course, which sets the general long-term orientation of the country's economic development.

The high level of Soviet industrial development has created prerequisites for establishing in industry new proportions between the output of means of production and consumer goods. Already under the Eighth Five-Year Plan the growth rates of industries in Group B were substantially raised to approximately the same level as in Group A. This tendency will be further developed in the new five-year period.

Moreover, it should be noted that the rapid expansion of

output of consumer goods is to be achieved both by developing agriculture and the light and food industries and also by notably increasing the production of consumer goods in heavy industry. While the total rise in the output of consumer goods is 44-48 per cent, the increase in their production by heavy industry will exceed 80 per cent.

The planned increase in the production of consumer goods and services is of exceptional socio-economic and political importance. It will make for more effective stimulation of labour productivity, for fuller satisfaction of the growing effective demand and for saturation of the market with the goods that are needed. And, lastly, the general balance of the economy, the harmonious development of all its links and the stability of retail prices to a great extent depend on this.

The key to the simultaneous accomplishment of the major tasks confronting the country—raising the people's well-being, developing and technically improving all branches of the economy, and strengthening the country's defences—is substantial improvement in the effectiveness of social production. This entails a comprehensive approach to all factors of economic growth, and thrifty use of natural wealth, productive assets and labour resources. Much was accomplished in this respect over the past five years. National economic plans are oriented on the maximum use of sources for intensive development. They concentrate greater attention on labour productivity, the technological level of production and saving of material resources. The growth rates of labour productivity in all sectors of material production will be higher in the new five-year period than those attained in the last ten years.

Table 10

Growth of Labour Productivity by Five-Year Plan Periods (per cent)

Sectors	1961-65	1966-70	1971-75
Industry	25	32	36-40
Agriculture	18	35	37-40
Construction	29	22	36-40

The exacting productivity targets have made it necessary to plan measures designed to introduce the most rational structure of production, wide mechanisation and automation and scientific labour organisation.

Utmost use of scientific and technological achievements is a major requisite for the solution of this problem. The effect of their application in the economy over the next five years will amount to 40,000-42,000 million rubles, of which more than half will come from reduction of the material-product ratio. To achieve this target provision is made for wide introduction of new technology, progressive consumption rates of materials and more efficient designs of machines, equipment, instruments and other goods.

Vast opportunities for raising the efficiency of the economy are to be found in more rational use of productive assets. In the last five years we succeeded in eliminating, in the national economy as a whole, the adverse tendency towards a decrease in output per ruble of fixed assets which had emerged in the early 1960s, and in stabilising the yield of the fixed productive assets. This saved many thousands of millions of rubles in capital investment. In the Ninth Five-Year Plan we are faced with the task of utilising even more rationally the fixed assets in conditions of new big structural shifts in the economy and the technical re-equipment of its sectors.

Thus, the general conception of the Ninth Five-Year Plan is embodied in the solution of the problems of optimising the structure and proportions of the national economy, all-round intensification and utilisation of material resources and the operating productive apparatus as the main trend in the technological and organisational improvement of all the sectors of the economy. This path will enable us to raise considerably the efficiency of social production and the people's well-being.

In the mid-1970s, as regards scale and qualitative characteristics the Soviet economy will be a huge complex of highly developed sectors and lines of production based on the achievements of modern science, which is increasingly becoming a direct productive force. The Ninth Five-Year Plan will go down in the history of the Soviet economy as

a qualitatively new period, with all-round intensification of social production as the highroad for the development of the socialist economy.

Improvement of Planning Methods

The Communist Party and the Soviet Government are constantly orienting the planning agencies towards a more efficient organisation of their work. The transition to the sectoral principle of managing the economy has created favourable conditions for applying a single technical policy, for concentrating and specialising production. As a result of the economic reform cost accounting has become a more vigorous instrument, the system of material incentives has become more effective and the workers' collectives have stepped up their efforts to find and utilise reserves within their enterprises. All this makes for improved planning.

Every year the scale of the Soviet economy expands, ramified inter-sector relations are established, and the role of scientific and technological progress in the development of production rises. More and more often we face big economic problems that can only be solved through participation of many sectors of social production. To cope with these problems efficiently we are trying to secure precise interaction of sectors, not allowing a departmental and parochial approach in the formulation and substantiation of plans.

An example of the comprehensive approach to economic planning is afforded by the decisions on the development of the material and technical basis of agriculture, which is needed for a swift and stable growth of agricultural output.

The inter-sector approach to evaluating economic measures and charting ways for carrying them out imposes special responsibility on the personnel of the state planning system. The consolidation of the sectoral system of economic management in the last five years creates favourable conditions for releasing the State Planning Committee from the task of settling numerous current questions and enables it to concentrate on dealing with cardinal economic problems.

Efficiency in managing the national economy greatly depends on the further enhancement of the role of ministries

and departments in planning the respective sectors of production. Today they have every possibility of putting the plans for the development of their sectors on a sounder basis, of bearing full responsibility for the study and satisfaction of the country's needs in equipment, raw materials and high-quality consumer goods. And the ministries are doing their best to utilise these possibilities in their work.

Alongside this, great attention is being paid to combining sectoral and territorial planning by enhancing the role of the planning agencies of the Union Republics and local Soviets, of ministries and departments.

The planning agencies are persistently working to improve the organisation and techniques of planning. Their chief concern is to analyse and reflect in their plans the indicators of economic efficiency, particularly the efficiency of capital investments, the quality of goods, the utilisation of labour resources and fixed assets and questions of technological progress. Definite progress along these lines has already been achieved.

Another important task of the planning agencies is to further improve the balance of the main sections of the plan: production and capital construction and their provision with materials and equipment; growth in effective demand and a corresponding increase in the production of goods and services; financial resources and the expenditures planned by society. These problems are being solved on the basis of a comprehensive application of the achievements of modern science and technology and the wealth of experience accumulated by socialist planning.

Big demands are made on the planning and economic agencies in view of the task of long-term planning of national economic development set by the 24th CPSU Congress. At present Soviet economic plans cover one-year or five-year periods. This will no longer do. Many problems arise which it is impossible to solve within one or even two five-year periods. These include, for example, the development of new mineral deposits, the building up of large industrial complexes, the development of big industrial areas and centres. The need for long-range planning is also dictated by the pattern of the present-day external economic relations. Specifically, in recent years the Council for Mutual Economic Assistance has already examined questions of

economic integration which go beyond the bounds of one five-year period. The absence of planning projections designated for a long-range perspective often hinders the adoption of properly grounded decisions concerning the allocation of capital investments, the siting of new large enterprises, the determination of the trends of geological prospecting, the working of mineral deposits and the organisation of research and development work. That is why a long-term plan for the economic development of the USSR is an essential requisite for deeper scientific substantiation of the five-year plans and constitutes an important factor in raising the level of all economic planning.

Modern computers as well as economic and mathematical methods are of great importance for balancing current and long-term plans, for finding optimal decisions and accelerating plan computation. Diverse and intricate calculations, both sectoral and inter-sectoral, are now made by the Chief Computing Centre of the USSR State Planning Committee. This work will be greatly extended in the new five-year period.

Formulation of a long-term plan for the economic and social development of the USSR will be of great importance for consistently implementing the decisions adopted by CMEA member countries on deepening socialist integration in its different forms, and this will make it possible to take better advantage of the socialist international division of labour.

Long-range planning of the national economy presupposes the improvement of organisation of the work on scientific, technical and socio-economic forecasting.

The State Planning Committee has submitted to the USSR Council of Ministers proposals for the elaboration of a draft long-range general plan for the development of the Soviet economy. These proposals envisage the enlistment of a wide range of the planning and economic agencies, the USSR Academy of Sciences and other research and designing organisations for accomplishing these tasks.

* * *

Reviewing the path traversed by the socialist economy, we are bound to acknowledge the decisive importance played in its development by the state economic plans, the success-

ful fulfilment of which has ensured high economic growth rates, the unparalleled advance of culture, the strengthening of the defence potential and the conversion of the Soviet Union in a brief period into a powerful highly industrialised socialist state. It is economic planning that makes it possible to provide an efficient guidance of the economy on a country-wide scale, to set optimal proportions, to distribute the productive forces rationally and to save material, manpower and financial resources. The rich experience accumulated in the accelerated economic development of the USSR on the basis of state plans has received international recognition and is extensively utilised by the countries which have taken the socialist road. L. I. Brezhnev, General Secretary of the Central Committee of the CPSU, in his report on the centenary of Lenin's birth stressed the importance of socialist planning, saying that the planned development of the entire economy at the highest technical level in the interest of the people's well-being was a cardinal feature of socialism built in the USSR.

THE SCIENTIFIC AND TECHNOLOGICAL REVOLUTION AND SOCIAL PROGRESS

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An Objective Law of the Development of Socialist Society

Rapid progress of science and technology is a major objective law governing the development of socialist society. Mastering this law is an indispensable condition of building the material and technical basis of communism, whereby it will be possible to meet all the reasonable, historically formed needs of every member of society through all-round development of social production and a continuous rise in labour efficiency.

It is commonplace that under the capitalist mode of production all means are used, even sweated labour, to increase efficiency and maximise profit. The position is quite different in socialist society, in which the interests of the working people are the most cherished interests of the state. Higher efficiency is achieved under socialism chiefly through the introduction of new machinery, sophistication of the operating plant, improved organisation of labour, and better management. Improvement of the organisation of labour is necessarily correlated with the level of the productive forces and the kind of machinery in use. At the same time, socialist organisation and management of production have a great stimulating effect on the development of the productive forces, furthering the introduction and better employment of new machinery. Technological progress depends in large measure on the successful development of science and application of its achievements in industry.

In the Soviet Union, for instance, science and scientists enjoy a great deal of attention. This deep and constant

concern for science has found expression in many documents of the Communist Party of the Soviet Union—from the Draft Plan of Scientific and Technical Work, drawn up by Lenin,[1] to the decisions of the 24th Congress of the CPSU. In the grim days when the destiny of the young Soviet Republic hung in the balance, Lenin clearly foresaw the role that science was to play in the future reform of Russia. He contemplated a plan of scientific and technical work on a national scale, investigation and development of the country's natural resources, and evolved the idea of the electrification of Russia.

The first Soviet research centres and experimental stations were launched as early as 1918, when a Scientific-Technical Department was set up under the Supreme National Economic Council to direct work on major problems concerning the rehabilitation and development of the national productive forces. Thus, from the very start of its activities in the economic sphere, the Communist Party concerned itself with providing adequate material facilities for Soviet science and set about bringing science closer to production. Now the whole world can see the fruitful results of Leninist policy, which has enabled the Soviet Union to emerge to leading positions in many fields of science and technology.

Lenin repeatedly stressed the significance of technological progress for the building of socialism. He said that economic success "can be assured only when the Russian proletarian state effectively controls a huge industrial machine built on up-to-date technology...".[2] Lenin's famous formula, "*Communism is Soviet power plus the electrification of the whole country*",[3] is an expression of the same idea, for electrification meant putting the economic development of the Soviet state on a modern technological foundation.

Technological advance exerts a manifold effect on every aspect of Soviet society and state. Its acceleration is a major condition for building the material and technical basis of communism. The measures for building the material and technical basis of communism, set forth in the CPSU

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[1] See V. I. Lenin, *Collected Works*, Vol. 27, p. 320.
[2] *Ibid.*, Vol. 31, p. 420.
[3] *Ibid.*, p. 516.

Programme, envisage a high rate of scientific and technical progress. They include complete electrification of the country and perfection on this basis of the techniques, technology and patterns of social production in every sector of the national economy; all-round mechanisation and greater automation of production, intensive development of economically effective new-type industries and new kinds of power and materials; and an organic fusion of science and industry. Speeding up scientific and technological progress to the greatest possible extent is a major national objective in the Soviet Union.

By increasing the effectiveness of production and introducing new types of products advanced technology helps to promote the material well-being of the workers of socialist society. Labour tends to become intellectual, its conditions improve, and those participating in production develop new traits as their professional and general culture increases and their mental horizons broaden.

Mechanisation and automation of production call for coordination of industrial activities to an even greater extent than before. Hence, the greater significance of collective effort. Socialism makes it possible to combine the principle of teamwork, indispensable at the modern level of science and engineering, with a free unfoldment of the creative faculties of the individual. Planning technological advances, making it economically worthwhile for the factories and other bodies to develop and introduce technical innovations, and mobilising public opinion are powerful means of inducing every worker to contribute to technical progress.

Under socialism, all the producers, conscious of their common, vital and enduring interests, strive to increase the technical level of production as much as possible, for in socialist society it secures for them a higher living standard without threatening them with either unemployment or disqualification, or any of the other social misfortunes usual under capitalism. The building of communism presupposes extensive practical introduction of the achievements of the scientific and technological revolution, which induces qualitative changes in production technologies, the power industry, the instruments and objects of labour, the system of management, and the character of labour.

As one of the decisive directions of the building of com-

munism, technological progress is always in the centre of attention of the Soviet state. In guiding this work the Communist Party formulates the tasks facing society at each stage. Even at the earliest stages of Soviet government Lenin sought to promote the more promising of the new developments in technology and create favourable conditions for research and development. He insisted on money, facilities and manpower being allocated for these purposes, despite the dislocated state of the economy at that time.

The beginning of Soviet industrialisation gave particular urgency to the problems of technical progress. Already in the resolution of the 14th Party Congress adopted on December 23, 1925, on the Central Committee's report, the task was to "develop our socialist industry through achieving a higher level of technology".[1] This statement was developed further in the directives formulated in the resolution of the 15th Party Conference "On the Economic Situation of the Soviet Union and the Tasks of the Party", which emphasised that "the national economy is entering a new period of its development which is one of reorganising the economy on the basis of new and higher technology".[2] As one of the principal aims for industry the resolution mentioned all-round industrial rationalisation and utilisation of the latest technological achievements.

The resolution of the 15th Party Congress "On the Directives for Drawing Up the National Economic Five-Year Plan" (1927) has a section on "Socialist Rationalisation, the Significance and Role of Mass Organisations". It maintains that rationalisation is impossible unless a greater role is assigned to science and technology and underlines the need "to study thoroughly all the recent discoveries and inventions". "Money should not be grudged on experiments to improve methods of work, while every encouragement must be given to the initiative of workers, technicians and engineers."[3]

Party decisions outline concrete ways to ensure the progress of science and technology at each stage of the

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[1] *Party and Government Decisions on Economic Problems*, Vol. I, Moscow, 1967, p. 508 (in Russian).

[2] *Ibid.*, p. 538.

[3] *Ibid.*, pp. 675-76.

country's economic development. The guiding role of the Party is being particularly enhanced now that the building of the material and technical basis of communism has become an immediate economic and political task. The goal stated in the CPSU Programme is "to consolidate the advanced positions which Soviet science has won in major branches of knowledge and to take a *leading place in world science* in all the key fields".[1] Accordingly, the Party now sets the task of all-round acceleration of scientific and technological progress. The 23rd and 24th Congresses of the CPSU gave special consideration to the ways of accomplishing this task.

While directing the work of state bodies for the guidance of technological progress, the Party simultaneously concentrates the attention of all mass organisations on solving concrete tasks in this sphere, emphasising the need to step up the efforts of factory technical councils, scientific and technical societies, voluntary commissions for the promotion of technological progress, rationalisers' councils, and other creative workers' associations.

The present revolution in science and technology forms the main arena of the economic competition between the two opposing socio-economic systems.

As Leonid Brezhnev emphasised in his report to the 24th Congress of the CPSU, the Communist Party and the Soviet people are confronted with a task "of historical importance: *organically to fuse the achievements of the scientific and technical revolution with the advantages of the socialist economic system,* to unfold more broadly our own, intrinsically socialist, forms of fusing science with production".[2]

The superiority of the socialist over the capitalist system, the social reserves of the socialist system undoubtedly favour the triumph of socialism in the sphere of the present scientific and technological revolution, too. As L. I. Brezhnev said at the International Meeting of Communist and Workers' Parties in 1969: "Here the struggle will be a long and difficult one. And we are fully resolved to wage it in

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[1] *The Road to Communism*, Moscow, p. 576.

[2] *24th Congress of the CPSU, Report of the Central Committee of the Communist Party of the Soviet Union, Delivered by Leonid Brezhnev*, Moscow, 1971, p. 69.

earnest so as to demonstrate the superiority of socialism in this sphere as well."[1]

The scientific and technological revolution demands a higher level of research in the social sciences. Social processes are now analysed with the aid of up-to-date machines; the use of computers opens up new possibilities for research, scientific forecasting and optimisation of economic planning.

The resolution of the Central Committee of the CPSU "On Measures Towards Further Developing the Social Sciences and Increasing Their Contribution to the Building of Communism", published in September 1967, points out the need for constructive development of theoretical problems in close conjunction with the specific tasks of the building of communism, the need for further improving the standards and effectiveness of research. One of the main lines on which social scientists are expected to concentrate their efforts is to solve problems related to the progress of technology. The social sciences must materialistically synthesise socio-revolutionary experience in the conditions of the scientific and technological revolution and all that is new in the struggle for communism, and thus develop revolutionary theory.

In recent years Soviet researchers have stepped up investigation of the economic, political and philosophical problems relating to the building of the material and technical basis of communism, and made more intensive study of the changes in the productive forces occurring under the impact of the most recent discoveries in natural science and the development of technology, and of ways of making best use of the advantages of socialism to advance technology. Ever greater attention is being paid to the scientific elaboration of the problems of increasing the efficiency of socialist production and thus ensuring a steady growth of the people's welfare and development of culture and every sphere of public life; to the investigation of problems of the further improvement of socialist social relationships, of the forms and methods of scientific management of the national economy on the basis of democratic centralism and a

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[1] *International Meeting of Communist and Workers' Parties, Moscow 1969*, p. 162.

consistent employment of the moral and economic incentives. Simultaneously, more is being done to elaborate theoretically such problems as the development of socialist democracy, the collective and the individual, society and the state.

The Directives of the 24th Congress of the CPSU on the Five-Year Plan of the National Economic Development of the USSR, 1971-75, provide for further development of the social sciences, and comprehensive research into social development in order to achieve scientific direction of socialist economy and to solve other problems of communist construction.

Scientific and Technological Progress and Development of Democracy

Socialist society is a society organised into the state and governed on the principles of socialist democracy. Socialist democracy implies government by the working people and this means that ever greater numbers of working people have to run the state, and not merely take part in administration but take part in it consciously and decisively, and that ultimately the entire adult population should share in such participation. Conscious discipline and good organisation of the working people are indispensable attributes of socialist democracy.

The great advantage of the socialist social system is that it makes it possible to combine scientific and technological progress with the further development of democracy. Under socialism, first, the scientific and technological revolution becomes a matter of the creative endeavour of millions and, second, its achievements are used in a planned manner on a national scale for the benefit of the people at large. Socialist democracy furthers this revolution and provides for a successful solution of new and complex problems facing society; in turn, the scientific and technological revolution furthers socialist democracy. These features of scientific, technological and socio-political progress under socialism underline the fundamental distinction between the socialist system and bourgeois society, in which the technological

revolution tends to build up the monopolies, enables them to merge with the state and strengthens bureaucratic centralism.

The progress of science and technology provides ever better conditions for increasing the role of the representative bodies in the socialist state system. The rise in cultural standards of the bulk of the working people makes it possible to elect people of various occupations and specialists of all kinds to representative government bodies. This helps to improve the work of these bodies and makes for more effective control and direction of administrative agencies.

The spectacular growth of the productive forces of the Soviet Union and the advance of the scientific and technological revolution have called for further improvement of the forms and methods of organisation and economic management. This purpose is served by the economic reform, which is yielding good results.

The economic reform presupposes a new approach to economic management. It further stimulates the creative initiative of the working people and their role in managing production. The rights of the working people in managing the enterprises have been greatly extended. For example, factory and office workers hold meetings to discuss the problems of production, the production targets, and the collective agreements between management and trade unions and how they are fulfilled. This involves discussion of the introduction of new machinery and the economic and social consequences of technological progress in the factory.

An important part in technological progress, especially under the new system of planning and economic stimulation, is played by socialist competition among working people, which is, in fact, a form of socialist democracy and gives free scope to mass initiative. Commitments and plans for the social development of enterprises include measures for improving the workers' skills and knowledge, extending their general education and training them in new skills. In the conditions of the scientific and technological revolution factory managements and union committees pay increasing attention to workers' training and retraining and to their creative approach to labour.

A major social advance brought about by scientific and

technological progress under socialism is the moulding of a new type of worker. The rapidly growing number of inventors and rationalisers among workers is conclusive evidence of this intensive process, which is altering the content and character of labour. The scale of the movement may be judged from the fact that in 1970, for instance, the number of inventions and improvements introduced in the Soviet economy exceeded 3.4 million. This reflects the creative response of workers, technicians and engineers to society's need for the development and introduction of new technology.

Technological progress calls for an effort on the part of workers to utilise, collectively and individually, the various reserves for increasing efficiency. In the Soviet Union, scientific and technological progress is achieved through the efforts of the working man and its ultimate aim is his welfare. That is why technological progress under socialism relies on the creative initiative of millions, on the active involvement of the mass organisations, the trade unions and the Young Communist League first and foremost, in the effort to achieve a steady rise in the scientific and technical level of production.

The letter of the Central Committee of the CPSU, the Council of Ministers of the USSR, the All-Union Central Trade Union Council, and the Central Committee of the Young Communist League "For Better Utilisation of the Production Reserves and More Thrift in the National Economy" (1970) emphasised that it is necessary to work consistently to raise the standards of efficiency, increase the productivity of every worker, collective farmer, specialist and scientist.

The socialist system combines technological progress with full employment and ensures methodical redistribution of manpower according to the requirements of social production. The Communist Party and the Soviet Government have raised the problems of rational utilisation of manpower, redistribution and retraining of workers to the level of national tasks. The solution of these tasks has been assigned to special government bodies responsible for the employment of the labour resources. Their particular function is to prepare and carry out, jointly with ministries and enterprises, measures for retraining workers and redistributing them

among factories, building projects, industries and economic areas.

Scientific and technological progress calls for continuous improvement of the whole system of state guidance of society. This refers both to the organisation of the state machinery itself—its structure and the system of relations between state bodies, and to its methods of administration in various spheres of human activity. Here, the standing problem is that of optimal delimitation of powers for the various levels of state administration and the representative bodies of state power, which for the most part decide questions of administrative policy, and also local management bodies.

The administrative apparatus undergoes substantial changes. Because these changes reflect objective tendencies, it is able to influence scientific and technological progress more effectively. This is promoted by the growing role of forecasting, technical-economic rate setting, management of research and development work. As far as the character and methods of their work are concerned, many managing bodies increasingly come to resemble economic and technological research centres. This is largely due to the greater role research institutes and scientific opinion in general play in management as they take an increasing part in preparing forecasts, supplying data for development projects, and drafting decisions.

Scientific workers come to play an appreciably greater role in the state bodies where they are not only (and not so much) engaged in administrative functions. All this puts management on a thoroughly scientific foundation. Certainly, the effectiveness of management, as well as its general standards, depend on the use of up-to-date machinery, including computers, which sharply increase the efficiency of administrative work and facilitate decision-making. Under the economic reform, better conditions are provided for state guidance of scientific and technological progress through the new system of planning and economic stimulation.

Classification and grouping of enterprises according to type within each industry has made it possible to pursue a single technical policy, without which it is impossible to ensure proportional and all-round development of the material and technical basis. This policy is essential under public ownership of the means of production and is to lay down a

clear line of technological development both of individual enterprises and industries and of social production as a whole.

In exercising control the state decides in what order steps must be taken to ensure technological progress and determines the main lines of such progress both for individual sectors and their various combinations. The shift to the sectoral system of economic management was necessitated, above all, by the requirements of scientific and technological progress. Ministries, i.e., the bodies in charge of individual industries, are responsible for the technical level of a given branch of production. Important functions in this field have been vested in the USSR Council of Ministers State Committee for Science and Technology. The state establishes the order of research priorities and sees to the prompt introduction of the results in industry.

The resolution of the Central Committee of the CPSU and the Council of Ministers of the USSR "On Measures to Raise the Effectiveness of the Work of Research Organisations and Speed the Introduction of the Achievements of Science and Technology in the National Economy", of September 24, 1968, outlined a number of new objectives and conditions serving to make the work of research and design organisations more effective and pointed out how to improve the planning and economic stimulation of such work, and—most important—determined the procedure for practical utilisation of its results.

State administration is a major condition of rapid scientific and technological progress in socialist society. It is one of the great advantages of the socialist system over capitalism. As the socialist economy develops and the process of technological change becomes more intense, the role of state guidance steadily increases.

As was decided at the 24th Congress of the CPSU, further improvement of economic management is one of the key questions of Party policy. In essence it is a question of how best to accelerate the economic and social development of Soviet society. The increasingly extensive participation of the working people in managing production is a major factor in raising the effectiveness of economic organisation and management. The decisions of the Congress provide for all-round development of all forms of socialist democracy that ensure effective participation of the masses in the elaboration and

discussion of economic plans and decisions and in active control over fulfilment of these decisions.

A very important point is that the working people's participation in economic management is not confined to economic tasks within the boundaries of a single enterprise. "What we must achieve is, as Lenin emphasised, that every working person, every politically-conscious worker should feel 'he is not only the master in his own factory but that he is also a representative of the country' (*Collected Works*, Vol. 27, p. 403)."[1]

A big role in economic management is played by the primary Party organisations, which unite millions of workers, collective farmers and professional and office workers. Using their right of control over enterprises' economic activity, they exert an effective influence on production matters. The 24th Congress gave the primary Party organisations of research institutes, teaching establishments, cultural and other institutions the same right of controlling their administrations.

The Party's line is to further enhance the role of the most broadly based organisation of the working people—the trade unions—as schools of management, schools of communism. The trade unions are urged to draw the working people into production management and dealing with problems of scientific and technological progress on an even broader scale. In recent years production meetings, workers' conferences and general meetings of collective farmers have become more active and the practice of having the leaders of amalgamations and enterprises and also the top officials of ministries reporting back directly to the workers has developed.

In the current period the range of the Leninist Komsomol's participation in matters concerning the young generation's work and study and in the economic and scientific and technological spheres is markedly increasing. Leading Komsomol building projects, contests of skill between young workers, student building teams, youth production teams, summer labour and holiday camps and so on, are a concrete expression of this activity.

Genuine popular rule in the USSR is embodied in the nationwide organisation of socialist society, in the Soviets

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[1] *24th Congress of the CPSU*, Documents, Moscow, 1971, p. 84.

of Working People's Deputies. In accordance with the decisions of the 24th Congress of the CPSU, measures for further enhancing the authority and activity of the Soviets and particularly their influence on social production, have been worked out and are being put into effect.

The Scientific and Technological Revolution and the Ideological Struggle

The objective laws governing the scientific and technological revolution in socialist society differ fundamentally from those that apply under capitalism. This is due, first, to dissimilarity of the socio-economic conditions in which this revolution takes place and, second, to its dissimilar social effects, which directly or indirectly influence its character and rate of advance. Under capitalism scientific and technological progress entails intensified exploitation of labour, redundancy, and higher profits for the bourgeoisie.

In socialist society, which is free from exploitation of man by man, planned automation and mechanisation of production rule out the possibility of unemployment and serve to promote the people's welfare, as Soviet experience conclusively testifies.

Similarly, the driving forces of technological progress are fundamentally different under capitalism and under socialism. Explaining the mechanism of technological progress under capitalism, Marx wrote: "The law of the determination of value by labour-time, a law which brings under its sway the individual capitalist who applies the new method of production . . . this same law, acting as a coercive law of competition, forces his competitors to adopt the new method."[1] To elucidate this idea Marx quotes from an English economic treatise: ". . . so that every art, trade, or engine, doing work with labour of fewer hands, and consequently cheaper, begets in others a kind of necessity and emulation, either of using the same art, trade, or engine, or of inventing something like it, that every man may be upon the square, that no man may be able to undersell his neighbour."[2]

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[1] K. Marx, *Capital*, Vol. I, p. 319.
[2] *Ibid.*

Thus, the technical improvement of production and products is an economic necessity to every producer, born of competition, of the struggle for survival, for defeating the rival producers. The profit of each individual manufacturer and defence of the class interests of the bourgeoisie, not of society as a whole, are the forces motivating technological progress under capitalism. These principal motives still hold at the present stage of bourgeois society, i.e., under state-monopoly capitalism, when the capitalist state, carrying out a system of measures that proceed from the class interests of monopoly capital, tries to give these measures a semblance of national necessity. Actually, however, all such measures ultimately prove to be a masked offensive by the monopolies against the vital interests of the working people.

The problems of the scientific and technological revolution are today a vast field of tense ideological struggle. The essence, character, prospects and social effects of this revolution, all are questions to which radically different answers are found in scientific socialist ideology, on the one hand, and bourgeois ideology, on the other. Bourgeois cnceptions follow different trends. One of them is a variety of social pessimism, which reflects the decay of the capitalist system. The supporters of this trend, apprehending the conflict between the productive forces and capitalist relations of production in a distorted way, contend that the progress of science and technology leads to man's social and moral annihilation.

The American sociologist Lewis Mumford, for instance, believes that technological progress and liberal human culture are incompatible. It is not difficult to see that such views on the development of science and technology under capitalism reflect the deepening antagonisms of bourgeois society at its present stage and the negative consequences of the capitalist form of technological progress. It is common knowledge that modern capitalism uses the brilliant triumphs of the human mind first and foremost to create the weapons of annihilation that world imperialism needs for persecuting its aggressive policies, for fighting socialism and the anti-imperialist popular liberation movement. Therefore, under the conditions of imperialism there does indeed exist a most acute antagonism between the progress of science and technology and the development of civilisation. But this antag-

onism is due to the evils inherent in capitalism, not to the scientific and technological revolution.

Under socialism, however, technological progress has entirely different consequences. Systematic introduction of the latest achievements of science and technology in the socialist countries consolidates the new social relationships, raises the economic and cultural standards of the working people, and strengthens and advances the socialist countries. Under socialism the scientific and technological revolution is a mighty force contributing to the building of communism. Socialism alone provides the adequate social pattern for present-day technological advance, which under capitalism is fettered and impeded by private ownership. Bourgeois ideologists either fail to see, or deliberately shut their eyes to, these facts. At the same time, their dread of the progress of science and technology reflects the contradictory character of this progress under capitalism.

Equally unsound is the approach taken by other bourgeois ideologists who interpret the scientific and technological revolution in terms of apology for modern capitalism. In the process of acute ideological struggle they increasingly resort to distortion of reality, to shifts and subterfuges, seeking to frame their "own", bourgeois explanation of the laws governing the development of society.

To defend the foundations of capitalism, all sorts of theories and conceptions have been invented, of which the theory of "economic growth stages" and the theory of "a single (new) industrial society" advanced by F. Perroux, Raymond Aron and John K. Galbraith are fairly widespread. The authors of these theories often quite skilfully tailor their facts to fit into a preconceived pattern and, in so doing, give an anodyne account of the development of capitalism today, seeking to hide its true face and its imminent doom from the peoples.

The "industrial society" theory passes over completely the question of the relations of production, the sum total of which makes up the economic structure of society. Industrialisation as a real historical process is viewed out of any immediate connection with its actual economic base, capitalist or socialist. This is done quite deliberately in order to gloss over the principal factor determining the character of the current epoch, viz., the existence and struggle between two

socio-economic systems, capitalist and socialist, and also to pervert the scientific criterion of social progress.

The authors of the "new industrial society" theory regard the progress of science and technology separately from the class struggle, seeking to belittle the revolutionary role played by the working class in the development of society at present. This is exactly what John Galbraith does in his book *The New Industrial State*[1]. R. Aron, in addition, seeks to create the false impression that, in the industrial state, the party of the working class loses its revolutionary spirit.[2]

This difference in approach to the progress of science and technology among bourgeois ideologists and theorists reflects the contradictory tendencies in the development of science and technology in the era of monopoly capitalism, which were uncovered by Lenin, viz., the monopolies' inherent tendency to hold back the progress of technology and the tendency to promote it. By sharpening the contradictions of capitalism these two opposite tendencies increase the need for the socio-economic and political transition to the new social system, to socialism.

Time and again in bourgeois political and legal literature on the problems of scientific and technological progress one finds the unscientific idea that industrialisation supposedly brings about "the same living conditions" under capitalism and socialism. Those sharing this point of view allege that as corresponding indices of production come level and identical forms of planning emerge, the two opposite socio-economic systems presumably tend to converge, while the "sharp edges", political as well as ideological, between socialism and capitalism "wear down".

John Galbraith speaks of the "convergent tendencies of industrial societies, however different their popular or ideological billing. . .".[3] Another American, N. Preston, tries to prove that capitalism and socialism have some common characteristics, including recognition of the fact that under capitalism, too, public welfare is a national concern. In his opinion, all this is bringing nearer the end of the ideological

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[1] See J. K. Galbraith, *The New Industrial State*, Boston, 1967, pp. 263, 265, 270.

[2] See R. Aron, *La révolution introuvable*, Paris, 1968, p. 33.

[3] J. K. Galbraith, *The New Industrial State*, p. 389.

struggle, the time when all the nations and parties will adopt a common system of administration and regulation of the economy.[1] M. Duverger, a bourgeois French ideologist, expresses himself approximately in the same spirit.[2]

The main object of the bourgeois "convergence theory" is to deny the necessity for revolutionary reorganisation of capitalist society. The crudely technological approach, concentration and overemphasis on the coincidence of minor, purely managerial features coupled with complete silence on the socio-political nature of the existing systems and, first and foremost, on the fundamental distinction between socialist and capitalist economic relationships—such are the basic methods of argument adopted by the "convergence theory". Imperialist reaction regards this theory as a major instrument of "eroding communist ideology".

Closely associated with the "convergence theory" is the theory of "technological determinism", which has been widely publicised of late. Its supporters argue that technology *per se*, regardless of its social environment, gives rise to identical social and political processes. It is widely known, however, that the application of a certain kind of technology under capitalism produces diametrically different social results from what the same technology produces under socialism. Bourgeois ideologists attempt to assess the role played by technology in isolation from the social context of its development and use this to slip in the notion of "technology" in place of the Marxist-Leninist concept of the productive forces, on the one hand, and to negate the significance of socio-economic relations to society's development, on the other.

From the "convergence theory" they deduce that the fundamental distinction between socialist and bourgeois ideologies becomes progressively less and less important. Hence there arises yet another bourgeois theory—the "deideologisation" theory. Its exponents seek to show that the road to truth lies through overcoming "ideology" as the antipode of science, through renouncing the class approach. This theory is spearheaded against Marxism-Leninism, its aim

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[1] See N. Preston, *Politics, Economics and Power. Ideology and Practice under Capitalism, Socialism, Communism and Fascism*, New York, 1967, pp. 220-21.

[2] See M. Duverger, *La démocratie sans le peuple*, Paris, 1967, pp. 200-03.

being to increase the influence of bourgeois and reformist ideology.

An expression of the imperialists' fear of the growing appeal of socialism, the "convergence theory" also springs from a desire to whitewash monopoly capitalism and prove that it is capable of changing into an utterly different, non-capitalist, kind of society. It is not accidental either that some bourgeois ideologists avoid using the word "capitalism" altogether, so obnoxious has it become.

The scientific and technological revolution, which under capitalism involves extreme concentration and centralisation of capital, intensifies the contradictions between social production and private appropriation. This further reveals the historically obsolete nature of capitalist relations and private ownership of the means of production, and fosters the growth of material prerequisites of socialism.

Under socialism alone, does the progress of science and technology have free scope and bring higher living standards for the people, thus hastening the triumph of communism.

SOCIALIST INTERNATIONAL DIVISION OF LABOUR

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Organisation of social labour and production has hinged, from the start, on division of labour. Marx and Engels described division of labour as "the totality of the physical aspects of social labour",[1] "a definite organisation of the labour of society",[2] "the basic form of all production".[3]

Division of labour assumes different forms, namely, in society as a whole (general and specific division) and in separate enterprises (individual division). In the present epoch there seems to be a good case for singling out yet another form—the division of labour between national economies (international division of labour). Although based on common principles, each form of division of labour has important specific features of its own and must be studied independently. Thus, the theory of division of labour investigates its general principles, the development of its various forms, and their interaction in the course of history.

Division of labour in modern society is a twofold process. The division of labour inside society and inside each enterprise is supplemented by that which takes place between national economies. At some periods and in some countries the effect of different forms of division of labour may vary to a considerable extent. But given certain conditions inter-

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[1] K. Marx, *A Contribution to the Critique of Political Economy*, Moscow, 1970, p. 51.
[2] K. Marx, *Capital*, Vol. I, p. 364.
[3] F. Engels, *Anti-Dühring*, Moscow, 1969, p. 344.

national division of labour may become crucial to the organisation of the whole of social production.

Like production relations as a whole, division of labour is specific to each mode of production. Lenin observed that in different economic formations and in different periods division of labour assumed different forms.[1]

The historical succession of different forms of division of labour sees the twofold influence of the productive forces and division of labour, on the one hand, and of ownership and division of labour, on the other.

In capitalist society, thanks to the productive forces, division of labour progresses much more rapidly than under the pre-capitalist modes of production. Large-scale industry constantly brings about radical changes in the technical base of production, the workers' functions and the social combinations of the process of labour, thus constantly revolutionising the division of labour. Concentration of production is conducive to monopoly; the scale of production exceeds the home demand. Division of labour on the basis of large-scale capitalist industry takes the form of capitalist international division of labour. Division of labour between monopolies, particularly in the international field, becomes a major form of production under monopoly capitalism. Marx could state long ago that "thanks to the application of machinery and of steam, the division of labour was able to assume such dimensions that large-scale industry, detached from the national soil, depends entirely on the world market, on international exchange, on an international division of labour".[2] With the development of capitalism, international division of labour acquires ever greater importance and provides the groundwork for the emergence and expansion of the world capitalist economy.

Under monopoly capitalism, science and arms production stand out as the spheres of activity fundamental to the production cycle as a whole. These important fields deflect considerable manpower resources and national income and decisively affect the progress of technology, although they do so in a specific capitalist way, which necessarily implies wars. Science is becoming a leading productive force and it

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[1] V. I. Lenin, *Collected Works*, Vol. 2, p. 231.

[2] K. Marx, *The Poverty of Philosophy*, Moscow, 1959, pp. 139-40.

could play an immense part in expanding production to meet society's needs, but under capitalism it has to work primarily for imperialism.

An equally antagonistic distribution of the conditions of labour emerges in territorial terms as well. The capitalist international division of labour, relations between national economies, take shape as relations of enmity and rivalry, domination and subjection, typifying the imperialist colonial policy of the principal capitalist powers. Imperialism intensifies the contradictions between the industrial and agrarian countries, establishing a division of labour between primary-product and manufacturing countries, which is profitable to imperialism and unprofitable to the colonies, and creating new forms of colonial and semi-colonial dependence. The division of labour between developed capitalist countries is also antagonistic. It increasingly proceeds via the biggest monopolies, particularly those of the United States, penetrating into other national economies. Capitalist division of labour promotes the reproduction of capitalist property and of antagonistic differences between classes, between mental and physical labour, the town and the countryside, the advanced capitalist countries and the developing countries. At present, capitalist division of labour is proving less and less able to show up such advantages as are to be derived from specialisation of production, and has become a formidable obstacle to progress. The abolition of the capitalist division of labour along with all other capitalist relations of production emerges as an indispensable condition of free development of the productive forces in the interests of the whole of society.

Thus, since it is an expression of major relations of production and distribution and takes place as a stable and systematically repeated phenomenon, division of labour is an economic law governing the development of social production. From its very beginning, division of labour has been an objectively necessary form of organisation of labour. In the course of time the importance of the law of division of labour increases. Each socio-economic formation obeys its own law of division of labour. Socialist international division of labour is a law which governs the development of the socialist world economy, a law of universal significance.

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Socialist international division of labour—which is an objective developmental tendency—is affected by the entire system of the laws of socialist world economy. The objective necessity of providing ever more fully for the needs of the community, applying advanced technology most extensively for the sake of building up production, maintaining optimal economic proportions, keeping the growth of labour productivity ahead of earnings, aiding less developed countries—all this materially affects the rate and scope of the socialist international division of labour. Because it is not cramped by private ownership of the means of production and antagonistic contradictions between nations, socialist international division of labour develops more quickly. That is one of the important advantages of the socialist world system over the capitalist system. Unlike the capitalist division of labour, the socialist division of labour is organised according to plan. As Marx defined it, division of labour under capitalism is "a system of production which has grown up spontaneously and continues to grow behind the backs of the producers".[1] Socialist division of labour, on the contrary, is a system of production which is methodically developed by society as it gets to know and applies objective economic laws.

Socialist international division of labour is rooted in the emergence of national socialist economies which, as distinct from national capitalist economies, are able to employ more fully the essentially international productive forces developed under capitalism and create fresh productive forces of an international nature. Socialist ownership of the means of production not only abolishes relations of exploitation inside the national socialist economy; it is naturally conducive to relations of friendly co-operation between the working people of different countries, a mutually profitable, systematic socialist international division of labour, and complete equality and sovereignty in foreign relations. Such are the general, most important and constantly operating factors of the socialist international division of labour.

Right from the start national socialist economies make a

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[1] K. Marx, *Capital*, Vol. I, p. 106.

clean break with the unequal capitalist international division of labour. Since they are economically and politically homogeneous, the socialist countries have been able to speed up the socialist international division of labour and ensure it greater strength and stability than the old, capitalist division of labour.

Successful development of industry, national economic upswing, the need to use the results of the scientific and technological revolution and intensive economic growth factors contribute massively to the development and improvement of the socialist international division of labour. This process is of a systematic, continuous and overall nature. Its description is given in the Comprehensive Programme for the Further Extension and Improvement of Socialist Economic Integration by the CMEA member-countries. The Programme, which was adopted by the 25th Session of the CMEA Council in 1971, states: "The extension and improvement of economic, scientific and technological co-operation and the development of socialist economic integration by the CMEA member-countries is a process that is consciously and systematically regulated by the Communist and Workers' Parties and the Governments of the CMEA member-countries. It is a process of the socialist international division of labour, the drawing closer of their economies and the formation of modern, highly effective national economic structures, of a gradual drawing closer and evening out of their economic development levels, a formation of deep and enduring ties in the basic branches of the economy, science and technology, an expansion and consolidation of the international market of these countries, and an improvement of commodity-money relations.[1]

Socialism provides for a rapid growth of the productive forces, and "each new productive force . . . causes a further development of the division of labour".[2] The building of communism with its characteristic international use of productive forces intensifies the international division of labour, which becomes one of the most progressive and permanent

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[1] *Comprehensive Programme for the Further Extension and Improvement of Co-operation and the Development of Socialist Economic Integration by the CMEA Member-Countries,* Moscow 1971, pp. 14-15.

[2] K. Marx and F. Engels, *The German Ideology,* Moscow, 1964, p. 32.

historical tendencies. Division of labour is closely bound up with the progress of technology and forms its general basis. As the technical base of every branch of the national economy expands, it becomes possible to divide the process of production on truly scientific lines.

Development of the socialist international division of labour gives rise to additional, so to speak, natural forces of international social labour which cost the national economies nothing. Thanks to the social division of labour, the same amount of work yields more products, their production costs diminish, and accumulation rises.

Progress of the international division of labour and its greater effect on social production is generally expressed in a more rapid advance of specialised branches compared with overall production. One gets a general idea of this from the ratio of the dynamics of national income (overall net output) to foreign trade (output of the branches with international specialisation). If the physical volume of foreign trade surpasses the net product, the international division of labour must be gaining ground.

Thus in 1971 the national income and industrial production of the CMEA countries increased by 6.3 and 7.8 per cent respectively. Simultaneously the volume of reciprocal trade grew by 9 per cent, the exchange of engineering products rising ten per cent.

Socialist international division of labour is expressed above all in inter-country specialisation and co-operation in production. International specialisation and co-operation begin in those branches and lines of production where productive capacity is employed rationally due to the socialist world market or where meeting the collective needs calls for international regulation of production, including the building of new projects. International specialisation is needed also where the interests of scientific and technological progress require joint international effort in developing pioneer enterprises or a concentration of research on problems of interest to all or several of the socialist countries together. Without international specialisation it would be difficult to set up such optimal enterprises as we have now or obtain any substantial increase in production efficiency. Of course, there may also be other concrete conditions for international co-operation.

International division of labour is not limited to specialisation of enterprises and industries. It is conducive to the specialisation of the national economies as a whole and to the emergence of national socialist economic complexes. Specialisation is first taken up by enterprises or industries, but as its practical importance increases, it is geared to the national economy as a whole, and this raises the problem of determining the place of each country in the socialist world system. Since there is no world planning authority, and as the international specialisation of economic branches and planning of national economic complexes is the sovereign concern of the socialist states, it becomes increasingly important with time for the latter to co-ordinate their efforts and use the economic mechanism of co-operation to rationalise the economic patterns of each country and of the socialist world system as a whole.

A national socialist economic complex is a specific form of organisation of production which depends on the level of economic development (viz., the forms of ownership and degree of socialisation; the production facilities, labour resources and skill standards; production of the social product and national income; production patterns and the capacity of the home market), on the natural resources and geographical situation of the country, its part in the international division of labour and the tendencies of its historically conditioned progress towards socialism and communism as part of the system of the socialist world economy. A national socialist economic complex is incompatible either with autarky or one-sided international economic specialisation. Its distinctive features are as follows: developing industry in each country, including, of course, heavy industry, as the mainstay of its economic progress, independence and unchallenged sovereignty; developing agriculture and the consumer goods industries to provide for a maximum satisfaction of the growing requirements; deriving the full benefit of the advantages afforded by the international specialisation of production, increasing the output of export goods and accumulating enough exchange to pay for essential imports; developing transport and communications sufficiently to meet the needs at home and expand foreign trade; providing full employment for its population; adjusting the pattern of the national economy so as to make it more effective and

build up the economy of the world socialist community as a whole; promoting the development of research centres as the strongpoints of scientific and technological progress. The development of national economic complexes proceeds in accordance with the laws of socialism and communism. It helps to equalise the socialist countries' economic levels, involves aid to the less developed countries by those that are more advanced, and paves the way for a gradual integration of the national economies.

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Intensification of the socialist international division of labour depends to a great extent on how much the overall economic conditions favour the specialisation and stable cooperation in various branches and lines of production and how much they facilitate the grouping of international commodity producers. It seems that a quantitative criterion of the maturity of a national economy for taking a stable place in the international division of labour may be found in the correspondence of the value of goods intended for the foreign market to the socially necessary expenditures of labour (international value). Suiting the national production costs to international value is an intricate process which cannot be mastered without scientific planning and takes time. The division of labour between socialist countries takes into account a number of economic and political factors and is never based merely on any one criterion.

Before the world socialist system emerged, the Soviet Union had to develop on its own with the result that its economy was practically autarkic. Right up to the Second World War its foreign trade fell short of the pre-revolutionary level, amounting in 1938 to only a fraction of the 1913 volume. After the war, the situation altered a great deal. Foreign trade began to grow faster than national income. In 1970, it exceeded, in comparable prices, the pre-revolutionary level 5.7-fold and the 1938 level 20.2-fold. This mainly refers to trade with socialist countries.

Compared with national income, the volume of Soviet foreign trade is relatively small, amounting to about 7 per cent. The experience of other countries, however, testifies that both international division of labour and foreign trade can decisively contribute to social reproduction provided

that a much larger share of national income is realised through foreign trade—at least three times more than is the case with the Soviet Union at present. In such countries as Bulgaria, Czechoslovakia, the GDR, Hungary and Yugoslavia export trade accounts for a fifth to a third of national income. But the socialist international division of labour is steadily advancing. And since reproduction in the Soviet Union takes place in the context of the socialist world system, one must not only know what role the international division of labour plays in the economic development of the Soviet Union, but foresee what impact Soviet economic foreign relations may have on reproduction in other socialist countries.

The most significant division of labour among the socialist countries has been established, and is developing, in raw material production and engineering and in the sphere of science and technology.

Keeping up the supply of raw material was already an international problem under capitalism. With the growth of the socialist productive forces, this problem becomes even more significant. Analysis of the foreign economic relations of the CMEA countries shows that with respect to the primary products industries there exists a marked and increasing division of labour among the socialist countries. Bulgaria, Czechoslovakia, the GDR, Hungary, Poland, Rumania and the USSR are bound up with one another by deliveries of coal, coaking coal, and coke. Oil and oil products are supplied to the European socialist countries mainly by the Soviet Union and partly by Rumania. Iron and steel works in Hungary, Poland and Czechoslovakia and, to a certain extent, in Rumania and Bulgaria are based on Soviet iron ore. Bulgaria, the GDR, Hungary and Rumania import large quantities of cast iron and rolled stock. The Soviet Union is a major consumer of Hungarian bauxite, Polish sulphur, and non-ferrous metal ores and metals from a number of countries. Nearly all the European socialist countries use Soviet timber and fertilisers. The textile mills of Poland, the GDR and Hungary use Soviet cotton. The Soviet Union, Czechoslovakia, the GDR, Hungary, Rumania and Bulgaria jointly operate electric power stations.

Some socialist countries get nearly all the key raw materials they want through reciprocal deliveries. Taken

as a whole, the CMEA countries obtain via reciprocal deliveries 98 per cent of their total coal imports, up to 96 per cent of their oil and oil products, about 80 per cent of their iron ore, and the bulk of non-ferrous metals, phosphorous and potassic raw materials, timber and cotton. Without reciprocal deliveries of raw materials, neither individual economies nor the world socialist economy at large would be able to function. Soviet raw materials predominate in the socialist countries' reciprocal trade in raw materials. In 1971-75 the Soviet Union will deliver still more raw material and fuel to the European CMEA countries. Soviet oil deliveries will increase from 138 million tons in 1966-70 to 243 million tons in 1971-75, while the deliveries of natural gas will increase from 8 to 33 thousand million cubic metres, electric power from 14 to 42 thousand million kilowatt hours, and iron ore (in terms of metal) from 72 to 94 million tons.

Division of labour among the socialist countries with respect to raw material production has exploded the notions entertained by bourgeois economists. Whereas under capitalism the supply of raw materials is the exclusive function of colonies, under socialism such a highly industrialised country as the Soviet Union has become the principal supplier of raw materials. Some unscrupulous economists seek to explain this fact by alleging that this is due to the "high prices" of raw materials which, they claim, are dictated by the Soviet Union. But such "explanations" will satisfy only absolutely uninformed people. The socialist countries, as a rule, stick to the prices quoted on capitalist world markets. Hence, no prices are, in fact, dictated. The real answer lies in the principles of socialist division of labour, which are altogether different from capitalist principles, and in proletarian internationalism, in mutual support and the aid that advanced socialist countries afford to those that are less developed.

The same line for equal, progressive development of the socialist countries is clearly demonstrable from the division of labour in the engineering industry. All the socialist countries produce machinery and participate in the division of labour between engineering works. A relatively even distribution of the engineering industry in all the socialist countries is a vital factor in equalising their economic levels. Co-operation in the engineering industry is especially closely

linked with application of the results of the scientific and technological revolution. Countries but recently backward and entirely dependent on the import of industrial equipment, have now become major exporters of machinery. So, Bulgaria, which formerly exported no plant whatever, now does so on a large scale, and to advanced countries as well. It sells the GDR electric cars, telphers, metal-working and wood-working machines, farm and textile machinery. Czechoslovakia imports Bulgarian metal-working machines, equipment for the food industry, and storage batteries. The Soviet Union buys from Bulgaria plant for the food and light industries, farm machinery, vineyard tractors, electric cars, electric motors, etc.

Radical changes in the situation of formerly less developed socialist countries in the capital goods market may be observed from the rising share of machinery in their total exports. Before the revolution Bulgaria exported no machines at all, while less than one per cent of total exports from Poland and Rumania in 1948 were of machinery. In 1967, however, machines and equipment accounted for about 20 per cent of Rumania's total exports, over 25 per cent of Bulgaria's, and 36 per cent of Poland's.

Important sections of the Soviet national economy are supplied with equipment made in the CMEA countries. Between 1966 and 1970 Soviet industry received from the CMEA countries plant for 54 chemical factories. More than 35 per cent of the tonnage of sea-going vessels added to the Soviet fleet in this period was built in the shipyards of the CMEA countries. At the same time, a third of the machines imported by the CMEA countries come from the Soviet Union—power-engineering and oil-well drilling plant, tractors and lorries, farm machinery, excavators, road-building machines, and complete sets of plant for factories in leading industries.

With the help of Soviet equipment, socialist countries have completed or are constructing major industrial projects and are able to launch new branches of industry. In these countries between 1966 and 1970 more than 300 industrial and agricultural enterprises were built or reconstructed with Soviet technical assistance. Co-operation in machine-building has become one of the most notable features of the socialist countries' economic relations. In 1970, reciprocal deliveries

of plant and machinery accounted for about 41 per cent of the total amount of business transacted between CMEA countries.

The socialist international division of labour in the engineering industry has resulted more observably than in the case of other economic branches in inter-state specialisation and co-ordination of production. The CMEA countries have accordingly concluded a large number of bilateral and multilateral agreements concerning, among others, such fields as the production of computer-controlled metal-cutting lathes, provision of material and technical facilities for a container transportation system, manufacture of lorries, transport and farm machinery, inland sea-and rivercraft, glass and ceramic articles. A more detailed division of labour has been outlined in the production of plant for atomic power stations to meet the requirements of the CMEA countries before and after 1980. Joint operation of bearing plants has kept the co-operating countries supplied with bearings at much lower cost. Soviet production of motor-cars at Togliatti is being co-ordinated with factories in Bulgaria, Czechoslovakia, Hungary, Poland and Yugoslavia.

Division of labour and co-ordination of research in the socialist countries are essential to the rapid and systematic progress of the scientific and technological revolution. The scale of research today is so vast, and so costly, that none but very large and very rich countries are able to engage in it to full extent. But international division of labour and co-operation in research yield most effective results. The following figures illustrate the scale on which the socialist countries co-operate in science and research.

In accordance with the Comprehensive Programme, co-operation agreements concerning eighteen research and development efforts have been signed by competent bodies of CMEA members, and twenty co-ordination centres, seven research co-ordination councils, two international research bodies, and one research and development association have been set up. Co-operation is mostly organised through co-ordination centres, in which over 500 research and design establishments in CMEA countries take part. The scope of co-operation with respect to scientific and technological forecasting, co-ordination of scientific and technological research, and exchange of scientific and technological knowhow has

been widened. The organising role in these efforts belongs to the Scientific and Technological Co-operation Committee instituted by the 25th CMEA Session.

In 1971, agreements were signed on scientific and technical co-operation between Bulgaria, Czechoslovakia, the GDR, Hungary, Mongolia, Poland, Rumania and the Soviet Union in seven fields and problems of science and technology. It is intended to set up international co-ordination centres on the following problems: research into biophysics; development of biomedical instruments and apparatuses for research and clinical medicine; anti-corrosion measures; protection of nature; all-round utilisation of wood; development of new kinds of pesticides and biological and other methods of plant protection, and overall investigation of the effect exerted by the means of protection on environment; development of new industrial catalysts and improvement of those in current use.

We see from these facts that the socialist international division of labour is of great and ever-growing significance to the countries of the world socialist system. The Directives on the Ninth Five-Year Economic Development Plan of the USSR for 1971-75, envisage a number of new concrete steps towards a systematic development of close economic and scientific-technical co-operation between the USSR and other fraternal countries, and of the socialist division of labour between them.

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Progress in the socialist international division of labour calls for a further improvement of economic management. To keep the socialist countries supplied with raw materials adequately and in the most rational way, to increase specialisation and co-operation in the engineering, chemical and other industries, to advance co-operation in the sphere of science and technology, to accomplish the co-ordinated technical re-equipment of the countries of the world socialist system, to improve the pattern of foreign trade, including prices—to do all this, the socialist nations must co-ordinate their long-term and five-year development plans. In fact, the CMEA countries have already started their common work on the next five-year (1976-80) and long-term plans.

The aim of the effort is to make their economic and scientific-technological co-operation an increasingly integrated process, enhance the role played by science in defining the prospects of development, and master the latest scientific achievements in the shortest possible time. The plans for 1976-80 will be drafted bearing in mind the co-ordination of the longer-term plans—up to 1990.

Planning of foreign trade is also being improved. Facts testify that the plans of foreign trade are systematically overfulfilled. Under the seven-year plan for the economic development of the USSR, Soviet trade with other socialist countries was scheduled to increase more than 1.5-fold in 1965 as against 1958. Actually, however, it increased more than 1.7-fold. In the five-year period (1966-70), trade between the Soviet Union and other socialist countries increased by nearly 50 per cent. Between 1971 and 1975, the Soviet Union's trade with the other CMEA countries is to increase by another 50 per cent. The annual rate of increase will be 30 per cent.

Socialist international division of labour demands special forms of co-operation. Accordingly, while the present forms of economic organisation are being improved, new ones, tailored to suit the needs of internationalised production, are being tried out.

We believe that co-operation between socialist countries in developing and financing branches and lines of production that are of common interest to all or a group of socialist countries is highly promising. We have seen a proof of this in the joint financing of enterprises producing raw materials (oil extraction in the USSR, coal-mining in Poland, potash fertiliser production in the GDR, copper mining in Bulgaria, exploitation of the Danube water resources, etc.). It is a well-known fact that the primary products industries need heavier investment and take several times longer to start paying back than the manufacturing industries. This is one important reason why the per capita rate of investment is higher in the Soviet Union than in other countries. Co-operation makes it possible to spread capital investment rationally among the countries consuming the raw materials. Usually the crediting party supplies the necessary material and plant, receiving manufactured goods in return. Completed projects are the property of the countries on whose

soil they are situated. This form of inter-state co-operation is recognised as most convenient and will undoubtedly continue to develop.

Also promising are international organisations which arrange for specialisation of enterprises, comprehensive and rational exploitation of available capacity, and exchange of specific goods (e.g., Intermetal). The international operations of the Hungarian Medicor group of factories, one of the world's biggest producers of medical equipment, provide an interesting example of organisation. The firm co-operates with the Polish Varimex, Czechoslovak Kovo, Soviet Medexport, and the Intermed in the GDR in supplying complete sets of hospital equipment to third countries. The agreement of the five producer-suppliers whose enterprises employ tens of thousands of workers, engineers and scientists is based on mutual advantage and financial liability for each partner in the event of his failing to perform a contract.

Besides providing market facilities, the amalgamation achieves stable specialisation, co-operation, modernisation and considerable expansion of production. In the power industry, the CMEA recommended going over gradually to integrated power grids embracing a group of countries. The Mir international power grid has marked the beginning of such integration. From the economic point of view, this may be regarded as the emergence of a network of international socialist cartels handling important organisation and economic problems concerned with the progress of the socialist international division of labour. All-round introduction of cost-accounting and a higher rate of profit are of essential significance to international socialist cartel agreements. It is quite probable that in some cases the introduction of cartels will make for greater participation in industrial management.

Co-operation between socialist countries may also give rise to what can be described as socialist concessions. For instance, the Soviet Union has made available to Bulgaria some forest areas on certain terms. These are worked by Bulgarian lumbermen with their tools. Socialist countries enjoying international credit may launch other kinds of industrial and trading organisations. Cartels may also prove useful for exploiting the raw material resources of developing

countries on mutually profitable terms and for helping them advance their national economies.

The socialist world has entered a new period of development when, thanks to the technological revolution, it can use much more fully the great potentialities inherent in its social system. Time increasingly bears out the correctness of the course for closer co-operation and socialist economic integration.

Even the initial steps towards realising the Comprehensive Programme have demonstrated the palpable advantages of the socialist type of international economic relations, combining the national and international interests of all the CMEA member-countries. Since 1972, when Cuba joined the CMEA, this international association includes nations of three continents.

Today we can see the general outline of the colossal development programme of the socialist community of nations, populated by 382 million, whose realisation will nearly double its industrial potential in ten years.

As they use together the results of the technological revolution and the advantages of the socialist division of labour, the CMEA member-countries by no means confine themselves to its limits. As the 26th CMEA Session, held in 1972, again stressed in its communique, the CMEA member-countries "will heretofore further in every possible way the development of world trade and the all-round industrial, scientific and technical cooperation between the member-countries and third nations on a mutually beneficial basis, and will promote the economic and cultural progress of developing nations. The measures and projects put forth in the Comprehensive Programme are open to all peace-loving nations which are free to join in wholly or partially realising the Comprehensive Programme."

NEW HORIZONS OF SCIENTIFIC AND TECHNOLOGICAL PROGRESS IN THE CMEA COUNTRIES

Konstantin Mikulsky, C. Sc. (Econ.)

The countries of the world system of socialism are today entering a period of radical transformation of the scientific and technological foundations of production and of corresponding advances in various spheres of social life. Conditions are ripening in these countries for fundamental progress of the productive forces, destined to make social labour far more effective than ever before.

A period when socialist industry progressed as far as it could progress on what have become traditional technological and organisational principles is now drawing to a close. Today we are witnessing the beginning of *qualitative* changes in production, when the latest achievements of science make it possible to embark on fundamentally new solutions in the field of industrial organisation and designing, to find the optimal economic proportions, to change man's functions in the production process and further improve economic life on a new scientific and technical basis, by fuller realisation of production potentials.

* * *

The scientific and technological revolution is becoming an increasingly important component in the whole set of problems that have to be solved in the course of the contest between the two world systems. While clinging to the past in the field of social relations, capitalism is trying to "escape into the future" in production. In forcing the pace of the scientific and technological revolution, the leading capitalist

powers calculate that it will cushion the most acute class contradictions and allow them to improve and strengthen their positions in the contest with socialism. What actually happens is something quite different, however. The accelerated growth of the productive forces restructures the population socially, stimulates the people's urge for social justice and the need for self-expression, and actually sharpens class contradictions. It becomes apparent that the system of social relations based on exploitation is incompatible with all the positive innovations that scientific and technological progress introduces in the life of society. As Lenin remarked, "capitalist technology is increasingly, day by day, outgrowing the social conditions which condemn the working people to wage-slavery".[1]

At the same time the scientific and technological revolution creates conditions for a quicker realisation of the advantages of the socialist mode of production. Until recently the general level of development of world science and technology offered relatively modest opportunities for increasing the effectiveness of the socialist economy, for an upsurge of the productive forces. Strictly speaking, only as the scientific and technological revolution takes effect does the new system create a sufficiently highly developed material and technical basis. No matter how great the successes of the socialist countries have been in developing their economies, the present productive forces are as yet in many ways not sophisticated enough for a consistent and comprehensive utilisation of the possibilities opened up by national ownership of the means of production and for fuller application of the principles of social organisation of labour.

For want of an adequate scientific and technical base, for example, socialist society for a long time lacked the knowledge and equipment required to carry out comprehensive and effective auditing of the economy, to select the most rational variants of economic development and so on. This reduced the effectiveness of planning and not infrequently compelled the economic agencies to take decisions based on insufficient information, on an incomplete picture of the system of economic interrelations, on only a partial prediction and estimate of the possible economic and social con-

[1] V. I. Lenin, *Collected Works*, Vol. 19, p. 62.

sequences of this or that project. Now, however, the countries of the Council for Mutual Economic Assistance (CMEA) are mastering scientific methods and acquiring the technical means that will allow them to realise the principles of socialist planning much more fully.

Within a few years the economico-mathematical modelling of extended reproduction, the application of cybernetics and the use of computers, programming and other techniques will make it possible to raise economic guidance to a qualitatively new level, to maintain optimal proportions and tap vast reserves for accelerating the growth of the planned socialist economy. This upswing of the productive forces of the socialist countries will be accompanied by elimination of the disproportions and imperfections that are inevitable at the early stages of social and economic development of the world socialist system.

The Comprehensive Programme for the Further Extension and Improvement of Socialist Economic Integration by the CMEA Member-Countries, unanimously adopted by the 25th CMEA Session in 1971, opens up fresh great possibilities of the further economic advance of the socialist countries. Expressing the firm determination of the CMEA members to carry out the long-term fundamental aims of their all-round co-operation and win the economic competition the Comprehensive Programme particularly emphasises the need to multiply efforts in developing jointly the problems of scientific and technological progress, applying the results of the technological revolution in every sphere of the national economy, and providing for a more efficient use of the technical apparatus of production and a higher labour productivity.

Today, as a result of the increasing transformation of science into a direct productive force, the development of many of its branches is becoming, in effect, a component of the complex process of reproduction. Research and development in the CMEA countries is now one of the stages of reproduction. Science determines the economic effectiveness of all industries. As has been shown in practice by the economically most developed countries of the world, the application in production of the latest scientific techniques yields no less than 50 per cent of the growth in national income.

The increase in the amount society spends on research and development is a prerequisite for raising the scientific and technological level of production in the CMEA countries. What is more, the rate of this increase must be higher than the growth rate of direct investment in industrial expansion.

The CMEA countries, even at this stage, have a fairly powerful research apparatus to work with. These countries provide a third of the world's scientists, although they have only a tenth of its population. The Soviet Union's research contingent, which accounts for a quarter of the world's scientists, is particularly significant. The number of researchers in the CMEA countries is increasing at a much faster rate than in the United States or advanced West European countries.

Taking into account the growing importance of research and development, the CMEA countries are spending large sums in this field. In the USSR, for instance, RD investment in 1950 accounted for 1.4 per cent of the national income, in 1960 for 2.7 per cent, and in 1970 for 4.1 per cent. The share of the national income spent by the USSR on research and development is now 50 to 100 per cent greater than that spent by the West European countries, and the USSR has drawn level with the USA in this respect.

In the other CMEA countries the portion of the national income allotted to research is also considerable.

The CMEA countries are faced with the dual task of simultaneously increasing the number of researchers and ensuring a faster rate of technical re-equipment of laboratories and research establishments. This naturally requires increased allocations from the national budget to scientific development. At the same time, however, it is particularly important to make more effective use of the personnel and the material and technical base of research establishments. In this respect the CMEA countries have tremendous unused reserves and their utilisation will make it possible to increase both the volume and effectiveness of research and development faster than the growth of allocations for these purposes.

As has been shown in practice, expenditure on research and development repays itself with interest in terms of production when their results are put to use. In the USSR today,

every ruble invested in basic and applied research, and also in development, contributes 1.45 rubles to the national income. It has been calculated that investment in research and development is four times as effective as any other investment.

Forecasts give every reason to suppose that the benefit accruing from the application of science will steadily and rapidly increase, that the "economic barrier" encountered in the application of scientific advances will more and more successfully be overcome. For example, it has been noted that the cost of electricity produced by atomic power stations is being reduced and that within a few years they will become economically competitive. The forecasts say that by 1980 conditions should be ripe in the CMEA countries for increasing the output of electricity mainly by building atomic power stations. Basic research in these countries on a number of other key scientific problems has at present reached a stage when the gaps in certain theoretical conceptions will shortly be filled and experiments completed, thus offering a prospect of major discoveries that will have a revolutionary effect on production. Some important discoveries have already passed into the stage of technological application.

The scientific and technological revolution implies the radical and comprehensive technical reconstruction of social production, which will be converted into a vast complex of automated production systems. In the course of this process the sphere of application of living labour will be sharply reduced and its functions in production substantially curtailed. Not only will man be liberated from direct physical participation in the production process; production itself will be "liberated" from the participation of man, will cease to be fettered by his biological possibilities. The transference of production functions hitherto performed largely or wholly by living labour to congealed labour will sharply increase the productivity of the former. At the same time the significance of the latest equipment will grow and its role in the production process will acquire correspondingly greater scope. "... Technical progress is expressed precisely in the fact that the work of machines pushes human labour more and more into the background."[1]

[1] V. I. Lenin, *Collected Works*, Vol. 1, p. 85.

The worker is liberated from direct participation in the production process by the introduction of all-round automation, when material production becomes to a certain extent and within definite limits a function of congealed labour. In the course of the scientific and technological revolution not only the interaction of the instruments and objects of labour will be automated; automation will spread to many processes of planning and regulating production and also its control, which has up to now been the province of mental work. Electronic machines will in a certain sense take over part of man's intellectual functions.

At the same time man's role in the development of the productive forces will increase rather than decrease, because his activity will gravitate even more towards genuinely creative work, towards the creation of fundamentally new means of production, new systems of guiding economic and technical processes. This will make it possible to speed up considerably the processes of industrialisation of agriculture. Mechanisation and automation of economic control and service operations will acquire greater scope. All-round automation of production processes, calculations and control and also the functioning of all sections of the national economy in keeping with the principles of cybernetics form the key element in the current scientific and technological revolution.

The CMEA countries approach this set of problems with significant successes to their credit (automation of electrical power engineering, for instance). Their industry, particularly that of the USSR, has achieved a higher level in certain branches than the developed capitalist countries. This applies to metallurgy, machine-tool building and the chemical industry. The Soviet Union's achievements in steel-making (continuous flow method) and welding (in space, for instance) are well known.

One of the main conditions for success in the current situation of revolutionary scientific and technological advance is proper structuring of the national economy. The CMEA countries have already, in the main, coped with the task of giving the leading role to machine-tools, chemicals and electrical power, which now contribute two-fifths of the gross industrial output of the CMEA countries, a proportion similar to that achieved in the most highly developed capi-

talist countries. The tendency for these branches to increase their share of total output will continue in future.

The primary task at present, however, is to speed up the growth of ancillary branches that are particularly important for technical progress. In the engineering industry this applies to electronics, instrument-making, the production of control and measuring apparatus, etc., and in the chemical industry, to the production of plastics, synthetic fibres, and so on. With this end in view, measures have been drafted to promote specialisation and co-operation of multiple plant for the chemical and some other industries.

It has also become exceptionally important for the CMEA countries to renew the assortment of output in all branches of industry, replacing old articles by new ones that cost less and are easier to make. Hence they are planning to accelerate the progressive tendencies in the balance of fuel power and raw materials, specifically by raising the share of oil, gas and atomic power in the whole complex of power sources, increasing the share of oil in the whole mass of raw materials processed by the chemical industry, and by making wider use of scrap metal to achieve a faster growth in steel manufacture compared with that of pig iron.

Society's constantly growing demand for more services, for more educational and health facilities, will have far-reaching consequences. On the one hand, it expresses the CMEA countries' new capacity to provide more input for the development of these spheres as labour productivity in production steadily rises. On the other hand, it is closely connected with the growing dependence of material production on progress in the non-productive sphere. The level of material production is at present largely determined not only by the extent to which the population can be employed but also by the rate at which people can be educated for creative forms of work. Whereas in 1950 the number of people in the CMEA countries employed in the non-productive sphere was approximately 13 per cent of the population, in 1967 it had risen to 19 per cent, according to our calculations, and continued to grow in subsequent years.

The Communist and Workers' Parties of the CMEA countries attach particular importance to wider utilisation of the possibilities that the scientific and technological revolution offers for improving the socialist system of eco-

nomic management. Long-term planning will be increasingly based on forecasts of scientific and technological and socio-economic development, on research and development programmes, and on the training of suitable personnel. The process of managing social production will be put on a firm scientific basis—the regulation of the mechanism of the national economy on cybernetic principles, electronic data processing and so on. Forecasting, planning and control by means of computers will, in effect, become a major new branch of the economy, at both the national and local (district or factory) levels. The mechanism for the conscious utilisation of the objective economic laws of socialism will thus become fully operational.

The raising of the factory workers' qualifications, the development of their ability to use the latest equipment and to improve it plays a special part in the scientific and technological revolution in the CMEA countries. "Investment in brain power" thus becomes exceptionally important for advancing the national economy.

Engaged in the national economy of the CMEA countries today are millions of experts graduated from secondary technical schools and colleges. Graduation of young specialists here proceeds on a steadily rising scale. It is gratifying that with respect to the number of students per ten thousand of population the CMEA countries hold foremost positions in the world, leaving behind many advanced capitalist countries. In the Soviet Union, for example, the annual increase in the number of graduate engineers employed in the national economy is several times that of the United States. In 1970, 257,000 engineers graduated in this country against 52,000 in the United States, the total number of graduate engineers in the Soviet Union that year exceeding that in the United States 170 per cent. Within the next few years most of the CMEA countries will introduce universal compulsory secondary education.

The composition of the working masses as regards trades and qualifications is also undergoing qualitative change. For example, in the coming years, according to current estimates, twothirds of the living labour expended in agriculture in the CMEA countries will be skilled. The CMEA countries are also tackling the important problem of systematic mass retraining of specialists, and raising their qualifications to

fit the demands of the scientific and technological revolution. It is a well-known fact that the knowledge acquired at college is quite often not enough to last the specialist more than five or six years in industry. Hence, the need to set up a country-wide network of retraining establishments, which is being done in the CMEA countries.

The CMEA countries' spending on education at present runs to between 5 and 8 per cent of the national income. The efforts of socialist society to raise the general educational and professional level of the working people contributes substantially to the upswing of the economy. In recent years in the USSR, for example, every ruble spent on raising the educational and professional level of the population has yielded an annual increase in the national income of 53 kopeks.

It is also worth noting the truly mass character of the "quest for knowledge" in the socialist countries, which has seized the broadest sections of working people. That is one of the greatest social gains of the new system and a major prerequisite for the further growth of socialist production on a new scientific and technological basis. Thanks to their determined effort to provide enough qualified personnel for the national economy, the CMEA countries have been able to provide a reliable foundation for the further progress of the scientific and technological revolution. For the socialist economic system this revolution signifies a transition to a new, higher stage of rationalisation of economic processes. This is expressed primarily in the intensification of socialist extended reproduction.

In the five-year economic period completed in 1970, the CMEA countries already achieved a faster growth of the social productivity of labour compared with the preceding five-year period. The social productivity of labour in these countries as a whole, estimated in terms of the amount of national income per person engaged in material production, increased by 35 per cent in 1966-70, compared with 29 per cent in 1961-65. In spite of the fact that in developed capitalist countries the results of the scientific and technological revolution are also applied on a growing scale, the socialist countries boast a much higher growth rate of labour productivity. Thus, while in 1961-71 the average annual increase in labour productivity amounted to 6.3 per

cent in Soviet and 3.3 per cent in US industry, in 1966-70 it amounted to 5.8 and 2.2 per cent respectively.

The socialist countries seek to raise the role played by the growth of labour productivity in the economic competition with the developed capitalist countries. As is known, the Soviet Union has already attained a higher level of labour productivity in industry than that in some developed capitalist countries, and is now shortening the gap so far obtaining between it and the United States. The gap will be eliminated in the first place by increasing the productive assets and power available per worker, as well as by improving the operational characteristics of new assets and using the old ones more efficiently. An important part will be played by reducing the proportion of auxiliary and manual labour. Of considerable importance will be the further improvement of the industrial pattern of the Soviet economy, such as, for example, the relative growth of the new industries.

The success achieved by the socialist countries in developing the progressive industries is indicated by the following figures. In 1951-71 oil extraction in the socialist countries increased 9.6-fold compared with a 4.2-fold increase in the rest of the world; the production of synthetic resins and plastics increased 27.5- and 19.7-fold respectively; and the production of chemical fibres increased 7.6- and 4.4-fold over 1951-70.

Under socialism, the effort to raise the effectiveness of production is closely combined with the growth of personal incomes. In contrast to capitalism, technological progress here entails no unemployment or insecurity; on the contrary, it is a prerequisite of an ever fuller satisfaction of the people's requirements. Greater productive forces will ensure a rapid growth of the living standards of absolutely all sections of the working people, the highest national living standard in the world. During the current five-year plan period alone, real incomes of the population in the CMEA countries will increase by about a third. A higher growth of capital investment in the CMEA countries, compared with the capitalist countries, is accompanied by a more rapid growth of living standards. Thus, in the Soviet Union, the real per capita income in 1975 will be nearly three-quarters higher than in 1965. It took the United States, the richest

capitalist country, about thirty years to secure a roughly similar increase in average personal incomes.

The social consequences of the scientific and technological revolution in the socialist countries will be seen not only in exceptional progress towards fuller satisfaction of the growing requirements of the masses. They will also be seen in the strengthening of the indissoluble ties between the interests of society and both the future and current interests of the collectives at enterprises and of every individual worker. The forms of social relation between the worker and the means of production that are characteristic of socialism, his role in the system of production and management, the principles of distribution of the social product will be further developed and improved. This will be an expression of the high maturity of socialist production relations and the scientific nature of the direction of society's social development on the basis of qualitatively new forces of production.

The socialist countries belonging to the Council for Mutual Economic Assistance are solving for the good of man the many complex problems and contradictions which inevitably arise in the course of the scientific and technological revolution. These include: the problem of combining the state control of a highly centralised economy with promoting the initiative of the working people, with bringing the masses into practical participation in running the affairs of society; making the labour of people employed in the mass trades steadily more creative in character; rational use of leisure to enrich the personality; prevention of the negative effects of industrial development on the environment.

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The path of the scientific and technological revolution is likely to be long and far from easy. It would be wrong to expect automatic progress in this field, to think that one has only to wait for the "fruit to ripen". This revolution makes serious demands on all research and planning, on the system of education and material and moral incentives, on practically all spheres of social life.

The handling of the scientific and technological revolu-

tion in the socialist world is the international task of all the fraternal socialist countries and it must be solved by their combined efforts. Experience shows that only the new type of international economic relations that has formed in the world socialist system expresses truly equal and mutually advantageous co-operation, which is the great accelerator of the productive forces in every country of the socialist community.

SPECIFIC FEATURES AND SOCIAL CONSEQUENCES OF THE SCIENTIFIC AND TECHNOLOGICAL REVOLUTION

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Some of the substantial qualitative and quantitative features of the scientific and technological revolution may be highlighted by comparing it with the development of science and technology in the past.

Its most general qualitative feature may be described as follows. This is history's first scientific and technological revolution. It is not merely a coincidence in time of revolution in science and technology. There have been such coincidences in the past. What was absent, however, was the profound interrelation and interdependence inherent in the present-day development of science and technology.

These are bilateral relations. On the one hand, all the major achievements of present-day technology are based on fundamental, revolutionary discoveries in the natural sciences; the range of scientific subjects which find technical application is being steadily expanded, and the time required for their application reduced. Today science is preparing the ground for the further revolutionary development of technology. The higher rate of development of science compared with that of technology and production is expressed as a characteristic feature of the scientific and technological revolution in the formula proposed by Soviet scientist G. Dobrov: $\frac{dS}{dt} > \frac{dT}{dt} > \frac{dP}{dt}$, where d is development, S—science,

T—technology, P—production and t—time. But this is only one aspect of the current revolution.[1]

On the other hand, scientific progress rests on the modern machine industry. As Lenin pointed out, "large-scale machine industry alone introduces a radical change, throws manual skill overboard, transforms production on new, rational principles, and systematically applies science to production".[2]

Without considering the role of the machine industry and also automation and electrification of production in social progress, it is impossible to understand the very essence of the scientific and technological revolution, which entails radical changes in science itself, its industrialisation and the increasingly frequent transformation of the work of scientists into a "variety of industrial labour". Without all the modern installations, such as proton accelerators, cyclotrons, nuclear reactors, it is impossible to develop the physics of elementary particles, nuclear physics, etc. A scientific experiment depends not only on the use of large and intricate installations, the erection of which has become possible only in the present stage of industrial development, but on industry itself. More and more often scientific experiment has to go beyond the bounds of the laboratory and can only be satisfied by testing on an industrial or even cosmic scale. Though science in its powerful leap-like advances outstrips technology and production, its development is still directly influenced by production and technological requirements. The determining role of production and technology in relation to science can be symbolically expressed in the following way: $\frac{dP^1}{dt} > \frac{dT^1}{dt} > \frac{dS^1}{dt}$, where P^1 is the quantitative characteristic of production, T^1—technology, S^1—science and t—time.

This formula might appear to exclude the previously cited Dobrov formula. This is not so, however. Whereas the first formula reveals the spiritual factor as being *in advance* of the material factors ("spiritual" here implies the producing,

[1] This aspect is sometimes exaggerated. G. Bohring (GDR), for instance, notes "... a change in the basic social functions of science, which is being transformed into a direct productive force and acquires an absolute leading influence on production". (G. Bohring, "Die philosophische Grundeinschätzung der wissenschaftlich-technischen Revolution der Gegenwart". In: *Zu Grundfragen unserer Zeit*, Die Technische Hochschule für Chemie, Leuna-Merseburg, 1967, S. 25.)

[2] V. I. Lenin, *Collected Works*, Vol. 3, p. 542.

constructive function of the mind, which not only reflects but also "ideally creates" the world), while the second formula reveals the *determining* role of the material factors (production and technology) in respect of the spiritual factor (science). Both formulas are correct at one and the same time, since they merely reveal different aspects of the interaction of the material and spiritual factors. The recognition of this is relevant to modelling scientific and technological progress and to an understanding of its essence. It can be concretely expressed in figures and graphs.

The interaction of science and technology is naturally subject to the influence of other social factors, such as the social system, economic incentives, wars, etc. However, it is a fact that the revolutionary processes taking place today in science and technology are interwoven and form a single process definable as the scientific and technological revolution.

This revolution is a general process involving in one way or another the entire system of science and technology. Now let us examine its two components, taking science and technology separately, since, despite the unity of their present-day revolutionary development, their qualitative changes are of a specific character.

As far as *science* is concerned, this implies: (a) fundamental renewal of factual material and information; (b) intrusion into principally new spheres, uncovering of the laws of nature, consciousness and society on new levels of knowledge; (c) radical changes in the methodology of scientific research connected with the wide-scale introduction of mathematical and cybernetic methods; (d) intensification of the processes of the differentiation and integration of sciences, setting up of a unified system of scientific knowledge; (e) industrialisation of science, transformation of its technical basis. Thus, this revolution covers all aspects of science and is taking place in virtually all branches of scientific knowledge.

In the *technological* sphere, revolutionary changes affect all its branches and all its aspects, and are characterised by: (a) radical transformation of the material substratum of technical equipment and technical systems connected with utilisation of fundamentally new materials or radical changes in the properties of traditional materials; (b) utilisation of

new sources of energy, processes and forms of the movement of matter; (c) qualitative change in the elements and structure of technological systems connected with creating machineless technology, the construction and utilisation of control and logical devices; (d) radical changes in the functions performed by machinery, with automation turning over to mechanisms more and more functions of an intellectual nature.

The scientific and technological revolution has virtually embraced all the major spheres of social life—production, transport, information and communications media, public health and living conditions, and is actively intruding in the sphere of culture, art, etc. But its primary influence has been on the nature, rates and trends in the development of its components—science and technology.

In the past two or three decades the scientific potential of society has made a qualitative leap. And this manifests itself both in the more or less steady rise in the number of scientific workers, engineers, agronomists, etc., and in the noticeably changing correlation between the above-mentioned categories and the remainder of the population engaged in production. Between 1940 and 1950 the number of scientific workers in the USSR increased from 98,300 to 162,500 persons, i.e., less than twofold. During the next decade their number more than doubled, reaching 354,200. The next 100 per cent increase was achieved within six years and by 1966 the number of scientific workers reached 712,400, while by 1970 the figure was 927,700. It is difficult to predict how long this rate of increase in the number of scientific workers will be sustained. Obviously, it cannot be a permanent process, for the doubling would occur even more frequently and the entire population would very soon be absorbed in the sphere of scientific activities.

Some professions are being replaced by entirely new ones. The post-war decades have seen a sharp growth in the number of specialists in cybernetics, the atomic industry, space vehicles construction and design, rocketry, quantum generators, etc. The automation of production alone has brought about more than 20 new specialities. Hence an unprecedented increase in the need for trained personnel.

The scientific and technological revolution has led to a profound awareness of the enhanced role of science in

society, and has elevated the guidance of science and the training of scientific personnel to the level of state policy. The President of the USSR Academy of Sciences, M. Keldysh, has pointed out that throughout the world science is becoming an object of state activity. This is the new feature which has been developed to the full since the Second World War. And whereas the Soviet Union was the first country where numerous scientific institutes made their appearance and where the state organisation of science came into being, gradually all countries followed suit and not only socialist, but highly developed capitalist countries, too.

Characteristically, under capitalism the personnel requirements of the scientific and technological revolution are met in a contradictory way. Along with stepping up the training of one's own experts, the intellectual resources of other countries are also exploited. The United States has become the centre of a peculiar form of colonialism in the sphere of scientific and technological progress. In the decade, 1957-67, emigration of highly trained specialists from Western Europe to the United States increased sixfold. Between 1949 and 1964, 85,000 foreign scientists, doctors and engineers, including many from the developing countries, settled in the United States.

Thus, the exploitation of the resources of one country by another under capitalism also gives rise to new forms of social contradictions. Writing about the development of bourgeois society under the impact of technological progress, Lenin pointed out: "This progress, like the progress capitalism makes in every other field, is accompanied by the 'progress' of contradictions, i.e., by their intensification and expansion."[1]

Under socialism, however, the planned economy provides for conscious guidance of the changes taking place in the pattern of personnel occupied in science and technology, and one of its aims is to make best use of socialism's advantages over capitalism in this sphere.

The scientific and technological revolution changes the structure of the subjective elements of the productive forces, the social composition of the labour force, and there is an absolute and relative increase in the number of brain work-

[1] V. I. Lenin, *Collected Works*, Vol. 2, p. 187.

ers (scientists, technicians, engineers, agronomists, livestock experts, etc.) engaged in the sphere of production. Thus, the number of workers in the Soviet economy engaged mainly in intellectual work amounted to 2,888,000 in 1926, to 13,821,000 in 1939, to 20,495,000 in 1959 and to 27,360,000 in 1967. The approximate figure for 1969 was 30,000,000. There has been a noticeable change in the proportion of engineers and other technical personnel, on the one hand, to workers, on the other, with the percentage of the former increasing. The number of workers in new, highly skilled trades is constantly rising. There is an increase in the general educational level of the working class. Whereas in 1959 out of every thousand personnel employed in industry 386 had either secondary or higher education, by the beginning of 1971 this figure had risen to 550.

A change in the technical basis of production, the nature of labour, professional skill, etc., is a necessary condition for overcoming the essential differences between mental and manual workers due to the automation of production. Whereas in the prewar years there were only a few automatic and semi-automatic lines in individual branches of the Soviet engineering industry, in 1967 some 50,000 mechanised and automatic lines were in operation in the country. More than 6,000 such lines are annually being commissioned, while some ten per cent of the already operating lines are modernised due to the improvement in technological processes.

Human adjustment to the new conditions of the scientific and technological revolution—the mechanisation and automation of production—is an important task. In the USSR this is carried out on the basis of the state economic development plans which envisage the training of new specialists through the system of higher and secondary educational establishments, wide-scale polytechnical instruction in the schools, vocational training, etc. A major factor in solving this problem is social planning at individual enterprises. Such planning envisages conditions for overcoming the essential differences between mental and manual workers (mechanisation of labour-consuming processes, elimination of heavy manual work, improvement in technical training and general education, etc.). This makes it possible to take into account the peculiarities of technical progress at

individual enterprises. Social development plans are already being drawn up and implemented at many enterprises in Moscow, Leningrad, Sverdlovsk and Perm regions, in Lvov and other Soviet cities.

The 1950s saw the emergence among Western ideologists of the theory of the "Second Industrial Revolution". This theory claims that the scientific and technological revolution automatically transforms capitalism into a new society free of its former antagonistic contradictions, and leads to a new civilisation. Herbert Marcuse, for instance, thinks that, by substituting automated labour for machine-manual labour, the revolution in technology would inevitably "revolutionise the whole society" and this would mean "transcendence toward a new civilisation".[1]

These conceptions which have already been criticised in detail by a number of Marxist researchers show a one-sided exaggeration of the role of technological progress, which is automatically identified with social progress. They ignore the specific features of the dominating socio-economic relations, exclude the need for a revolutionary transformation of society and, finally, uphold the inviolability of the capitalist system.

Soviet authors relate the scientific and technological revolution with the industrial revolution in a positive way. First of all, what kind of industrial revolution is it? I. Dvorkin, for instance, maintains that the term of industrial revolution implies an upheaval in the relations of production, while the new technology is merely its prerequisite and basis.

Industrial revolution is also presented in current Soviet writings on the subject as the concluding stage of the scientific and technological revolution, meaning a situation when automated production begins to oust machine-factory production qualitatively. At the same time it is stressed that the scientific and technological upheaval will be followed by a "production revolution", which will entail a fundamental change in the social relations of production, final amalgamation of all the individuals participating in production, elimination of all unskilled labour, and institution of complete social equality for all members of society.

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[1] H. Marcuse, *One-Dimensional Man*, London, 1964, p. 36.

Another point of view is that the scientific and technological revolution is simultaneously an industrial revolution. Although these concepts are not identical, they nevertheless can be considered to be of the same order, reflecting the upheaval in the technological basis of the production process. Those who share this point of view do not include as part of the industrial revolution the upheaval in the system of social relations in production.

It is generally known that the industrial revolution of the 18th-19th centuries started with the introduction of machine production. The employment of machines resulted in a change in the technological method of linking man with the means of labour and at the same time led to new social combinations of production processes, to a change in the class structure of society, to the division of labour and a radical change in the social relations of production. Dealing with the characteristic features of the first industrial revolution, Lenin pointed out that during the time of Sismondi "there began that sharp and abrupt change of all social relations under the influence of machines (note, under the influence of machine industry, and not of 'capitalism' in general), a change which is known in economic science as the industrial revolution".[1]

The scientific and technological revolution of today transforms the technological basis of production as well as the pattern of the productive forces of society. This is primarily linked with automation, as a result of which men and machines are mutually liberated, as it were, from the restrictions imposed by man's psychological and physiological potentialities. The ties between man and machine are not severed by the automation of production but acquire more flexible forms; changes take place in the technological method of linking man with the means of labour. This, in turn, is accompanied by changes in the social combination of production processes, and leads to a definite transformation of the division of labour, to qualitatively new elements in social relations of production. Such changes go beyond the framework of the scientific and technological revolution and cannot be reduced to its characteristic features. It may quite naturally be suggested, however, that changes in the

[1] V. I. Lenin, *Collected Works*, Vol. 2, p. 236.

technological methods of production which go beyond the framework of the scientific and technological revolution are one of the decisive elements of the industrial revolution making for a qualitative break-up of the entire system of the social relations of production.

When speaking of a radical break-up of social relations of production one should have in mind that the extent of this break-up is to a considerable degree conditioned by the entire system of existing social relations. Thus, the first industrial revolution started after a social revolution. For instance, in Britain the industrial revolution proper was preceded by the bourgeois revolution of the 17th century and the radical break-up of the social relations of production that accompanied the industrial revolution in the 18th and 19th centuries should not be identified with the appearance of capitalist production relations in general. This break-up was connected with a change in the mode of production and above all meant an acceleration in the socialisation of production, influenced by the spreading of machine technology, the break-up of the economic relations which had survived up to a definite point after the bourgeois revolution and which were in accord, using Marx's words, with the conservative technical basis of production, with the manufacturing industry and with production that as yet retained comparatively secluded centres of a natural economy. As a result of the break-up of the social relations of production, the first industrial revolution facilitated the further development of capitalism.

Unlike the first industrial revolution, which initiated the process of the socialisation of production, the industrial revolution which we believe is going on today provides the prerequisites for completing this process. This leads to a sharpening of the basic contradiction of capitalism, the contradiction between the social nature of production and the private method of appropriation. However, even under capitalism, following changes in the technological relations of production and the deepening of the social nature of the productive forces, the socio-economic structure and the class structure of society are undergoing changes. The social nature of the productive forces is partially manifested in the concentration of finance capital, in the setting up of large monopolies, trusts, syndicates, etc. We, therefore, consider

it correct to say that an industrial revolution is also taking place in the developed capitalist countries.

Under capitalism, however, this industrial revolution cannot be carried out to the end and only prepares the material and technical conditions for the victory of socialism. Under socialism, a change in the technological method of production based on the scientific and technological revolution encounters no resistance on the part of the new production relations and leads to the formation of a new type of productive forces, to a qualitative transformation of the entire system of the social relations of production, to the communist method of production.

One of the essential results of the scientific and technological revolution is the contradiction at present to be observed between the artificial environment created by society for the benefit of man and the natural environment which man has not created but the material resources of which he utilises. On the one hand, there is the increasing power of the productive forces, resulting from the scientific and technological revolution, which provides the means for creating a high level of comfort in everyday life (comfortable housing, elegant clothes and fine furniture, high-speed transportation facilities, universal means of communications, etc.). On the other hand, the same growing might of the productive forces increases the rotation of matter and energy between nature and society, facilitates a more intensive utilisation of and change in the surface of the earth's crust, its water and air basins, which frequently leads to a violation of the established equilibrium between natural processes providing optimum conditions for the life of human society and the vital activities of the human organism. A new by-product of the scientific and technological revolution is the repeated radioactive contamination of the atmosphere, some parts of the earth, the seas and the oceans. At present we are, therefore, confronted with a greater need for compensatory measures, neutralising the influence of the by-products of technological progress on natural conditions. The protection of natural resources should become not only a principle of nation-wide management of the economy, but a matter for wide-scale international co-operation.

Along with the optimism over the prospects of social advance, of providing an abundance of material and spiritual

values, apprehensions also arise as to the exploitation of the achievements of the scientific and technological revolution. An irresponsible utilisation of the resources of nature that come under man's control could lead to unparalleled destruction. This means that today, as never before, people and states have greater responsibility for the fate of the Earth, for using the scientific and technological achievements attained through the genius of man.

"Not we alone, but the coming generations should also be able to use and enjoy all the gifts of our country's splendid natural environment. We are also prepared to participate in collective international schemes for nature protection and the rational use of natural resources,"[1] states the Report of the CC of the CPSU to the 24th Party Congress.

The scientific and technological revolution represents a break-through to a new level of freedom as recognised necessity. However, mankind is as yet not free in the face of many of the social consequences stemming from this revolution. This means that not all features of the scientific and technological progress (including its negative results) are as yet within the sphere of man's control. Its negative results work retroactively both on this progress and the social and living conditions of people. Society's control over these causes is so far only in the first stage of forecasting.

Complete freedom arises only when all the results and the causes of social history come under man's control. "Only from that time," Engels wrote, "will man himself, with full consciousness, make his own history—only from that time will *the social causes set in movement by him* (our italics. —*U.M., Y.M.*) have, in the main and in a constantly growing measure, the results intended by him. It is the ascent of man from the kingdom of necessity to the kingdom of freedom."[2] Such a state of society cannot be achieved under capitalism. Socialism and communism alone open up prospects for complete control not only over the scientific and technological revolution but also over its social consequences.

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[1] *24th Congress of the CPSU*, Documents, p. 70.
[2] F. Engels, *Anti-Dühring*, p. 336.

THE SCIENTIFIC AND TECHNOLOGICAL REVOLUTION AND GUIDANCE OF SOCIAL DEVELOPMENT

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The struggle between antagonistic interests, the violent subordination of the interests of certain individuals to those of others, has been a substantial part of human development. As the communist social formation begins to take shape, a new pattern emerges: society acquires the ability to make the common interest coincide with that of the individual. But this identity of interests does not come about automatically. It is the result of an ability to guide society's practical development in such a way that every step forward is conducive to social harmony.

Socialist society constantly directs its practical energies towards solving the numerous problems that constantly arise in the process of its development. It seeks to raise the efficiency of material production, to stimulate technical progress, to influence the development of the individual, the education of the young, and so on. The solution of the many complicated problems that arise during this process demands more than the ability to improve the efficiency of the relevant practical activity within the framework of human relations. Any substantial improvement of that efficiency demands improvement of the human relations that are formed during the activity. This applies to everyone concerned, from small groups of people to society as a whole. This in turn means that any really complicated problem calls for effective improvement of relations in society as a whole, for guidance of its development. Thus, the need to raise economic efficiency demands a substantial improvement of

organisation and management. This is at present being achieved within the framework of Soviet economic reform.

This unprecedented ability of socialist society to guide its own development is universal and constantly develops along with improvement in the processes of labour and improvement of society as a whole. The scientific and technological revolution, which makes for ever more complex management and consequently demands increasingly effective managerial decisions, entails fundamentally important changes in the whole process of management. It is, therefore, vitally important for socialist society to improve its ability to guide its own development and this calls for considerably deeper knowledge of the laws of guidance.

The main tendency in the development of management is to make each individual a part of the process of the purposeful and practical shaping of the future. This process is inseparable from the development of social relations, from the development of practice.

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Management itself is a manifestation of the specifically human ability to make "one's own activity the object of one's will and consciousness".[1] It is this ability, understood not merely theoretically but above all practically, that is in fact management of practical activity. Man's development, his ability to rise to a qualitatively new level of historical development, becomes the object of his practice, the object of management. But the essential difficulty in understanding man's ability to control his own life processes lies in the fact that his ability does not remain unchanged.

There is a wide tendency to consider the history of human society as a spontaneous process. John Lewis, for instance, writes that "social evolution is the same kind of unconscious process that we find in the animal world".[2] That is true only in respect of the period when social development was a spontaneous, uncontrolled, unstudied process. The specific law of that process was excellently noted by Engels: "Thus

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[1] K. Marx and F. Engels, *From Early Works*, Moscow, 1956, p. 565 (in Russian).

[2] John Lewis, *Man and Evolution*, London, 1962.

orientation on the past. Actually, of course, it is a question of perpetuating past relations into the *future*. The individual consciousness in such societies acts like a cog in a machine, carrying out a set programme, not like an autonomous stage in its functioning. The very structure of such a society limited the development of man's creative potentials. Progressive innovations asserted themselves more as the result of spontaneous trial and error in critical situations rather than as the outcome of a practical striving to see progress of labour and society as the very means of ensuring man's existence. From the moment antagonistic class contradictions appeared, the ruling classes began to regard the conservation of unchanged social relations as the condition for their own existence, which they identified with the existence of society. This illusory identification was inseparable from the striving of the ruling classes to fight the spontaneously growing revolutionary changes that were essential to the development of labour and the existence of society but destructive of the outmoded system of privileges.

The successive downfall of antagonistic class societies was needed to overcome the striving to go on reproducing the established system of relations.

The industrial revolution of the 18th and 19th centuries saw the final assertion of capitalist society, a social system based on machine production. It ushered in a new type of social relations, the specific feature of which was a remarkable instability, due above all to the revolutionary technical basis of industry. Modern industry "is continually causing changes not only in the technical basis of production, but also in the functions of the labourer, and in the social combinations of the labour-process".[1]

Such a system is capable of orientation on changes increasing society's creative potential. For example, a capitalist enterprise needs to be oriented not on conservation of its particular type of organisation or of some kind of ritual, but on obtaining the maximum economic effect. The organisation of enterprises and the technology of production have to change in such a way as to ensure a sufficiently high level of activity and adequate efficiency, otherwise the very existence of the enterprise is jeopardised. Development thus

[1] K. Marx, *Capital*, Vol. I, p. 487.

acts not in a destructive capacity, but as a necessary condition for existence. A specific feature of capitalist society, as opposed to preceding societies, is, among other things, the increasing significance of an intensified form of extended reproduction. Man's practical relationship to nature becomes an object of scientific study, since the aim now is not so much the conservation of the labour process in the historically established forms as its improvement and development in order to achieve a constant growth of efficiency.

By revolutionising man's relationship to nature, capitalism made the development of labour something that could be practically controlled and transformed the necessity for improving labour into the daily aim and function of labour. This process, however, required constant changes in the whole system of social relations.

Submitting to this vital necessity, capitalist society endeavours to adapt itself spontaneously to the changes in the sphere of labour. However, the atomised character of capitalist society, the prevalence of private interests and the class antagonisms produce in the ruling classes a desire to oppose these changes, to preserve the pillars of the social system by reproducing and stabilising it. Hence the theoretical inability to explain, on the basis of bourgeois relations, the mechanism of social development and the practical impossibility of subordinating this development to the inherent requirements of the dynamics of society as a whole.

The capitalist formation is a transitional society between societies orientated on conservation of the established relations and a society whose own development can be purposefully and practically controlled.

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Man controls himself from the very first stages of his existence. But initially this ability is confined to the creative mastering of established means and methods of labour. Constant change in the character of labour is inseparable from change in the character of control. But this is a question requiring special consideration.

Practice, as a specifically human form of activity, is by its very nature a creative process. It continually improves during its historical development. The specific feature of

practice, above all the practice of labour, is the ability to replace acts of labour, certain aspects of practice, by natural processes. The animal is not capable of making a single tool for the making of another tool, whereas man is capable of overcoming this limitation. Any substitution of man-transformed natural processes for what man has to do himself inevitably gives rise to other acts of labour which direct and organise this substitute system. In principle the process of substitution of labour is infinite. The important thing is that the character of practice changes after every act of substitution, since substitution primarily affects the more stereotyped and routine aspects of human activity. The result is that the creative potential of labour increases and its character changes. "The general development tendencies of human technology lead to the machine making superfluous first of all the physical strength and then the skill of the worker operating the tool; at the same time, man's organising intelligence acquires increasing significance."[1] This process leads to changes in the man-means of labour technological relationship.

Man plus the implements of production constitute the human-material working mechanism which is the historically concrete form of the "man-technology" system. Changes in this system lead to the appearance of consecutively superimposed technological modes of production. The basis of the first of these is manual labour. In the process of labour at this stage, man also acts as the source of motive power of the tool. At the second stage, the tool acts as a machine element and the worker is freed of the necessity to provide the source of power. The worker controls the machine. The third stage is connected with automation. Man stands beside a technical system to control it. The next stage is connected with cybernetics, which is capable of replacing certain aspects of brain work. The appearance of each technological mode of production is connected with a technological revolution, with a change in the means and methods of labour.

The process of replacement of certain aspects of labour intensifies the need to increase man's efficiency in exploiting and improving the substitute technical system in accord

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[1] S. Strumilin, *Problems of Labour Economy*, Moscow, 1957, p. 27 (in Russian).

with his developing aims. This means that every major act of replacement connected with a change in the technological mode of production must raise the practical significance of the production of knowledge. It should be noted in passing that, however far the replacement of labour by forces of nature goes, they cannot in principle replace labour, although this process does lead to increased intellectualisation of the whole of human practical activity. Marx did not separate these two aspects of labour development. He wrote: "The implements of labour, in the form of machinery, necessitate the substitution of natural forces for human force, and the conscious application of science, instead of rule of thumb."[1]

The further the substitution of natural forces for labour goes, the greater is the need for the production of knowledge. This is the result of the changed role of knowledge, of thinking in labour, that is to say, in practical activity. For example, prescientific types of thinking, which narrowed down the possibility of innovation to the extreme, were typical of primitive levels of the development of practice, at which any departure from the historically established stereotypes of activity threatened man's very existence.

The appearance of machine production necessitates not only the conservation of the historically established methods of labour, but also their constant development. The need arises to transform labour development itself into an object of practice. This requires knowledge of the profound essence of things, which is distinct from immediate being, the ability to find an explanation, a causal link, to re-create in terms of ideas the process by which things arise, and so on. It was this that led to "the separation of science as applied to production from labour as such".[2] The process by which science was singled out from the historically established forms of labour signified at the same time that the specific form of scientific labour which had appeared was an inherent condition for the development of production at its new stage. It was no coincidence that methodology was the basic subject-matter of new philosophy. The very renunciation of the

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[1] K. Marx, *Capital*, Vol. I, p. 386.

[2] "From Marx's Manuscripts", *Kommunist* No. 7, 1958, Moscow, p. 22.

traditional canons by which labour was confined led to the necessity for labour aimed at developing knowledge and constituting a necessary condition for expanding production.

Finally, with automation and the use of cybernetics in production, with the scientific and technological revolution, the replacement of more and more new aspects of practice inevitably goes so far that immediate prescientific labour will be cut down, as Marx foresaw, "quantitatively to insignificant proportions".[1]

Thus, whereas in the earlier stages of its development the logic of practice was implemented as the logic of empirical manipulation of things, the logic of practically successful recipes, it gradually elaborated in the form of a science, its own universal logical basis reflecting the universal laws of nature and the laws of development of practice itself, its own inherent logic. The need to convert scientific work from being a remote sphere of human activity, counterposed to labour, into an actual element of production arises simultaneously with the need to find a basis for guiding the development of man's own vital activity, for guiding the relations established in the process of that vital activity. This need arises at first in some limited sphere of labour and then steadily goes on to embrace the whole of human practice. The scientific and technological revolution considerably intensifies this process. Its significance lies first of all in the fact that the replacement of definite aspects of practice goes so far that the very need to maintain and conserve the established production processes becomes more and more a subordinate element of their improvement. The scientific and technological revolution based on cybernetics is destined to transform the production of knowledge into a determining form of labour. All forms of production are gradually being transformed into "a technological application of science".[2] This does not mean any kind of dissolution of the material in the ideal. Inasmuch as material activity becomes more and more a creative transformation of the ever deeper essence of things, it becomes necessary to mediate this process by the knowledge of the essence of things and of the universal laws of their development.

[1] K. Marx, *Grundrisse der Kritik der politischen Ökonomie, 1857-1858*, Moscow, 1939, S. 587.

[2] K. Marx, *Capital*, Vol. I, p. 624.

The process of the qualitative development of labour provides the key to understanding the motive forces of progress and society's ability to make its development the object of its own vital activities.

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The development of labour and the improvement of society's ability to direct labour and all practical activity should not be regarded as two interacting parallel processes. They are but two sides, two aspects of human practice. Every stage in the development of labour requires a definite level of social relations. In a society of class antagonisms, the private interests of the ruling classes at a certain stage come into contradiction with the demands of the historically matured level of labour development. Only under socialism does society become capable of making the very possibility of contradictions between the various aspects of practical activity an object of practice and of directing the removal of these contradictions, directing the development of social relations in the interests of society as a whole. "It is only in an order of things in which there are no more classes and class antagonisms that *social evolutions* will cease to be political revolutions."[1] Social development ceases to be a spontaneous result of the strivings by many people, groups, and classes to attain their private ends. It ceases to be irrational in man's eyes and becomes a conscious practical aim whose achievement is the necessary condition for the existence of society and each individual.

It has already been said that the scientific and technological revolution involves such a high level of replacement of labour that the need arises for an unprecedented development of scientific labour in order to exploit and further develop the complicated technical system that replaces labour. At the same time, this very replacement provides the possibility for developing scientific labour. When developing in some narrow sphere, for instance, the field of design and technology, scientific labour has an inevitable tendency to go beyond the narrow confines of a specific field and embrace all spheres of human activity one after

[1] K. Marx, *The Poverty of Philosophy*, p. 175.

another. The scientific and technological revolution requires that the whole of human practice, and not only individual spheres, should be transformed into a scientifically grounded and guided process. This in turn implies that full development of the scientific and technological revolution is by no means possible in all social conditions.

In order to realise its potentialities, any scientific revolution requires a new type of production, a new type of division of labour. The scientific and technological revolution can be fully developed only with the removal of the social limitations on the process by which all forms of human practice are transformed into scientifically grounded activity. This is possible only in a society capable of considering its development as an object of its own activity, that is to say, under socialism. Socialist society, which aims at the creation of a social system under which the "development of human energy . . . is an end in itself",[1] inevitably finds in the scientific and technological revolution a powerful means for further all-round creative development of society as a whole and of each person individually.

The scientific and technological revolution thus finds a suitable social structure in socialist society. And socialist society finds in the scientific and technological revolution the scientific and technical basis for its progressive development. These two processes are the different sides of the single process of the development of society, which finds in science and in scientific methods of guidance the indispensable conditions for its own existence. The socialist revolution and the scientific and technological revolution are two aspects of one objective process of human development towards communist civilisation.

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The growing difficulty of decision-making in the process of guidance of a complicated, dynamic society is increasingly limiting the possibilities for arriving at sufficiently effective decisions on the basis of intuition, of past experience. Thus, the problem of effectively guiding development becomes

[1] K. Marx, *Capital*, Vol. III, p. 800.

more and more a problem of taking effective, that is, scientifically grounded organisational decisions.

Lenin's writings are of inestimable aid in studying this question. The exceptional significance which Lenin ascribed to organisational and reforming work in his analysis of the methods of guidance has already been studied in Soviet literature. In Lenin's opinion, the level of organisational work under the new social system becomes a decisive factor of social progress, science being the basis on which all organisational questions are settled. Lenin wrote that the task of building communism can be accomplished "only by assimilating all modern knowledge".[1] He insisted that "learning shall really become part of our very being, that it shall actually and fully become a constituent element of our life".[2] The reason for this is that politics has been transformed for the first time in history from chaos into a science. Lenin's idea of the decisive significance of scientifically grounded organisational decisions is of particular importance in the epoch of the scientific and technological revolution, when the need for timely and effective organisational decisions becomes exceptionally urgent. To arrive at such decisions, we need a steadily widening production of knowledge. The very problem of taking effective decisions develops into that of effective direction of the production of knowledge. This in turn requires a study of the specifics of the production of knowledge and the ways of its development.

The most important distinction between material production and knowledge production is that, since material things lose their use-value in the process of consumption, they must be constantly reproduced. Flour that has been consumed and machines that have been worn out must be replaced. Unlike material things, knowledge, except for certain losses, can be accumulated endlessly, and therefore the task of knowledge production is not to supply a replica of what is already known, but to acquire essentially new knowledge, to multiply it constantly. Knowledge production thus becomes an avalanche-like creative process, constantly producing new results.

Throughout its history, the human race has subordinated

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[1] V. I. Lenin, *Collected Works*, Vol. 31, p. 290.
[2] *Ibid.*, Vol. 33, p. 489.

its practical activity to such a definitive factor as the production of material wealth, vitally necessary for society's existence, for the biological existence of man. Under capitalism, man is subordinated to an alienated production process to such an extent, that the individual becomes practically part of the machine. Man does not use the machine; it uses him. This is expressed, among other things, in the fact that intercourse between workers in the production process is determined basically by the technology of production. The whole structure of capitalist society, irrespective of whether it is a matter of producing things or ideas or of the functioning of the bureaucratic management system, is built on subordination of man to material production. This, by the way, gives rise to the illusion that labour is productive only when it produces material goods. Marx repeatedly opposed this point of view. He wrote: "The determinate material form of the labour, and therefore of its product, in itself has nothing to do with this distinction between productive and unproductive labour."[1] For this reason the refusal to recognise the production of knowledge as productive labour in the conditions of the scientific and technological revolution leads to the paradoxical and absurd conclusion that society is striving to free itself as quickly as possible from productive labour. It is more logical to assume that the content of productive labour does not remain unchanged.

The specific feature of knowledge production is that the form of intercourse it requires is directly adapted not to exploiting machines efficiently, but to universally raising the creative potential of the people who take part in knowledge production, that is, to the creative nature of man, which is formed throughout human history. Intercourse between people is itself the "technological" basis of the production of knowledge, although the term can scarcely be applied in this sphere. Production of knowledge is characterised not so much by atomisation into producer and consumer cells as by a growing tendency to intellectual communication. The growing significance of intellectual communication makes guidance of intercourse, the creation of the most favourable conditions for developing the production of knowledge, indispensable for socialist society. Hence partic-

[1] K. Marx, *Theories of Surplus-Value*, Part I, Moscow, 1969, p. 159.

ular significance is attached to guiding the processes of urbanisation, leading to the emergence of powerful centres of intellectual communication, which become natural centres of knowledge production, of society's intellectual and cultural development. The development of our society's ability to guide intercourse for purposes of knowledge production coincides with the solution of the problem of building communist society, that is, a society in which progress is measured by the individual's degree of self-development.

Production of knowledge is not the absolute opposite of material production. It arose in the process of the production of things as an indispensable condition for developing that production. But today knowledge production is the main instrument for raising the efficiency of social production. A most important aspect of labour substitution in the epoch of the scientific and technological revolution is the emancipation of man and the forms of his communication from subordination to the technology of material production. This is the other aspect of subordination of material production to the development of society's creative potential. It is important to bear in mind that change in the character of labour, the transformation of knowledge production into a definitive form of production, is not a single act, but a long historical process. The fact that it has already gone pretty far explains the growing role of science in society. This process is displayed in various visible forms, particularly in the fact that the development of complicated equipment, electronics, telemechanics, etc., demands that the work of the toiler should become constantly more intellectual and that the proportion of people engaged in scientific work in a production collective should steadily increase. The ability to guide these complicated processes efficiently, according to their specific laws, is one of the most important factors in deepening the scientific and technological revolution.

Here the question arises: how do the specifics of knowledge production concern the problem of man's ability to make his own development the object of his practical activity? Analysis shows that, when in some field of practice, for instance, in the production of machines, there emerges some special activity for developing and improving that type of production, the need simultaneously arises to produce a

complicated system of knowledge that reveals the general laws of the things which are being transformed, of their transforming activity. This knowledge is a necessary condition for controlling development.

Every act of purposeful guidance of development, that is, guidance of the emergence of something qualitatively new, always includes the reconstruction of that new element in ideas, based on the creation of knowledge which did not previously exist. This new knowledge is the indispensable condition for guiding the process of creative improvement of human practice.

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In the epoch of the scientific and technological revolution, the growing complexity of society makes it increasingly difficult to analyse the intrinsic connections between social phenomena. The wealth of the whole cannot, so to speak, be embraced by the human eye. This stimulates the tendency to reduce the whole to one of its parts, which, due to the one-sidedness of education, professional or departmental limitation, or various chance circumstances, makes one liable to mistake the laws of parts of society for the laws of society as a whole. One-sided development in this direction diminishes man's ability to take effective decisions in the process of control, and this produces growing elements of disorganisation and decreases the ability to guide development.

The first condition for neutralising this tendency is that society should devote more attention not only to constructing one machine or another, raising harvest yields or improving the quality of school education, but also to improving the conditions for working out effective decisions in society as a whole and in each of its cells. Properly speaking, the ability of society to control its own development is inseparable from its ability to control the mechanism of decision-making. This means in effect that not a single complicated problem in social development can be effectively solved if it is considered separately from the mechanism for solving it. In other words, the process of solving complicated problems must include improvement and corresponding development of the decision-making mechanism. For instance, the need to raise the efficiency of socialist economy calls for

improvement of economic management at all levels. This problem is solved by concentrating attention on the fact that any complicated problem at any level of management must be solved as part of the process of improving the ability to create and stimulate the most favourable conditions for taking effective decisions at all other levels. Improvement of management under socialism is possible on the basis of a society that is becoming more united, and not by static juxtaposition of the parts to the whole, as is the case when management is reduced to manipulation.

To fulfil this task, one must free oneself from the old idea that management of people is just a peculiar form of managing things that have no value orientation of their own. In a complicated and dynamic society, this leads to contradictions between levels of management which, if not removed in time, diminish the effectiveness of the decisions taken. The economic reform in the USSR solves this problem by further developing democratic centralism in economic management. Improved methods of economic management and increased freedom for direct decision-taking open up wider possibilities for effective decisions at lower levels. This, in turn, extends the possibilities of taking decisions at higher levels, which analyse the general conditions of economic activity. It also extends the possibilities of putting economic development on a more profound scientific foundation and harmonising the value orientation of all levels of economic management.

As was emphasised in the Report of the CC of the CPSU to the 24th Party Congress, the growth of the scale and the qualitative changes in the Soviet economy make the questions of improving the system of management of social production particularly urgent. The possibilities for such improvement have of late considerably expanded thanks to the enhanced level of knowledge and professional training of personnel and of the working people as a whole, and thanks to the general development of the science of management and computer technology.

Contemporary socialist society is vitally in need of a mechanism which would constantly bring to the notice of the whole of society any substantial social processes, such as the appearance of new requirements in one field or another, ineffective decisions in one sphere or another of social

activity, lack of co-ordination between different management levels, etc. This is an indispensable condition for effective decision-taking at all levels and for the harmonious development of the whole and all its parts. It can be accomplished only by constantly widening the participation of the masses in working out decisions at all levels. Lenin pointed out that the creativity of the masses is the basic factor in creating a new social system: "Living, creative socialism is the product of the masses themselves."[1]

That is why the Report of the CC of the CPSU to the 24th Party Congress calls the drawing of the working people into production management on an ever broader scale one of the Party's central tasks.

Extension of the people's participation in management is of exceptional importance because it permanently minimises the very possibility of the common interests being replaced by the private interests and of one level of management becoming estranged from others or from society as a whole. Naturally, all levels of management will always need experts, but daily control from below will prevent their activity from being professionally or departmentally limited. Extension of mass participation in management removes the objective basis for various bureaucratic and technocratic illusions, for regarding not society as a whole but only a certain part of it as the subject of social management.

The increased complexity of management leads to certain changes in the relations between society and the individual. In this age of the scientific and technological revolution, the striving of each individual to work well in his narrow field becomes more and more necessary and at the same time less and less sufficient. It also becomes necessary for everyone to see in his activity not some small part of the whole but all the whole, if only from the standpoint of some specific part. Accordingly, it becomes increasingly necessary to develop in every individual the desire to take part in the cultural life of society as a whole, to assume some responsibility for the future of society. Such development of the individual is due to profound changes in the mechanism of management. The increasing complexity of socialist society will inevitably

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[1] V. I. Lenin, *Collected Works*, Vol. 26, p. 288.

enhance the role of management through culture, through people's ability to develop free association based on scientifically formed values. Particularly interesting in this respect is Lenin's idea of a stage of social development at which "the need for government of any kind begins to disappear altogether". Lenin linked this process with a condition in which all members of society, or at least the overwhelming majority of them, would have learned to administer the state *themselves*.[1] The ability of the masses to manage society leads to a substantial change in the nature of management. The desire to speed up or hold back this process artificially is bound to decrease the effectiveness of decisions taken and multiply the elements of disorganisation.

The management mechanism itself needs scientifically controlled development so that the creative ability to raise the effectiveness of decisions taken will constantly be ahead of their growing complexity.

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The problem of effective guidance of social development under socialism is one of unprecedented complexity and in the epoch of the scientific and technological revolution it is bound to become even more complicated. But in a society able to control its own development according to scientific principles, it is precisely this revolution that opens up unlimited possibilities for dealing effectively with this vital problem. At the same time, one must avoid the illusion that the provision of all management levels with up-to-date technical equipment will by itself guarantee enhanced effectiveness of decisions taken. This illusion, like a number of others, stems in one way or another from the refusal to study the practical nature of society, from a superficial understanding of the behests of Lenin, who regarded social management as the creative organising activity of the masses. Persistent illusions about the substance of social management cannot fail to result in chance decisions, in decreased effectiveness of practice, and slower rates of social development.

Man has entered a period in which he must cease to regard

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[1] *Ibid.*, Vol. 25, p. 474.

the future as a projection of the past. On the contrary, the past and the present must be viewed through the prism of the future. Then the future itself will appear not as a fatally predetermined result imposed from outside, but as an intended result, which society has the practical ability to achieve. This requires of society and of every individual more and more intellectual exertion, constant critical reflection on each practical step, growing attention to the mechanism of decision-making and of formulating aims, and to assessing means and results.

The world competition will be won by the social system which is capable of guiding its own development, of improving its social relations to such an extent as to ensure constantly rising effectiveness of its practical activity, of making society bear maximum fruit from the scientific and technological revolution. This problem can be solved only under socialism, in a society capable of guiding the process of its own qualitative improvement and of managing its own future.

THE SCIENTIFIC AND TECHNOLOGICAL REVOLUTION AND AGGRAVATION OF THE CONTRADICTIONS OF CAPITALISM

Sergei Dalin, D. Sc. (Econ.)

The scientific and technological revolution is having an immense impact on the process of capitalist reproduction. It has swept simultaneously every branch of industry, agriculture, transport, communications, and every field of science. It is developing both in the capitalist and socialist countries, but with diametrically opposed socio-economic effects in each case.

Because of its universal nature, the sweeping advance of science and technology gives rise to numerous theoretical problems. Thus, the self-contradictory process of the economic growth and decay of capitalism has again become a question of current interest.

Lenin described the decay of capitalism as one of the tendencies characteristic of its monopoly stage, observing that "in some branches of industry, in some countries, for certain periods of time, it gains the upper hand".[1] At the same time, Lenin pointed out that "it would be a mistake to believe that this tendency to decay precludes the rapid growth of capitalism".[2] This statement is of paramount importance also to the analysis of modern capitalism in general, for it has to do with the intensification of historical development, with the rapid growth of the antagonisms that are driving capitalism to its doom. Neither the numerous theories on the stagnation of capitalism nor the claim that Lenin's conclusion has lost its relevance since the Second World War have been confirmed by practice.

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[1] V. I. Lenin, *Collected Works*, Vol. 22, p. 276.
[2] *Ibid.*, p. 300.

The scientific and technological revolution has proved once again the truth of Lenin's teaching that capitalism develops more intensively at the imperialist stage, which by no means rules out the possibility of some industries, and even some countries, having periods of decay and stagnation. The dialectics of the scientific and technological revolution consists precisely in the fact that it has sharply accentuated the uneven development of capitalism. Thus, Japan has demonstrated high growth rates, while Britain's post-war development has, on the contrary, been sluggish and marked by frequent periods of stagnation.

Among the driving forces of the scientific and technological revolution, as it develops under capitalism, the monopolies' effort to lower production costs by cutting down expenditure on labour has turned out to be one of the most significant. The more the working class gains in its struggle and the higher wages become, the more the monopolies strive to cut the total wage bill by reducing, whether absolutely or relatively, the number of people employed.

The period from 1964 to 1972 is characterised by intensive scientific and technological progress. But despite the growth of industrial production in all the imperialist countries, the level of unemployment did not fall but, if anything, actually rose. The number of jobless workers increased from 413,000 in 1964 to 595,000 in 1969 in Britain, from 114,000 to 222,000 respectively in France, from 157,000 to 182,000 in West Germany, from 549,000 to 672,000 in Italy, from 324,000 to 385,000 in Canada, and from 370,000 to 611,000 in Japan. In the United States alone, on account of the Vietnam war and expansion of the war industries, which absorbed additionally over a million unemployed, joblessness at times slightly decreased. Nevertheless, by the close of 1970, it had again reached six per cent—a record figure for the past ten years, which means that over five million American workers were out of jobs.

Thus, while scientific and technological advance enormously boosts labour productivity, it also results in fewer jobs, both in absolute and relative figures. And although this tendency is restrained by the growth of new-type industries, services and the state apparatus, the general result of the scientific and technological revolution in capitalist society is greater unemployment, which is a constant menace to the working class. This revolution becomes the chief instrument of attack on the working class and a means of greater capitalist exploitation.

The scientific and technological revolution in the capitalist world is greatly influenced by rising competition in the world markets. The advantage the United States has in this respect is its higher efficiency of production, which is offset by the fact that in the European capitalist countries and Japan the workers are paid lower wages as compared with the United States. In recent years the European and Japanese workers have won higher wages through class battles, and the positions of the European and Japanese monopolies in the world markets have come to depend on the competition with the United States for technological superiority. Hence the drive for research and new inventions in which some European capitalist countries and Japan have already moved ahead of the United States in certain industries, e.g., in shipbuilding, railway transport and electronics. The scientific and technological revolution thus intensifies the uneven economic and political development of the capitalist countries, and this leads to an aggravation of the contradictions of imperialism.

And lastly, a major part in this revolution is played by the antagonism between imperialism and the world socialist system, by the economic contest between capitalism and socialism. Science and technology today form the arena for the economic competition between the two opposed socio-economic systems.

The first artificial satellite was launched by the Soviet Union in October 1957; the system of education in the United States was reformed; there, and in other capitalist countries, government appropriations to research were sharply stepped up. The financing, management and co-ordination of research have now become another expression of state-monopoly capitalism.

The imperialists seek to use the achievements of science and technology, above all, for the arms race. Nearly 90 per cent of total US budget appropriations to research is intended for military purposes. As a result, the better-qualified and more talented scientists and engineers are concentrated in the war industry while the civilian industries suffer from a shortage of scientific and technical personnel, by reason of which they lag behind the war industries.

The effect of the scientific and technological revolution on the capitalist economy is of a highly contradictory nature. While increasing production capacity, it simultaneously brings down employment, absolutely or relatively, and in-

creases the discrepancy between production and consumption. As a result, the scientific and technological revolution is accompanied by a growing chronic below-capacity operation of factories in all capitalist countries. In the interest of the monopolies, governments try to reduce such below-capacity operation by placing orders for armaments, which put a heavy burden on the tax-payers.

The scientific and technological revolution requires better-educated workers, and this is conducive to a levelling-up of mental and physical labour. Yet, the capitalist system still hinders the spread of education among the masses. For instance, in the United States the cost of college education, including tuition fees, amounts to $4,000 a year, or a total of $16,000-20,000, which is well beyond the means of the great majority of industrial workers, farmers and office workers. Moreover, for lack of means a large proportion of their children cannot complete secondary school, dropping out because they have to earn. Thus, while the scientific and technological revolution creates a greater demand for secondary-school and college graduates, capitalism deprives a large proportion of young people from working-class families of the qualifications absolutely required under present-day conditions, and thus dooms them to unemployment. At the same time, this revolution promotes the socialisation of research and its concentration at big monopoly or government laboratories, turning scientists into hired employees. It has put once privileged brainwork on the same footing as mass hired labour.

In agriculture, the scientific and technological revolution has brought bankruptcy to small and even to many of the moderately well-to-do farmers. Of the 5,967,000 farms the United States had in 1945 only 2,976,000 had remained by the end of the sixties. This means that in the past 25 years more than 50 per cent of the country's farms have been liquidated and their land went to the big farmers. This process is taking place in capitalist Europe as well, though at a slower rate: in West Germany, France and other capitalist countries.

Under capitalism the scientific and technological revolution has caused a growth of wealth which has not abolished and cannot abolish poverty but does increase economic inequality. The main effect of this revolution on capitalist

society is to aggravate the contradiction between the productive forces and relations of production of modern capitalism; far from moderating the contradictions of capitalism, it has heightened them.

Some bourgeois economists and Right-wing Socialists try to prove that the current scientific and technological revolution is a "second industrial revolution", heralding a new progressive stage in the development of capitalism, which, they claim, will end poverty. Actually, however, this is not so at all.

In recent years the main feature of the US economy has been the mounting economic crisis and continued inflation. The years 1969 and 1970 saw a perceptible slump in industrial production, a sharp increase in unemployment, and a skyrocketing of prices for consumer goods and foodstuffs with the result that workers' real wages have fallen and their living standards worsened. In the USA, the richest capitalist country in the world, where the scientific and technological revolution has made considerable headway, millions of people live below the subsistence level.

The facts described fully corroborate the conclusion L. I. Brezhnev drew in his report of April 21, 1970, that "imperialism has created a vast production machine but this machine serves only to increase the wealth and power of a tiny handful of capitalist magnates. Wherever international big business holds sway, scores and hundreds of millions lead a starved and impoverished existence. Imperialism uses the greatest achievements of technology to intensify the exploitation of millions of working people and to prepare for piratical wars".[1]

Modern Monopolies and the State

In the capitalist countries, the great scientific and technological speed-up is matched by growth of the monopolies' economic power. First of all, research activities as such require time, large and properly staffed laboratories, special equipment, and large capital outlays which are quite beyond the means of small and medium concerns. But new

[1] L. I. Brezhnev, *Lenin's Cause Lives On and Triumphs*, Moscow, 1970, p. 53.

technical achievements will yield effect only when given a sufficiently high concentration of production.

Thus, in 1968, the 500 largest American industrial corporations employed 14 million factory and office workers, or 57 per cent of the total labour force of 847,000 enterprises in the extractive and manufacturing industries, power and gas supply, transport and communications. The 500 giants accounted for 50 per cent of total takings. Concentration of production has reached about the same level in other imperialist countries, too. Most bourgeois economists today no longer talk of free competition or free enterprise, since the fact of concentration of economic power corroborates Lenin's teaching on monopoly capitalism, whether they like it or not.

Along with the enormous concentration and centralisation of capital, the structure of the monopolies undergoes a notable change. The monopolies of today differ from the cartels and trusts of the initial period of imperialism. They form complexes of large enterprises, highly integrated not only in financial terms but with respect to production, technology and management as well. Similarly, international monopoly associations are formed today not so much on the basis of cartel agreements as through setting up branches in other countries. In this situation, export of industrial capital to the more advanced capitalist countries acquires particular significance. At the same time, the international cartels increasingly assume a state-monopoly character as agreements between states, acting on behalf of the national monopolies, replace international agreements between private monopolies.

The late sixties were marked by an unusually intensive process of concentration and centralisation of capital, which spread to all the advanced capitalist countries. There were 1,020 mergers in Japan in 1968 alone. In the United States, mergers and take-overs, increasing every year, rose from 2,125 in 1965 to 6,132 in 1969. In France, in recent years their number has fluctuated between 1,300 and 2,000 a year. A similar wave of mergers and take-overs has swept Britain, West Germany, Switzerland, Belgium and other European capitalist countries. The dominant tendency is for giant monopolies to gobble up their fellows.

A distinctive feature of such mergers and take-overs is what is known as diversification of production, or penetration of the largest monopolies into utterly unrelated fields of production. It is characteristic of this process that all the larger monopolies engage, either more or less, in weapons production.

Diversification has given rise to giant monopoly conglomerates. As early as 1968, 398 of the 500 largest US industrial corporations had become conglomerates. Differing from the horizontal and vertical monopoly associations of the type of cartels and trusts, the conglomerate is a piecemeal collection of corporations of any and every variety. Its irrational structure is an expression of the laws of competition and anarchy of production as they operate under modern capitalism.

In Lenin's lifetime, monopolies controlled mainly heavy industry. Today, thanks to the concentration of production and centralisation of capital, they have seized key positions in both heavy and light branches of the manufacturing industry, and the extractive industries as well. They are invading retail trade and services and penetrating into agriculture, driving out a multitude of small and middle farmers. Thus, the last half-century has amply confirmed Lenin's theory of imperialism, which proved that the capitalism of free competition must inevitably develop into monopoly capitalism. This transformation has been followed by yet another—the conversion of monopoly into state-monopoly capitalism. As monopoly capitalism has grown into state-monopoly capitalism, the tax burden has become heavier. In addition monopoly prices have turned into state-monopoly prices, since the so-called corporate tax is not a deduction from monopoly profit. The profit tax is included in the monopoly price, and so has to be paid by the consumers. Thus, not only taxes but prices, too, serve the state as a means of redistributing the national income for the benefit of the monopolies in general and those manufacturing arms in particular. To this one must add inflation, which has become chronic and keeps eating away the workers' hard-won wage increases. Heavier taxation, soaring prices and inflation—these are the most dramatic consequences of the development of monopoly into state-monopoly capitalism.

Finance Capital And the Financial Oligarchy

Monopoly profits and various government measures to encourage investment, e.g., rapid amortisation, tax privileges granted to companies when they instal new plant, etc.,

have led to an enormous accumulation of money capital and "self-financing" of industrial monopolies.

Before the outbreak of war in Vietnam, between 1960 and 1964 the US industrial corporations' proper assets accounted for 76 per cent of their gross investment. This fact gave rise to claims that the ties between the industrial and banking monopolies were slackening. Actually, however, the fusion of banking and industrial monopolies has always been typical of 20th-century capitalism. The most conclusive example of this is the role played by the banks in the formation of monopoly conglomerates. In the recent wave of mergers and take-overs, the monopolies that came out on top have been those connected with the biggest banks. "Operation take-over" usually consists in buying up shares, and to do that one must have large sums of ready money. As a matter of fact, each conglomerate has its "own private bank" at its core. In the struggle of giants, one monopoly falls victim to another, whose bank has acquired the controlling interest.

Lenin's teaching on finance capital as the merger of bank capital with industrial capital is now being confirmed on an even larger scale. The tiny number of centres of finance capital testifies to the stronger domination of the financial oligarchy in the imperialist countries.

Marx established that with the concentration of production capital as property separates from capital as a function. The independent individual capitalist becomes a shareholder in a big concern, while the financial oligarchy disposes of other people's capital as if it were their own. Lenin wrote that "imperialism, or the domination of finance capital, is that highest stage of capitalism in which this separation reaches vast proportions".[1]

The well-known US electrical engineering monopoly, General Electric, had a mere 2,900 shareholders in 1900, 51,882 in 1928, and 534,970 in 1969. Another monopoly, American Telephone and Telegraph, had 7,535, 454,596, and 3,110,074 shareholders in 1900, 1928 and 1969 respectively. The total number of shareholders of the largest US monopoly corporations whose stock is circulated at the New York Stock Exchange amounted to 8,630,000 in 1956, increasing to 26,500,000 in 1969. The number of joint-stock companies also increased, and so did their share in the economy.

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[1] V. I. Lenin, *Collected Works*, Vol. 22, p. 238.

These figures illustrate what both Marx and Lenin said about associated forms of capital being dominant under developed capitalism in contrast to the dominance of private capital in the last century. Lenin observed that "scattered capitalists are transformed into a single collective capitalist".[1] As capitalist production and labour became socialised on a gigantic scale, the structure of capitalist property altered as well. Describing the joint-stock companies, Marx wrote that capital "is here directly endowed with the form of social capital (capital of directly associated individuals) as distinct from private capital, and its undertakings assume the form of social undertakings as distinct from private undertakings".[2]

In relation to individual private property, share capital is collective capitalist property. But in relation to public property, it is the private property of associated capitalists. Although it expresses a higher degree of socialisation, state ownership in capitalist countries is still as much a form of capitalist ownership as joint-stock company ownership. Engels wrote: "But the transformation, either into joint-stock companies [and trusts], or into state ownership, does not do away with the capitalist nature of the productive forces."[3] The nature of state ownership corresponds with the class nature of the state itself.

Despite the assertions of some petty-bourgeois economists to the contrary, the dominance of joint-stock property which Marx sometimes called social capitalist property to distinguish it from individual private property, certainly has nothing in common with socialism. "Socialism is inconceivable unless the proletariat is the ruler of the state. This also is ABC."[4] The prevalence of shared ownership implies that numerous individual capitalists are being ousted by a few collective capitalists, and so, "instead of overcoming the antithesis between the character of wealth as social and as private wealth, the stock companies merely develop it in a new form".[5]

Displacement of individual capitalist ownership by that

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[1] *Ibid.*, p. 214.
[2] K. Marx, *Capital*, Vol. III, p. 427.
[3] F. Engels, *Anti-Dühring*, p. 330.
[4] V. I. Lenin, *Collected Works*, Vol. 27, p. 340.
[5] K. Marx, *Capital*, Vol. III, p. 431.

of joint-stock companies and the mushroom growth of the number of shareholders has given rise to bourgeois theories of the "diffusion of capitalist property", "democratisation of capital", and "people's capitalism". These apologetic theories are a revival of conceptions old enough for Lenin to have commented on. He wrote: "The 'democratisation' of the ownership of shares, from which the bourgeois sophists and opportunist so-called 'Social-Democrats' expect (or say that they expect) the 'democratisation of capital', the strengthening of the role and significance of small-scale production, etc., is, in fact, one of the ways of increasing the power of the financial oligarchy."[1]

According to available data, 90 per cent of the US population held no shares in 1965. Despite the fact that the monopolies resorted to semi-compulsory methods, seeking, for political reasons, to distribute their shares among their personnel, only 2.7 per cent of workers held shares. A mere 0.3 per cent of the farmers had shares. Equally revealing is the distribution of shares among the shareholders. According to Professor Lampman of the United States, one per cent of the US population own 76 per cent of all shares. In 1964, in Britain 75 per cent of all shares quoted in the share markets were held by 1.7 per cent of the adult population. These data proved so damning to the theories of "democratisation of capital" and "people's capitalism" that they have been completely discarded by now, like bad coin.

In the imperialist countries, control of the monopoly corporations, and, by implication, economic and political control, is in the hands of the financial oligarchy, which heads the modern bourgeoisie and consists of the biggest capitalists —the millionaires and billionaires.

F. Lundberg, an American researcher, writes that the US financial oligarchy, which controls the 750 largest industrial, banking, insurance and trading monopolies, consists of 5,000 people. These are mostly directors, presidents and vice-presidents of monopoly corporations. In 1968, there were 200,000 people in the United States whose private fortunes exceeded a million dollars apiece; they made up 0.25 per cent of the working population. In 1960, 5 per cent of the British taxpayers owned 75 per cent of all private wealth.

These facts, like the data on the distribution of shares, conclusively demonstrate the great aggravation of the conflict between the social character of production and the private form of appropriation under modern state-monopoly capitalism.

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[1] V. I. Lenin, *Collected Works*, Vol. 22, p. 228.

The financial oligarchy is connected with the rest of the bourgeoisie through monopoly shares. R. Lampman's study showed that already in 1953 there were 1,659,000 people in the United States with fortunes larger than 60,000 dollars. The group of capitalists with fortunes of 60,000 to 100,000 dollars accounted for 20-23 per cent of shares. The next group —those with fortunes of 100,000 to 300,000 dollars accounted for 25-35 per cent of shares. The larger the fortune, the greater the extent to which it consists of corporation shares. With personal fortunes of over a million dollars, this proportion exceeds 60 per cent.

The fact that the financial oligarchy is economically linked with the rest of the bourgeoisie does not prevent differences and clashes inside the class, but such differences spring from competition for high profit. The modern financial oligarchy does not form a distinct class. It is connected by a thousand ties with all other capitalists, forming together with them the modern capitalist class. The present time gives added materiality to Lenin's words that the enormous dimensions of finance capital have brought forth "an extraordinarily dense and widespread network of relationships and connections which subordinates not only the small and medium, but also the very small capitalists and small masters".[1] Instead of becoming stronger, the economic positions of the petty and middle bourgeoisie have weakened during the past half-century, while the role of wage labour, constituting at present an absolute majority of the imperialist countries' population, has increased.

Change in the Social Structure of Modern Capitalism

A hundred years ago, when Lenin was born, the absolute majority of the population of all countries apart from Britain were peasants.

In 1870, the rural population of the United States amounted to 74 per cent of the total. In Germany (1871) the percentage was 64, and in Russia (1897) it was 87. At present, too, in all the Asian, African and Latin American

[1] *Ibid.*, Vol. 22, p. 285.

countries peasants make up the bulk of the population. In Western Europe and North America, however, most people live in the towns.

This dramatic change in the population pattern in the imperialist countries has followed from the advance of capitalism, capitalist industrialisation, enormous concentration of production, and the consequent growth of towns. These processes have intensified under the impact of the scientific and technological revolution, owing to the penetration of monopoly capital into agriculture. Monopoly and technological progress spell ruin to small farmers, who are being driven off the land. This process, attended by the growth of large-scale highly mechanised capitalist agriculture, which is developing in all the imperialist countries, has nowhere progressed so far as in Britain, the United States, and West Germany. Leaving out industrial and office workers, shopkeepers, etc., residing in the countryside, those directly engaged in the farming industry in 1960 accounted for 33 per cent of the total population in Japan, 21 per cent in France, 14 per cent in West Germany, 8 per cent in the United States, and 4 per cent in Britain. The relative strength of this section is progressively diminishing.

The urban population pattern, too, has drastically altered. It was mentioned earlier in this article that the process of centralisation of capital, concentration of production and the emergence of monopolies were influenced by the separation of capital as a function from capital as property. Hand in hand with this process there developed another whereby payment for management became separate from the manufacturer's income. Marx wrote: "Stock companies in general —developed with the credit system—have an increasing tendency to separate this work of management as a function from the ownership of capital. . . ."[1] It is natural, therefore, that with the growth of monopolies a system of hired production and distribution management should be adopted. The scientific and technological revolution has greatly accelerated and extended this process.

The huge dimensions of monopoly corporations, the complex technologies, the merging of the monopolies with the state, the growing economic intervention of the latter, all

[1] K. Marx, *Capital*, Vol. III, p. 380.

have caused managerial personnel, both industrial and commercial, to multiply. In US statistics, all employees are classified as white- or blue-collar workers, or workers by brain and by hand. Between 1950 and March 1969 the number of white-collar workers in the United States increased from 15,944,000 to 28,587,000, or by 79 per cent (we have excluded from the total the so-called managers belonging to the financial oligarchy, top government officials, and factory owners—in other words, mainly the bourgeois element and the state apparatus of enforcement).

These figures illustrate the advanced process of transition to a system of hired management under state-monopoly capitalism. It is, however, wrong in principle to contrast the white-collar with the blue-collar workers. This is done to back up one of the principal propositions of the bourgeois and petty-bourgeois theories of "the industrial state" that capitalist society today is characterised by "de-proletarisation" or by the diminishing number of workers, by the smaller role of the working class, its alleged integration with the bourgeoisie and the emergence of a "new middle class" of brain-workers or white-collar workers. The proletariat, then, just "vanishes into thin air".

Bourgeois theorists arrive at such unscientific conclusions by the trick of limiting the proletariat to manual workers alone or, to use their own phrase, to those representing "crude muscular strength".

First of all, it must be said that, regardless of the tendency to an absolute decrease in the size of the labour force in a number of industries under the impact of the scientific and technological revolution, the number of blue-collar workers, has, on the whole, increased rather than decreased. This is due to the growth of new industries, a general increase in the volume of production, and the relatively slow progress of automation for reasons of a purely capitalist nature, such as, for instance, that push-button plant is often more expensive than the labour to be displaced by it.

Allegations about the workers "integrating" with the ruling élite, about the "conformism" of the working class, are unmitigated nonsense. In fact, the present-day "industrial state" is characterised by sharper class struggle, expressed in the great surge of the strike movement and the

political action against the imperialist states' domestic and foreign policies. The sixties were particularly revealing in this respect. Altogether, more than 300 million workers took part in strikes between 1960 and 1968 compared with 150 million during the previous fourteen years. In the past few years the strike movement has been particularly strong in the United States, where the number of strikes grows from one year to another, having increased from 3,655 in 1964 to 5,600 in 1970, with the number of man-days lost through strikes jumping to 62 million.

No more substantial is the claim that only those working with their hands should be included in the category of "workers", and that, so long as the scientific and technological revolution tends to reduce the significance of muscular strength, the proletariat supposedly disappears. It should be noted in particular that at a time when engineers and technicians were economically privileged compared with ordinary workmen, Marx wrote that in addition to the latter "there is a numerically unimportant class of persons, whose occupation it is to look after the whole of the machinery and repair it from time to time, such as engineers, mechanics, joiners, etc. This is a superior class of workmen, some of them scientifically educated, others brought up to a trade. . . ." At this point, Marx adds the following note: "It looks very like intentional misleading by statistics (which misleading it would be possible to prove in detail in other cases too), when the English factory legislation excludes from its operation the class of labourers last mentioned in the text. . . ."[1] Clearly, as far as their relation to the means of production is concerned, engineers and technicians working for hire do not differ one whit from the wage workers. The above-quoted statement refers equally to some other categories of hired brain-workers. This group, inconsiderable in Marx's lifetime, has become very numerous in the course of the scientific and technological revolution. In 1970, in the United States, for instance, there were 905,000 graduate engineers, most of them working for wages.

Consequently, according to Marx, the proletariat does not consist of workers by hand alone. That is why the jux-

[1] K. Marx, *Capital*, Vol. I, p. 420.

taposition of blue-collar workers to white-collar workers, implied in bourgeois statistics and the theory of the "industrial state", is, as Marx wrote, deliberate deceit, all the more glaring because the scientific and technological revolution, as we mentioned, has created a need for operatives with much better educational standards, which unavoidably tends to draw together and consolidate all wage workers, by hand and by brain alike.

As long ago as 1921, Lenin showed that engineers would inevitably come to support the socialist revolution. He wrote that "many engineers everywhere supported the Soviet Republic, that in the near future Germany will have its so-called engineering proletariat, and that it was essential to win engineers over to the people's side".[1]

Certainly the engineers, doctors, etc., described in statistics as white-collar workers, do not present a socially uniform group. Along with the exploited majority working for wages, they include a minority which consists of employers exploiting the labour of others (owners of factories, private hospitals, schools, laboratories, etc.).

Immense concentration of capitalist production, the growth of monopolies, transformation of monopoly into state-monopoly capitalism, the scientific and technological revolution have induced profound changes in the overall social structure of modern imperialism. An absolute majority of the population of the imperialist countries have become wage workers. By 1970, the proportion of wage workers in the working population had amounted to 92 per cent in Britain, 90 per cent in the USA, 86 per cent in Canada, 82 per cent in the FRG, 76 per cent in France, 66 per cent in Italy, and 63 per cent in Japan. Close to them in status are small impoverished farmers, small artisans and shopkeepers who do not exploit any hired labour. Although the share of these groups in the population has drastically decreased, alliance with them in the struggle against the capitalists, who are ruining them, is still important to the victory of the working class in all capitalist countries.

At present, all wage workers consolidate into a single force directed against the domination of the financial oligarchy. This process is developing far from smoothly, for the

[1] *Kommunist* No. 5, 1970, p. 11.

engineers, technicians, researchers, doctors, teachers and other brain-workers working for hire, mostly coming of petty-bourgeois and middle-class families, have a mental outlook stemming from their bourgeois antecedents rather than from their actual position in society. It should be taken into account that a proportion of wage-earning engineers and technicians hold shares in monopoly corporations. Latest statistics show that the percentage of the shareholders among the US engineers, technicians and the office and sales workers is fairly high. Nonetheless, the scientific and technological revolution has accelerated the stratification of the intellectuals, turning many of them into wage workers who, because they are subtly exploited, steadily move nearer in interest and status to the working class. An indication of this is the growing number of white-collar workers joining trade unions and also the strikes staged by teachers, doctors, government employees, etc.

Having discovered the objective law that capital as a function separates from capital as property and shared ownership turns into the dominant form of capitalist ownership with its concomitant system of hired management, Marx and Engels stated that the joint-stock companies had already proved what little use the bourgeois was as such, since the entire business of management was conducted by salaried employees.[1] The militancy of the white-collar workers today and their joining up with the factory workers show that this section of working people increasingly realise the import of the above-quoted conclusion.

Workers of major industrial centres are in the van of the struggle against capitalist exploitation. They are the best-organised and most cohesive section of wage labour; they possess great experience of the class struggle, accumulated over the years.

Changes in the social structure of modern imperialism have led to a predominance of urban population. In place of the scattered mass of farmers of earlier times, now we see great concentrations of people in the towns. Nevertheless, Lenin's teaching on the alliance of the working class and working peasantry holds true in every imperialist country.

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[1] Cf. K. Marx and F. Engels, *Collected Works*, Vol. 35, p. 268 (in Russian).

Simultaneously, Leninism emerges as a teaching on the alliance between the international working class and the Asian, African and Latin American peasants fighting world imperialism.

Contemporary state-monopoly capitalism is characterised by the highest socialisation of production, labour, economic management and research. It forcefully demonstrates the principal objective law of its development, which Lenin formulated more than fifty years ago when he wrote: "Capitalism in its imperialist stage leads directly to the most comprehensive socialisation of production; it, so to speak, drags the capitalists, against their will and consciousness, into some sort of a new social order, a transitional one from complete free competition to complete socialisation."[1] This law of the development of capitalism acts with inexorable force, changing "certain of its fundamental characteristics . . . into their opposites".[2] Right-wing Socialists and some bourgeois economists describe socialisation of such vast dimensions as socialism. This is, in effect, what their theories of "mixed economy" and "peaceful transformation" of capitalism into socialism and, more recently, the convergence theory are about. They all carefully by-pass the issue of the distribution of national wealth among the different classes of modern capitalist society; they all seek to divert attention from the stark fact that the social means of production have been usurped by the financial oligarchy and made a source of enrichment to a tiny minority.

Massive socialisation of production is, to use Lenin's expression, the most complete material preparation for socialism, proving that transition to socialism is necessary and inevitable. But as long as the means of production and political power belong to the bourgeoisie, capitalism will remain what it is. The accelerating process of socialisation aggravates the contradictions of modern capitalism until they cry to high heaven. These profound contradictions and the growing militancy of the working class and all working people will inevitably lead to the triumph of communism all over the world.

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[1] V. I. Lenin, *Collected Works*, Vol. 22, p. 205.
[2] *Ibid.*, p. 265.

THE SCIENTIFIC AND TECHNOLOGICAL REVOLUTION AND THE SOCIAL STRUCTURE OF CAPITALIST SOCIETY

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Technological progress brings changes in social relations, in the position of classes and social strata, in the political superstructure and ideology of society, all of which is the Marxists' ABC. The new element is that the scientific and technological revolution which began in the middle of the 20th century involves particularly deep and far-reaching social consequences. This can be traced to a number of causes.

The pace of scientific and technological progress has grown so much that now more scientific discoveries and technological inventions are made in one year, than in a whole century of industrial capitalism.

The current revolution is considerably wider in scope and concerns many more people than the industrial revolution of the 18th and 19th centuries, to say nothing of the subsequent limited changes in the means of production. It covers both industry and agriculture, and not only the sphere of material production, but also the non-productive sphere as well.

The force of its social impact is also due to the fact that it signifies a transition from quantitative changes to a new quality. As automation and cybernisation of production develop, not only the functions of handling the objects of labour, but also sensory-reflex functions are transferred to the machine. The last function of man's direct participation in the production process—control, regulation and management—is transferred to a mechanical device. Machines are

being increasingly used for operating machines, which implies a change in the nature of the interaction between man and machine.

Mechanisation has taken the power of implements of labour far beyond the physical capacity of man, while automation and cybernisation are taking it far beyond the limits of his emotional-reflex and intellectual capacities. Unprecedented prospects are opening up for increasing the speed and intensity of production processes, for implementing the principle of aggregating machine units. The organisation of production processes is undergoing a profound re-thinking, and the whole system of the division of labour is being transformed.

The harnessing of nuclear reactions gives man fantastic power, which can be used both for creative or destructive purposes.

Relations among men, between man and nature, and his way of life are influenced more than ever before by technology. The development of transport, communications and mass media has made our planet a smaller place and has brought us all into closer contact.

The far-reaching social effects of the scientific and technological revolution are also due to the fact that it is contemporaneous with the revolutionary replacement of the capitalist social formation by the communist formation, for which all previous development paved the way. The social consequences of this revolution interact with the revolutionary processes that have been generated by a structural crisis deep within the capitalist system.

The scientific and technological revolution is still in its infancy. Its social results are showing through as yet only as faintly defined trends, but the question as to what these young shoots will develop into commands the widest attention and has given birth to a vast amount of scientific writing, as well as science-fiction and pseudo-scientific publications.

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Today bourgeois political economy, for the most part, no longer denies the all-important effect of changes in the mode of production upon social and political processes.

According to John Diebold, a well-known US expert on automation problems, "today's machines are far more powerful agents of social change than those of the first Industrial Revolution".[1] Diebold advocates major social innovations, and recalls that disregard of social problems in the past brought about the ideas of Marx which "have had more to do with shaping the lives of all of us than we might care to believe".[2]

Social changes brought about by the scientific and technological revolution are treated by bourgeois sociology from the angle of the transformation of capitalist society into a qualitatively different "new industrial society" (J. K. Galbraith), "cybernetico-electronic", or briefly "cybertronic society" (Zbigniew Brzezinski), or "post-industrial society" (D. Bell).

What are the main features of this mysterious society which to a large extent is the fruit of social prediction?

One of its essential elements is the new, "mature corporation", which is orientated towards social interests and not towards private profit. According to Galbraith, father of this theory, "mature corporation" leads to painless elimination of the rule of capital.

"Technotronic society" is run on scientific lines from top to bottom. Instead of the former plutocracy a "meritocracy", or "egghead élite" appears in its commanding posts. A prominent role in "post-industrial society" is assigned to the state, which relies on scientific knowledge and computers. The population in this society acquires a new professional and trade structure, and is largely engaged in service and white-collar occupations.

The theory of the "post-industrial society" also reflects some of the existing trends generated by the scientific and technological revolution. The latter further intensifies the concentration of labour and capital and hastens the process of merging the biggest companies. The domination of associated forms of capitalist property with their characteristic separation of the ownership of capital from its investment and control becomes further consolidated. The financial,

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[1] *Jobs, Men and Machines*, ed. by C. Markham, New York-London, 1964, p. 10.

[2] *Ibid.*, p. 13.

labour and material resources controlled by giant corporations already exceed those of an average-size industrial state and their activities extend far beyond the bounds of a single country. The massive introduction of new technological processes, new materials and commodities is based on the systematic application of the results of research, the development of which runs considerably ahead of the growth of production. Increased productivity of labour in the sphere of material production, as Marx foresaw, paves the way for expansion of the non-productive branches of the economy. The United States, the most technologically advanced state, has become the first country where more people are employed in the non-productive spheres than in the productive ones. It is estimated that by 1975, sixty-two per cent of all factory and office workers will be engaged in these spheres.[1]

Mechanisation and automation are now increasingly being introduced into the non-productive branches. This may slow down the growth-rates of employment in these branches. But taking into account that automation may find only a limited application in this sphere, and, more important, that major changes in the consumption pattern and rapid growth of new requirements (education, tourism, entertainment) are already afoot, it may be assumed that employment in the non-productive sphere will in future continue to increase faster than in the sphere of material production.

There can be no doubt that the growth of the white-collar group exceeds the growth of the blue collars, and that this trend will prevail in future. One of the major sources of such growth is the expansion of the non-productive sphere, where they constitute the predominant part of the employed. But the share of the white-collar group also increases in the spheres of material production. At the same time the number of engineers, technicians, scientists and experts within the white-collar group shows a particularly rapid increase. In the United States the share of the white collars among the employed went up from 35 per cent in 1947 to 46 per cent in 1967, grey collars (sphere of service) —from 10 to 13 per cent, while the number of blue collars fell from 41 to 37 per cent. According to forecasts, by 1975 the share of white and grey collars will increase up to 62

[1] See *Manpower Report of the President...*, April 1968, p. 304.

per cent, and that of blue collars will decrease to 34 per cent.[1]

Taking as their starting point the actual processes set in motion by the scientific and technological revolution, the authors of the "post-industrial society" conception and other theories of the transformation of capitalism treat their readers to an apology for the existing social system disguised in a "deideologised" wrapper.

This is particularly true of Galbraith's theory of the new, "mature corporation", which claims that in the big corporations power passes from the owners of capital to the specialised apparatus of management, to the so-called "technostructure". This is supposed to result in a change in the corporations' motivation and a consequent merging of the interests of the individual corporation, the industrial system and the whole of society. In essence, this is nothing else but a revival of the old idea of the "managerial revolution" propounded by A. Berle and G. Means in the thirties.

The fact of the matter is that in the big corporations control of property slips out of the hands of the mass of small shareholders and concentrates in the hands of the biggest property-owners. The separation of management from ownership in no sense means that management becomes completely autonomous. In fact, the manager exercises his ruling prerogatives only within the limits and to the extent that his policy corresponds to the interests of the big property-owners who control the corporations. Despite all the variety of the immediate motives of the "technostructure", they ultimately boil down to securing the maximum possible profit in the given circumstances, regardless of the consequences this may have for society as a whole. And the reward and social prestige of the top-level managers depends on the competitiveness and profit-making capacity of the corporations they control.

As a new social group of the "industrial society" they are by no means alien to the world of wealth; indeed they actually form an integral part of it. The salary of the top-level manager is several times higher than that of the most highly qualified engineer and enables him to adopt the way of life of a big capitalist. Many managers have controlling

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[1] *Manpower Report of the President. . .*, pp. 232, 304.

interests in corporations. According to C. Wright Mills, 45 per cent of the managerial staff of the corporations are big shareholders, while only 1.4 per cent of the workers hold shares at all[1]. Top managers are in fact an integral part of the monopoly bourgeoisie, although they remain dependent on the financial oligarchy.

The changing ratio of white collars to blue collars is also used by the theorists of the "post-industrial society" to substantiate the thesis of the "deproletarisation" of bourgeois society. Professor Daniel Bell of Columbia University had stated before he became chief oracle of the "post-industrial society" that automation would "create a new *salariat*" (i.e., salaried employees—*N.G.*) "instead of a *proletariat* as automatic processes reduce the number of industrial workers required in production".[2]

The "deproletarisation" theory is directed against one of the major conclusions of Marxism—the leading role of the working class in overthrowing the capitalist system of exploitation and in building a new society.

A revisionist variant of the theory of "deproletarisation" is put forward by Roger Garaudy, who in his book *The Great Turning Point for Socialism* claims that the leading role in political and social development is passing to a "new historical bloc", in which the intellectuals and the working class are merged.

However, the changes occurring in the social structure of capitalism do not refute but confirm the conclusion that the working class plays a leading role in world history.

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The conception of "deproletarisation" of bourgeois society, or the absorption of the working class into a new middle class is usually based on the theories of social stratification that take arbitrarily chosen and isolated facts as the criteria of class affiliation.

As presented by the stratification theorists, the social structure is completely deprived of any objective basis. But,

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[1] C. Wright Mills, *The Power Élite*, New York, 1957.

[2] *Dun's Review and Modern Industry*, Vol. 79, No. 1, January 1962, p. 60.

in fact, the origin and development of classes stems from the specific conditions of the material life of society. The production of material goods has everywhere and always been social in character. In the course of this production people enter into definite relations whose character changes in accordance with changes in the mode of production. Classes are, in fact, the product of these relations at definite stages in historical development.

In one of his articles Lenin gave the following definition of classes: "Classes are large groups of people differing from each other by the place they occupy in a historically determined system of social production, by their relation (in most cases fixed and formulated in law) to the means of production, by their role in the social organisation of labour, and, consequently, by the dimensions of the share of social wealth of which they dispose and the mode of acquiring it. Classes are groups of people one of which can appropriate the labour of another owing to the different places they occupy in a definite system of social economy."[1] These main indicators determine to a great extent such distinctive features of classes and social strata as standards and type of education, sphere of activity, status in the system of political power and specific ideological and psychological characteristics.

Social classes are not homogeneous masses of people conforming to a definite standard. They are made up of various groups and layers that differ in the nature of their activities, their way of life, opinions and so on, but these differences do not prevent them from uniting when their basic class interests are involved.

A genuinely scientific understanding of classes and the class struggle is of immense importance in analysing social processes. It makes it possible to discover the objective laws governing the life of society, which at first glance appears to be an accidental mingling of circumstances, to foresee the course of events and influence them through the conscious activity of the masses.

The main classes of capitalist society—the bourgeoisie and the proletariat—are born of capitalist production relations. They cannot be removed without removing the economic

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[1] V. I. Lenin, *Collected Works*, Vol. 29, p. 421.

basis of their existence—private ownership of the means of production.

Not only value and material elements of capital but also capitalist relations themselves are reproduced in the process of capitalist production. The very thing that is the starting point of capitalist production—the separation of the means of production from the immediate producer and their conversion into capital—is constantly reproduced by the very mechanism of capitalist economy. Just as simple reproduction constantly reproduces the capitalist relation—capitalist on one side, hired workers on the other—so reproduction on an extended scale, or accumulation, reproduces the capitalist relation on an extended scale—more capitalists or bigger capitalists at one pole, more workers at the other.

This proposition of Marx is fully confirmed under present-day conditions. Technological progress, by intensifying the concentration of capital, simultaneously hastens the expropriation of the small and medium property-owners. In recent decades this process has been developing with particular intensity in agriculture.

In all the developed capitalist countries since the war there has been an absolute and relative growth in the number of people working for hire. Whereas before the Second World War in several countries (Japan, for instance) the proportion of hired workers was less than half, or only a little over half (Italy and France) of the economically active population, today they constitute a significant or very large majority of the economically active population of all the developed capitalist countries.[1]

Contrary to the assertions of the theorists of "deproletarisation", these facts testify to an intensification of the process of proletarisation of the population. This does not mean that all people working for hire can be assigned to the working class. They include elements that are socially heterogeneous. No matter how the composition of the army of wage workers may change, the industrial workers continue to remain its largest contingent.

Under the influence of the scientific and technological revolution the branch, professional and territorial structure of the industrial workers becomes increasingly mobile. There

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[1] See p. 187 of this volume.

is a general tendency for labour power to flow out of such branches as textiles, footwear, clothing and coal into branches such as machine-building, chemicals, electrical power, i.e., those with an exceptionally high level of concentration and monopolisation of production. Many old trades are dying out, while scientific and technical workers and the professions connected with servicing machines and equipment, the so-called multi-purpose professions, are rapidly multiplying.

Despite all the social barriers with which capitalism hinders the working people from gaining wide access to the liberal arts and professional education, the tendency towards higher qualifications is nevertheless making headway in the conditions of the technological revolution.

All this testifies to the fact that the proletariat in the technological age differs in many ways from that of the age when the large-scale machine industry was coming to the fore.[1] Not only the composition of the working class, but also its technical and educational standards and working conditions are changing; it is acquiring a different way of life and mentality.

How do these changes affect its economic and political role? The bourgeois sociologists write about the working class in the developed capitalist countries as having "lost" its former importance, but on the contrary a more highly trained, educated and intellectually mature working class is capable of playing a considerably more active role as the motive force of social progress. The wider territorial distribution of the proletariat, along with even higher concentration in the major industrial centres, the key points of economic life and the main sectors of the struggle against the monopolies, should only enhance this role.

The changes noted above refer primarily to the industrial proletariat. But the working class does not consist solely of industrial workers. Here it is worth recalling Lenin's remark that it is unjustifiable to equate the " *'unifying significance' of capitalism with the number of factory workers*", that there are diverse social types within the proletariat and semi-pro-

[1] Interesting data on this question is supplied in the book *The Working Class of the Capitalist Countries and the Scientific and Technological Revolution*, Prague, 1969.

letariat, that the proletariat is divided into more or less developed layers.[1] It would be even less justifiable to imagine the proletariat as a uniform "grey mass", when under the influence of the scientific and technological revolution major developments in the social division of labour in the *social* structure of bourgeois society are taking place.

Here we must return to the problem of the white collars and the blue collars. What is the actual social significance of the notable increase in the proportion of white-collar workers (including engineering and technical personnel) to the total number of people working for hire?

The change in the proportion of white collars to blue collars in the sense in which these terms are used by the national statistics of the countries in question, merely signifies a change in the proportion of people engaged in predominantly mental work to those engaged in physical work. This change does not in itself determine the social position of any group of the population. If one applies the criteria of class affiliation mentioned above it becomes clear that the employees, the white collars, are socially a very mixed conglomeration, including members of various classes. A substantial part of them make up the middle classes of society occupying an intermediate position between the main classes.

The increasing concentration of capital, the penetration of the monopolies into new spheres of the economy, the constant introduction of the latest equipment are intensifying the process of social stratification of the white-collar workers. A minority of employees involved in assisting capitalist exploitation, people who play an active part in the state apparatus of coercion or the system of monopoly-controlled propaganda, preserves and consolidates its privileged position at the expense of the working class.

A substantial proportion of white collars, however, have throughout the 20th century, and particularly in the last few decades, been drawing closer to the industrial workers as regards their role in the capitalist system of production, their status and conditions of work. In the last century the engineers and technicians along with the commercial and

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[1] V. I. Lenin, *Collected Works*, Vol. 1, p. 316.

office employees, despite the fact that they worked for hire, nevertheless enjoyed special privileges that separated them from the mass of the workers and brought them closer to the bourgeoisie. Owing to the universal nature of their work and the need for lengthy training and education that were available to only a narrow circle, the salary level of this group of employees was considerably higher than that of the skilled worker engaged in physical labour.

The comparatively small office staff was in close contact with the owner of the firm and was largely concerned with administration and disciplining of the workers. In those days commercial and office employees could count on accumulating enough funds to start their own businesses.

Today their position has changed radically. As their numbers have increased they have come to occupy more and more subordinate positions in the bureaucratic hierarchies of the corporations. The great majority of them now have nothing directly to do with the functions of controlling and supervising the workers. They are losing their sense of identity with the management. The deepening capitalist division of labour deprives their work of its universal creative character. The same methods of capitalist rationalisation (time and motion study), that were formerly applied only to industrial workers are being applied more and more widely to office employees, a process that is intensified by the mechanisation and automation of office work and the work of engineers and technicians. The gap between salaries and wages is also narrowing. Sometimes the office workers' salary may actually be lower than the wage of the skilled industrial workers. The stability of their position on the labour market is also becoming a thing of the past. White and blue collars alike become the victims of mass dismissals.

Modern state-monopoly capitalism is sweeping away the remaining privileges that used to distinguish the mass of office and commercial employees, technicians and junior engineers from the workers. In the final analysis this process will create a situation in which some mass categories of white-collar workers will acquire the basic class attributes of the proletariat.

As already suggested, the scientific and technological revolution and the development of state-monopoly capitalism have breathed new life into the technocratic theories, whose authors now talk of the rise of an all-powerful "egghead", or electrono-cybernetic élite that is taking over society. These theories get a nod of approval from Roger Garaudy, who claims that the scientists and research workers are at present bearers of the decisive power to change the world.

Yet, no matter how great the part played by scientists, technical experts and other members of the intelligentsia, their independence is strictly limited. They are subject to the categorical imperatives of class society. Directly or indirectly through state institutions the activities of the intelligentsia come under the control of monopoly capital. Research and development financed by the big corporations are directly subordinated to the extraction of profit. Growing state intervention in the financing and organisation of science is accompanied by its unprecedented militarisation. Never before in history has such a multitude of highly educated and gifted people been drawn into the work of making and developing weapons of mass annihilation.

Modern state-monopoly capitalism's imposition on science and culture of aims that starkly contradict their humanitarian purposes and fetter the creative initiative and integrity of the intelligentsia is encountering growing opposition from the intellectuals themselves, who react particularly sharply to the standardisation and sterilisation of minds through "mass culture", a kind of semi-culture that is often worse than no culture at all. They are the first to feel dissatisfaction over the general ousting of ideas by the consumer craze.

The intelligentsia cannot, however, serve the cause of progress while remaining in "splendid isolation" from the masses. Only in alliance with the working class can it play a social role befitting its capabilities and interests. The changes in the working class, particularly its increased skill and education and the enhancement of the intellectual side of labour, are creating conditions for the consolidation and expansion of this alliance.

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Scientific and technical progress not only changes the social structure of society. It simultaneously gives rise to extremely serious problems and contradictions.

Unlike the panegyrics to man's mental daring that one finds in predictions concerning the advancement of science and technology, the forecasts of many Western sociologists regarding social development are couched in pessimistic tones. Labour played a determining role in the formation and development of man as *Homo sapiens*. Now that automation is with unprecedented speed reducing the need for labour, some sociologists are asking whether robots do not promise the ruin of mankind through idleness. An article by Gérald Messadié, a French sociologist, bears the self-explanatory caption: "Is Man Obsolete?"[1] Professor Robert L. Heilbroner of the United States foresaw the arrival of a society where technology would have generated "immense wealth together with an equally immense vacuum of toil".[2]

Many other social aspects of the scientific and technological revolution give rise to considerable apprehensions. In his book *The Year 2000. A Framework for Speculation on the Next Thirty-Three Years*, H. Kahn, Director of the Hudson Institute (with A. J. Wiener as co-author), has predicted that the growth of material wealth will be accompanied by the moral and spiritual degradation of society. According to Joachim Bodamer, a West German sociologist, constantly accelerating technological and industrial progress will be paid for by accelerating human regress and depletion of the humane principle.

It should be said that today there are indeed grounds for alarm about the consequences of scientific and technological progress, but bourgeois futurologists are looking for the source of alarm in the wrong place.

It is a fact that the discovery of secrets of the microcosm, the harnessing of the fission and fusion reactions has brought about the manufacture and stockpiling of hydrogen bombs and the threat of a thermonuclear war which could wipe human civilisation off the face of the earth. Despite the

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[1] *Science et vie*, mai 1962.

[2] See B. D. Nossiter, *The Mythmakers. An Essay on Power and Wealth*, Boston, 1964, p. 137.

revolution in the techniques of agricultural production, the developing countries are faced with a food crisis. Contrary to established opinion, illiteracy in our "age of enlightenment" is growing, since in some countries the population is increasing faster than the number of students and pupils. The richest capitalist country—the United States—cannot cope with the problem of poverty. Intensive introduction of automation and new equipment has caused growing instability and unemployment for the working masses.

The ruthless exploitation of natural resources based on the application of modern technology arouses growing concern. Even now two-thirds of the population of the United States breathe polluted air. For every American (including children) there is more than half a ton of pollution to be disposed of annually. Smog cuts short thousands of lives and destroys trees and plants. In the USA, as in many other capitalist countries, there is no longer a single large river with pure water. Factory waste has utterly poisoned Lake Earie. More and more people are coming to realise that the monopolies' continued irresponsible use of chemicals could threaten the existence of life on earth.

The more powerful the means of production, the more helpless a man feels in bourgeois society. His physical and mental activities are broken down and subjugated to the inhuman system of bureaucratic management, to someone else's will. When at work he is at the mercy of mechanical robots. Outside he must contend with the "consumer society", the cult of things, the power of mass media and the "entertainment industry", which spreads a typical middle-class conformism and system of values in the interests of monopoly capital.

While all this is undoubtedly true, technological progress is not responsible for these misfortunes. On the contrary, *the scientific and technological revolution opens up hitherto unprecedented opportunities for the enlightenment and development of man.* It provides the technical prerequisites for the transition to a social system under which man becomes not a means but the object of economic activities, and along with the achievement of material abundance the creation of intellectual values acquires tremendous importance.

The automation and cybernetisation of production lead to the elimination of strenuous and monotonous work, and free

man from his obligatory association with the machine. Manpower is being increasingly withdrawn from small-scale and unproductive enterprises. This process has acquired wider scope, particularly in agriculture which is becoming a highly developed industry. What Marx called "the idiocy of country life" will be eliminated and so will the domestic slavery of women, who will become associated with highly productive social labour and public life.

Removing man from direct participation in the production process, automation makes it possible and necessary to expand considerably the sphere of application of mental, and particularly creative, labour as well as labour which requires fundamental scientific and technological knowledge.

A certain number of men are needed to service the automatic system of machines. They are workers of a new type. They are not a composite part of the production process. They stand *over it,* performing functions of control and regulation. Their labour is more complex in nature. It requires vast technological knowledge and a conscientious and responsible approach, in which the intellectual functions of labour play a predominant role.

Servicing automated production requires, of course, far fewer people than before. Yet this does not mean that the rest of them are doomed to idleness. The sphere of services will be expanded to satisfy not only the material but also the growing intellectual requirements of man.

In accelerating the growth of labour productivity, automation creates the necessary prerequisites for reducing working hours, which in turn is an important condition for free creative activities and the spiritual development of the individual. In the future the very counterposing of working and leisure time will probably lose all meaning.

But the realisation of these huge potentialities for facilitating labour and enriching it with new creativity, for ensuring material abundance, and developing and perfecting the human personality, which are opened up by modern technology, and still more by the technology of the future, depends on social conditions and the social system where it is applied. It is this aspect of the problem that is ignored by bourgeois sociologists, who measure social development as well as the moral and cultural progress of any future society by the standards and concepts of present-day capi-

talist society. In this respect some sociological forecasts remind one of the technological forecasts of our predecessors who, for example, thought of future transport as consisting of a huge number of steam carriages and carts.

The very process of social development is pictured as an automatic evolution, without conflicts, towards the "post-industrial society" with technological progress gaining pace. This process has no place for class struggle, trade unions and workers' parties, and mass organisations of the working people. According to Galbraith, in the "new industrial society" trade unions must inevitably forfeit usefulness as a result of the transfer of power from proprietors to the "technostructure" and state regulation of the market, aggregate demand, prices and wages. Zbigniew Brzezinski, inventor of the "technotronic society", proclaims that this society cannot have a "unifying ideology of political action" similar to that of Marxism.[1]

The class struggle is, however, not the "nostalgic feelings of old-fashioned revolutionaries", as some advocates of "neo-capitalism" assert. A social system based on social antagonism provides ground for class conflicts. This is all the more true in the age of scientific and technological advance, which not only deepens the old contradictions of capitalism but also gives rise to new ones.

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The class struggle, like the majority of social phenomena, is not a simple and straightforward process. It does not always fit into a simplified formula of the constant "aggravation of class struggle". In its course there are both ups and downs. The bourgeoisie has learnt its lessons from its historical defeats. Monopoly capital's appropriation of the tremendous benefits resulting from the introduction of the latest technological advances provides additional resources for flexible tactics of social manoeuvring carried out both within the framework of large corporations and the whole system of state-monopoly capitalism. Changes in the way of life which became possible due to the accelerated devel-

[1] See *The New Republic*, December 23, 1967, p. 19.

opment of the productive forces, concessions won by the working people under the conditions of a highly favourable economic situation—all this can promote the spread of reformist illusions and the temporary neutralisation of a part of the working class.

However, as the scientific and technological revolution develops in the context of antagonistic capitalist relations, an increasing importance is attached to its social consequences, which electrify and stimulate into action new contingents of the working people.

It was no accident that in the late sixties when the situation on the economic market was comparatively favourable there should have been such mass outbursts, unprecedented in scale and composition, against key aspects of the policy of state-monopoly capitalism as the strike of ten million working people in France in May and June 1968, accompanied by mass demonstrations, setting up of action committees and the occupation of factories, or the strike of twenty million working people in Italy in November 1969. Student action in France, the USA, Britain, the Federal Republic of Germany, quite often involving barricade fighting against the police, are significant in this respect. So are the strikes by state employees. Some sociologists justifiably expect even more powerful popular outbursts in the future.

The problems connected with the scientific and technological revolution that will give rise to formidable social conflicts can be singled out with a fairly high degree of accuracy.

The destructive, inhuman way in which state-monopoly capitalism tends to use science and technology will almost certainly rouse growing protest and opposition. These tendencies are turning the productive forces into destructive forces. Militarism armed with nuclear missiles and swallowing up enormous funds not only threatens the world with suicidal disaster, it also acts as a powerful brake on social progress.

The current campaign for the protection of the environment which tends to be directed more and more against the monopolies will in future play an even bigger part and attract very wide sections of the population.

The traditional economic demands of the working class for higher wages and reduction of working hours will not

lose any of their significance. They will be guided to a greater degree by the possibilities opened up by the technological revolution, poverty and social inequality being even more fiercely rejected. Efforts to increase the working people's share of the national income will proceed more and more often on a national level and will lead to direct confrontation with the system of state-monopoly capitalism.

The predictions of a number of Western scientists, particularly Norbert Wiener, concerning the catastrophic unemployment that is likely to hit more than half of the economically active population in the near future, are probably not sufficiently grounded in fact. At the same time there is little evidence for the optimistic hopes of some economists, who believe that state control and economic growth will eliminate the problem of employment and unemployment.

Unemployment may increase in the future even while comparatively high GNP growth rates are being maintained. The immanent contradictions of capitalism will in the course of the scientific and technological revolution call forth sharp disproportions between the rate of release of manpower and the growth of the economically active population, on the one hand, and the rate of increase of the social product, on the other. Dismissals will affect the skilled as well as the unskilled and semi-skilled, and not only workers but also white-collar employees engaged in routine, repetitive operations. Characteristically, in the last ten years the proportion of white-collar unemployed in the United States has increased from 18.4 to 25.3 per cent.[1] By mid-1971, 65,000 researchers and over 300,000 engineers and technicians in the country were also unemployed.

Dismissals connected with the installation of new equipment and also lack of education and professional training will mean that considerable numbers of young people about to enter life will encounter great difficulties in finding work and this will stimulate their social protest against the existing system.

As time goes on the objective need to increase the adaptability and mobility of manpower will further contribute to instability and in some cases unemployment. Acclimatisation will involve much loss and hardship, which state-monopoly

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[1] *Manpower Report of the President...*, April 1968, p. 238.

capitalism will seek to thrust largely on to the shoulders of the working class.

It is highly probable that working people will in future protest not only against unemployment but also against the blocking of individual abilities and inclinations by the social rigidity of the capitalist system. The working people's increasing lack of stability under conditions of rapid change, the development of inflationary processes and also the growing proportion of old people in relation to the population as a whole will reveal ever more clearly the basic faults of the existing system of social security.

By the end of the century about 80 per cent of the population of the United States and nearly 90 per cent of Japan's population will be living in towns. Huge megalopolises with populations running into tens of millions are expected to arise out of the present conurbations. Overurbanisation will evoke a whole series of acute problems and contradictions connected with housing, transport and replanning.

The sources of social discontent will lie not only in the field of purely material interests. It will also accumulate around the problems of man's intellectual and cultural development, his political rights, individual freedoms and ability to control his own life.

A key role will be played by demands for the radical reform of education, for making higher education and professional training widely accessible and maintaining them on a scale suitable to the needs of the scientific and technological revolution.

There will be mounting protests against the excesses of the machinery of coercion set up by state-monopoly capitalism, against the uniformity of thinking, taste and behaviour imposed on working people by the mass media.

Demands for control of the activities of the monopolies (particularly with regard to the installation and use of new equipment), democratic programming of the economy, and actual participation in management at all levels will probably acquire increasing importance in the programmes of democratic reform proposed by the working people.

The above enumeration does not, of course, exhaust all the probabilities. Scientific and technological advance will intensify many other social contradictions within capitalist society, such as the uneven development of various eco-

nomic regions, racial and national conflict, the contradictions involved in the use of leisure, increase in crime and so on.

The social conflicts stimulated by the scientific and technological revolution are not an isolated phenomenon but an expression of the profound structural crisis of capitalist relations. They are the result of the ever widening gap between scientific and technical development, on the one hand, and the obsolete social structure with its inherent moral and ethical and cultural traditions, on the other.

Adequate social progress is becoming the categorical imperative of the scientific and technological revolution, and this in its turn brings to the fore the problem of revolutionary social engineering. Socialism and communism, not a modified form of state-monopoly capitalism, are now on the order of the day.

THE SCIENTIFIC AND TECHNOLOGICAL REVOLUTION AND THE DEVELOPING COUNTRIES

Vladimir Kollontai, D. Sc. (Econ.)

The second half of the 20th century has been characterised by the complex interplay of two seemingly unrelated developments—the revolution in science and technology and the collapse of the colonial system.

On the one hand, the unprecedented progress of science and technology opens up staggering opportunities for the development of productive forces and the solution of economic problems. In less than a century, man has not only learned to fly; he has actually penetrated into outer space. The achievements of previous millennia double and treble within decades. Life is changing at an incredible pace, translating the most daring dreams and projects into reality.

On the other hand, a good half of the earth's population are to this day living just as their distant ancestors did. Most of the Asian and African countries have won political independence but they still have to overcome the economic and cultural lag caused by decades of colonial and imperialist domination. These countries are beset by all kinds of involved and interrelated problems. They have to set up a modern industrial apparatus, mobilise huge material and manpower resources and see to their rational employment, reorganise relations in industry and society, radically alter their position in the world economy, and so on. The low economic potential, rapid growth of population, widespread poverty and the acute food problem, the preponderance of extremely backward political and social institutions make

it particularly difficult for them to shake off the colonial legacy and build a new way of life.

The manifold results of the scientific and technological revolution and the intricate complex of problems arising before the developing countries will, each in its own way, exert a tremendous influence on the course of society's development in the next few decades. Scientists the world over are trying to predict the probable scope and character of this influence. Unfortunately, however, they generally pursue matters separately, concentrating either on the problems arising before the developing countries or on the effect of the scientific and technological revolution on the various aspects of life in the industrialised countries.

It is quite clear that the effect of this revolution on the Asian, African and Latin American countries will increase year by year. As natural forces are conquered one after another, unprecedented productive capacity developed and economic management and patterns improved, new opportunities arise for handling many of these countries' problems. The construction of the mammoth hydroelectric station at Aswan, for instance, enables Egypt to solve many of its power-supply and irrigation problems. Even at the present technological level, the Afro-Asian countries could easily obtain annual increment of between six and eight per cent of the GNP and so double their present per capita income in fifteen to twenty years. But real as it is, this prospect runs into certain difficulties of an economic and social nature.

The quality and extent of the influence of the scientific and technological revolution on "third world" countries will largely depend on which path of development—capitalist or non-capitalist—they may choose to follow.

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Any discussion of the impact of the scientific and technological revolution on the developing countries, if it arose at all, used to be confined to various individual aspects of the problem.

In the fifties, attention was paid mainly to the changing patterns of raw material and fuel consumption and particularly to the effect of the intensified production of synthetic materials in the economically advanced countries on the

developing countries' exports. Many bourgeois economists emphasised the one point that the progress of science and technology tended to restrict the export possibilities of the Asian and African countries, causing prices to fall and so reducing the developing countries' export earnings. Of course, synthetic materials, reduced material-product ratio and other changes due to the technological revolution do have an adverse effect on the traditional exports of the Asian and African countries and make it objectively necessary for them to dispose of their old economic and foreign trade patterns without delay. But this was just what the apologists of imperialism would not concede. Moreover, as the colonial system crumbled and the national liberation struggle gained momentum, the imperialists actively sought to increase the number of suppliers of raw material and fuel to Western Europe and North America. Simultaneously they boosted home production of many synthetic materials, lavishly subsidising research in this particular field. The number of producers of identical raw materials was even extended, just in case any of them should cease to be available. Rather than promote the timely reorganisation of the Asian and African economies to suit the objective tendencies of the scientific and technological revolution, the imperialists actually stimulated the overproduction of those economies' traditional exports. This eagerness to preserve the specialisation of the "third world" in primary goods and fuel continues to exert its crippling effect on Asian, African and Latin American economies to this day.

In the early sixties, there was a shift of emphasis towards extending research that would have the maximum practical significance for the developing countries. A special UN conference on these problems was held in Geneva in 1963, giving a certain impetus to efforts in this sphere. Researchers began to look into the possibilities of a more comprehensive utilisation of local resources, of adapting to specific local climatic and natural features, etc. Certainly research conducted along such lines may yield definite results. Among other things, it would be useful to investigate the ways and methods of increasing agricultural production in the tropics, of controlling the erosion and impoverishment of soil, of a more comprehensive utilisation of local building materials, and so on. It is well known that in many countries the "green

revolution" is exerting a palpable effect on the volume of farm output. Since many countries badly need water, experiments in water-freshening may prove of great value to them. In countries which have to import most of their industrial fuel and power, constructing atomic power plants on the spot may be of considerable value.

But the experience of the past few years has increasingly demonstrated that no adequate solution will be found by attacking the problem piecemeal. One has to gauge accurately the overall effect that the scientific and technological revolution is having, and is likely to have soon, on the retarded economies. This alone offers a clear view of the opportunities and the challenges it makes to the developing countries. At present there is simply not enough information for an exhaustive analysis, but some of the important problems may be considered even now.

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So far the scientific and technological revolution has had but a limited effect on the solution of the problems confronting the developing countries. It has chiefly manifested itself in the construction of some modern enterprises, above all in the fuel-and-power, oil-processing and similar industries. The developing countries have been much less able to benefit from the immense economic potentialities of the rational concentration, specialisation and co-operation of production; in most cases, the economic level of developing countries prevents them from making the most of this major aspect of the scientific and technological revolution. By and large, the latest achievements of science and engineering are applied in the developing countries on a very small scale, in a few isolated fields; besides, their fruits are mostly appropriated by foreign monopolies and companies. On the whole, modern science and engineering are only just beginning to be introduced in certain branches of the economy of Asian and African economies.

Simultaneously scientific and technological progress tends to widen the gap between the advanced and the developing countries. Figures show that the disparity between these two groups in per capita income is increasing not only absolutely but relatively as well. More important still, the pro-

ductivity gap and the economic potential gap are also growing.

What has brought about this situation? How is it likely to develop? And—most important of all—what impedes the broad introduction of modern science and technology in the developing countries?

Bourgeois scientists often side-step the issue by contending that the scientific and technological revolution assumes forms which are consistent solely with the needs of the industrially advanced countries and would prove unsuitable for the economically retarded areas of the world. The following reasons are usually given to bolster this thesis. Present-day research and development aim primarily at bringing down labour expenditures and raising efficiency (through more investment). In the developing countries, however, investment is restricted for lack of means, while there is an abundance of unskilled labour. Under such circumstances, most bourgeois scientists contend, these countries should orient their plans not on the latest production methods but on another, "interim" or "transitional" technology yet to be developed, by which they usually imply primitive, simplified machines, obsolete production schemes, "various elements of late 19th- or early 20th-century engineering". Accordingly, it is often suggested that researchers should concentrate on developing "labour-intensive" production methods and "intermediate" technologies suitable for the tropics. Some people go as far as to say that it is necessary to slow down the progress of science and technology in the advanced countries and concentrate entirely on "intermediate" technology, which would supposedly make it easier for the developing countries to solve their internal and external problems.

A somewhat different variant of the same conception is represented by the following recommendation. To eliminate unemployment, all available venture capital should be distributed more or less evenly among the entire wage-earning population, and one and all equipped with the "intermediate", "labour-intensive" technology.

Employment is, indeed, an acute problem in the developing countries, and is made all the worse by insufficient investment. But a development programme hinging on intermediate technology (even though it may relieve unemployment for a time) cannot seriously help the Asian and Afri-

can countries to secure stable economic growth rates and win a more equal position in the world market. On the contrary, such a programme precludes any long-term solution of their problems. With outdated technology, accumulation can only be small and slow, and such a programme offers no solution to the problem of employment even in times to come.

The successful experience of a number of socialist countries in overcoming their economic backwardness reveals a different approach to development. They invested the bulk of the capital they were able to muster and concentrate in completely up-to-date projects. The main yardstick applied to investment was the amount and kind of output to be obtained, its value to the national economy, the efficient operation of the projects, etc., rather than the number of new jobs that might be created. Thus a body of modern highly efficient enterprises was established, which accelerated the accumulation of means for modernising other economic sectors and stamping out unemployment. At the same time, since unemployment in its various forms remained at a high level in some socialist countries at the early stages of their development, while investment and production facilities were small and scattered, it was inevitable that there should exist a fairly large sector of small and medium-sized enterprises characterised by a low productivity of labour. Productivity had to be raised considerably in this sector, too, but this was achieved not so much by the introduction of modern machinery as by a whole series of organisational and administrative measures that accompanied it, including a programme for the systematic introduction of co-operatives in agriculture. Success in this sphere exerted a tremendous effect on the entire process of the country's development, on its forms, rate and prospects.

In the present conditions, the task facing the developing countries is not so much to "average out" capital investment and introduce "intermediate" technology on a large scale as to find the optimal balance between the various technologies and methods of production and to conduct a well thought-out policy of consistently raising the social productivity of labour and introducing new technology.

Of course, not all the achievements of the scientific and technological revolution are, at the moment, of equal im-

portance to the developing countries. It is a fact that not all of them are applicable there in the same degree. In some cases it would be unwise to introduce certain costly methods of raising efficiency at the early stages, especially where similar results can be obtained by improving the organisation of production, and so on. In certain cases it may even be advisable to utilise some outdated equipment.

On the whole, however, it would be unreasonable and unrealistic to think that the scientific and technological revolution could be made to veer from its normal course of raising productivity and directed at building up the "labour-intensive", "intermediate" methods of production. Through the ages, man has always endeavoured to multiply the results obtained from so much labour expended. Higher labour productivity is, in the final analysis, the crucial source of the growth of accumulation and the national product at large.

Furthermore, the developing countries have inherited numerous problems from colonialism. Widespread unemployment, though important, is only one of them. Since they are bound to foreign markets, the developing countries must be concerned about the effectiveness and competitiveness of their industry. They must develop many capital-intensive branches (petrochemistry, power engineering, etc.), which should not be hitched to the science and technology of yesterday; otherwise the entire massive investment programme will soon prove obsolescent and unproductive and will have to be renewed.

The rapid increase in population in many areas, the worsening food situation and growing poverty also compel the developing countries to raise productivity as the only means of making production grow faster than population.

Thus, the very need to overcome economic backwardness prompts the developing countries to adopt a strategy of development which presupposes an overall growth of productivity and of competitiveness in the foreign markets. And this means that the scientific and technological revolution, which raises productivity, decreases the material-product ratio in industry, brings forth large industrial complexes, and so on, is of great potential value to the developing countries.

One should, however, remember that the revolution in

science and technology does not end with the construction of large and costly industrial facilities; it has also to do with the rational organisation and management of production, remoulding the totality of relations of production, improvement of planning and the methods of social analysis and elaboration of the scientific theory of social development. These aspects of the scientific and technological revolution are of decisive significance to the developing countries.

* * *

By increasing their store of knowledge, by mastering current discoveries in physics, genetics and chemistry, and by applying the most recent achievements of the social sciences and the advanced socialist experience of socio-economic development, the Asian, African and Latin American nations can find a way out of their present plight.

The most essential thing, in this writer's opinion, is to form a clear idea of what is actually hampering the broad introduction of the achievements of modern science and technology in the developing countries.

Scientific and technological innovation in Asian and African countries comes up against the same obstacles that are generally holding back the economic and social progress of these countries, viz., the low level of the productive forces, archaic social and production relations, and dependence on the capitalist world economic system. Overcoming economic backwardness means solving a host of complex economic problems, such as mobilising and utilising available resources, expanding the sphere of commodity-money relations, changing the structure of the national economy, drawing the nation's entire labour resources into production, and training one's own cadres. Simultaneously a number of social problems have to be tackled. Though it offers new opportunities of overcoming the economic lag, the scientific and technological revolution, in some respects, complicates the problems the developing countries have to face. Thus, most contemporary technical advances provide for higher productivity by raising the assets-products ratio and placing better and more expensive equipment at the disposal of every operative. New production methods and plant require heavier capital investment and larger markets. Consequently,

in this respect the scientific and technological revolution aggravates the problems of accumulation and the market problem, which are acute enough as it is.

Socialisation of production, large industrial complexes, necessarily imply the development of a ramified but clear-cut pattern of interrelation between economic branches and areas. When a new modern enterprise is being set up, it has to be properly supplied with fuel, raw material, semi-manufactures; there must be an effective system of material and technical supply, an efficient transportation system, an adequate market, and so on. In other words, a modern enterprise implies the existence of numerous associated branches; the introduction of new production methods and plant inevitably entails a serious reorganisation of the present economic structure, the break-up of the old proportions and ties and substitution by new and more complicated ones. There arise the difficult problems of determining the optimal economic pattern and creating the most effective mechanism of economic programming and regulation capable of translating the optimum into practice.

Economic development has always been attended by change in the economic pattern. But in countries which were in the van of technological and economic development such structural changes went off more smoothly and gradually. In past centuries, important scientific and technical discoveries were few and far between. Each new discovery or invention was introduced in the context of the most developed and modern economic standards of the period. The structural changes incidental to the introduction of new production methods and facilities in the economy of the more advanced countries were, therefore, not dramatic. Such structural changes—albeit at the cost of numerous bankruptcies, considerable unemployment, recurrent economic crises, etc.—could be effected by the spontaneously functioning market mechanism.

The tasks confronting the developing countries today are, however, much more difficult. These countries have to introduce the achievements of science and technology accumulated over the centuries into a society which is badly lagging behind economically. This necessarily involves great and abrupt changes in the entire economy. At a given stage some sectors, areas and industries develop faster than

others. It is, however, indispensable to economic and social progress that the elimination of the old proportions and relations should be accompanied by the emergence of new ones. The scientific and technological revolution greatly complicates the problem by increasing the range of economic fluctuations and giving rise to many new forms of connection. It is no accident that modern Western writers on the developing countries constantly refer to "booms" and "gaps", which in fact conceal the twin problems of casting off the old pattern and simultaneously ensuring the co-ordination of various sectors of the economy at each separate stage.

This complex problem cannot be entrusted to private enterprise and the free play of the market. The dimensions of the changes to be worked in the economy are such as to make it impossible for any one entrepreneur to predict the future of his enterprise even for some five or ten years ahead; he cannot foresee the structure of the market, the price level or other important factors indispensable to determining the rate of profit the enterprise may yield. Such estimates can be made only on a national scale, within the framework of a compulsory comprehensive plan of national economic development.

In order to provide for the sweeping structural changes indispensable to overcoming economic backwardness, a more rational and effective mechanism must be available, a mechanism which involves effective economic planning on a national scale, public ownership of the principal means of production, and effective government control of key economic sectors.

By increasing the scope of the structural changes indispensable to overcoming economic backwardness the current scientific and technological revolution objectively increases the need for national economic planning and for expanding the economic functions of the state in the developing countries.

Simultaneously the scientific and technological revolution compels the developing countries to go in for large accumulation and sharpens the alternative between a maximum use of manpower and the introduction of the most efficient machinery. The question of the proportions of national income to be allotted to consumption and accumulation acquires new emphasis. Nothing but extensive and systematic

social and economic reforms can remove such obstacles to the introduction of new production methods and plant as the restricted home market, limited capital investments, and shortage of skilled personnel.

The scientific and technological revolution modifies the international conditions in which the developing countries will have to solve their problems. Until the middle of this century the position of the Asian and African countries in the world economy was largely—perhaps decisively—affected by the following factors. The industrially advanced imperialist powers gradually increased productivity in their key economic sectors, thus making their goods more competitive. The export of such goods to Asia and Africa, however, increased but slowly, discouraged by the secluded natural and semi-natural economies still persisting in those continents, their narrow and specific markets, poor transportation and cheap labour. On the other hand, such factors as cheap native labour, climatic and natural conditions (e.g., convenient location of ore deposits) made Asian and African exports sufficiently competitive.

In the past few decades the situation has begun to change quite perceptibly. Better transportation facilities and the rapidly developing production of synthetic products have caused many of the old specific features and advantages of the developing countries to disappear. Owing to scientific and technological advance, labour efficiency in the imperialist countries has been increasing at a higher rate, changing the basis of the competitiveness of their goods. In this situation it is becoming more difficult and even impossible for the developing countries to hold their ground in the world economy in the old way. It is a well-known fact that over the past twenty years the developing countries' share of world exports has dropped to nearly a half of what it used to be, and there is reason to believe that this tendency will continue. At the present scale of the scientific and technological revolution in the imperialist countries, the developing countries cannot rely on cheap labour to keep their goods competitive. Nor will the old ways hold out in the newly-free countries, where the working people are stepping up the struggle for their rights, and achieving definite results.

The scientific and technological revolution and the changes it has worked in the world economy make the develop-

ing countries give serious thought to the general strategy of their development from the standpoint of their foreign economic relations. Bourgeois economists, as a rule, reduce the problem to the choice of suitable industries working for export. No doubt this is an important point but it, too, assumes a different aspect under the present conditions. As production in the developing countries becomes increasingly socialised and various branches of the economy become more interdependent, one has to deal with ever larger production complexes and the profitable operation of a large number of related economic branches. In many instances it may also be found necessary to specialise applied research so as to gear it as far as possible to the staple exports. But choosing the most expedient technical policy is no less important than making a close study of each separate branch. In the final analysis, the developing countries will be able to secure an equal place in the world economy and win economic independence only if they have a highly efficient, modern production apparatus.

Should they be unable to start modernising their production apparatus rapidly and on a large scale and fail to raise the social productivity of labour (by introducing new machinery, rationalising the organisation and management of production, and so on), the gap between efficiency standards in the imperialist and developing countries will rapidly increase. This, in turn, will not only enhance the positions of the imperialist powers but will breed new forms of neocolonialist expansion and exploitation, which can be seen, incidentally, from the adverse changes in the developing countries' trade pattern, and their increasing dependence on imports. It is also significant that the imperialists are using the delivery of technical information and patents not only as the chief means of invading other economies but also as an important channel through which they pump hundreds of millions of dollars every year out of Asia, Africa and Latin America.

At present the scientific and technological revolution economically favours areas and countries with a higher accumulation potential, more mature forms of the social division of labour and larger markets, with more skilled labour on hand, and so on. In other words, the latest achievements of science and technology increase the difference in the eco-

nomic growth rates of individual countries. This can be seen not only from the relations between the imperialist and developing countries but also from the relations within groups of developing countries themselves.

Under the impact of modern science and technology, the development of individual nations, those of Asia, Africa and Latin America as well, will unavoidably become still more uneven. Some countries will derive greater benefit than others from the scientific and technological revolution and get rid of their economic backwardness sooner.

Within individual developing countries, the technological revolution also makes for uneven development of enterprises, industries, areas and social groups. In view of their limited resources, these countries have to mobilise and concentrate large funds in restricted fields in order to introduce modern production methods and plant (which often requires heavy investment). Most often—especially in the initial stages of grappling with economic backwardness—this implies a redistribution of means, a somewhat slower progress of other sections of the economy and certain sacrifices on the part of various social groups.

Within certain limits, overcoming economic backwardness always involves a measure of unevenness, economic unevenness in particular; the economy is not like a ball that swells symmetrically in all directions as you pump it up. Constructing modern enterprises, investing large funds and mastering new technology, all involve great effort on the part of definite groups of the population, in definite areas and industries, but it also promises great economic rewards. Nevertheless, the character of economic changes, the extent to which economic advance tells on various social groups and areas are far from being uniform. The scope and character of all these processes, the scale of economic and social differentiation accompanying the introduction of modern production methods in developing areas largely depend on the social conditions in which an economy has to develop. They take shape in the course of a tense class struggle involving every sphere of social life, in the course of making the difficult political choice of which socio-economic path of development to take.

The capitalist path of private enterprise gives rise to numerous problems of utmost complexity. Since promoting

development entails concentrating and channelling large means to the more vital concerns, there can be no economic or social justification for placing the key resources in private hands or under private control. The budget, the credit system, the price mechanism and numerous fiscal bodies accumulate resources little by little all over the nation. These resources are, in fact, the contribution of diverse social groups, the working people above all, to national progress. They are social in origin and must belong to society as a whole and be applied in its interest, not in the interest of individual capitalists.

Apologists of capitalism claim that when put into private hands, public means are used more efficiently. But the experience of many Asian and African countries over the past ten or twenty years shows that whenever the private businessmen did not put their money into land or currency speculations, they invested it in trade or in the production of articles of luxury. As a result, these branches have grown out of all proportion, while many industries vital to speeding economic development continue to lag behind.

The system of private enterprise distorts development, allowing a handful of capitalists and the parasitic bureaucratic élite to enrich themselves systematically by plundering the mass of working people. In capitalist society economic and social differentiation reaches catastrophic proportions so that instead of promoting social progress it becomes a brake on it. In capitalist society, a quarter to a third of the national income is distributed as income on property, i.e., regardless of the direct contributions to national development. The entire process of economic development, the pattern of the economy, the sources of accumulation, etc., reflect the mercenary interests of a small group of the privileged, not of the bulk of the people. It is not accidental that in touching upon the choice with which the developing nations are confronted the CPSU Programme emphasises that "*Capitalism is the road of suffering for the people.* It will not ensure rapid economic progress nor eliminate poverty; social inequality will increase. The capitalist development of the countryside will ruin the peasantry still more. The workers will be fated either to engaging in back-breaking labour to enrich the capitalists, or to swelling the ranks of the disinherited army of the unemployed. The petty bour-

geoisie will be crushed in competition with big capital. The benefits of culture and education will remain out of reach of the people. The intelligentsia will be compelled to sell its talent."[1]

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The socialist path not only abolishes private ownership of the means of production with all its implications but creates a complex of economic, administrative, ideological and other measures which counteract and restrict the social and economic inequality accompanying uneven introduction of advanced production methods and machinery under private ownership.

Among the socialist countries, this complex of measures is expressed in economic and technical co-operation on mutually advantageous terms, in the rational planning of the international division of labour, in mutually advantageous long-term foreign trade relations, in the gratuitous conveyance of technical information and documents.

Historically, the socialist approach in the Soviet Union was expressed in the policy of rapid elimination of economic and cultural backwardness which was pursued with respect to the Central Asian republics, Transcaucasia and other parts of the former colonial fringe of tsarist Russia. In the twenties and thirties, large appropriations from the Soviet budget were made to these areas, and specialisation from which they stood to profit and which was backed by a long-term price policy of augmenting the resources of these former colonial outskirts was elaborated for them. Simultaneously an extensive cultural development programme, which included the establishment of national education systems, was implemented, and large numbers of teachers and experts were sent to the Eastern republics.

The socialist path provides numerous requisites for successful economic development and the introduction of the most up-to-date production methods. Universal education and a wide-ranging health service put quite a different face on the problem of manpower. A ramified system of social security, the socialist policy of economic incentives, the con-

[1] *The Road to Communism*, Moscow, 1961, p. 494.

sistent line for a more equal distribution of the national income—all these influence the pattern of demand, creating at each stage of society's development more uniform and correspondingly stronger demand for consumer goods; thus social policy vigorously promotes the solution of the marketing problem and helps provide the requisites for the introduction of up-to-date mass production. Planning the economy on a national scale opens up great possibilities for the maximum mobilisation of the country's resources and using them to the best advantage.

Certainly the "third world" countries which have embarked on the non-capitalist path can hardly expect these measures to provide an instant remedy for the unevenness that emerges in the process of overcoming economic backwardness; even so, such measures can materially restrain it, adapt it to the needs of national development, and subordinate it to the interests of the masses.

At the same time one should bear in mind the experience of the Chinese People's Republic, which has demonstrated that attempts at leaping over stages of economic development, voluntarism, ultra-Left calls for universal "levelling", i.e., for an equal distribution of the material goods irrespective of the amount and quality of work contributed by each citizen individually, impede social development, pose numerous complex problems, and put the country back. Economic stimulation can and must be used in a society following the non-capitalist path to encourage extra effort, further training, better quality of production, new techniques, and so on. Of course, the forms and methods of stimulation must be such as to encourage only socially useful activities and breed no parasitic, money-grubbing, profit-seeking tendencies.

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The scientific and technological revolution is remarkable for the diversity of its social effects. As a major field of the competition between capitalism and socialism, it has different social consequences in capitalist and socialist society. In the developing countries, its socio-economic effects have not yet revealed themselves to the full. This is largely due to the fact that in economically retarded countries modern

technology and production methods are introduced only on a limited scale. The great majority of developing countries are still part of the capitalist world economy, even if they occupy a special place in it. This is why many Asian, African and Latin American countries still maintain a one-sided orientation on the capitalist West as the one and only source of new means of production, technology and scientific discoveries. Imperialism is making the most of this dependence, holding back the spread of the achievements of science and technology or granting them on onerous and extortionate terms. In the process, the Western monopolies seek to exploit the intellectual resources of the "third world", its scientific and technical talent. (This is also another instance of the "brain drain".)

Under the circumstances, stronger ties and more effective co-operation with the socialist community become increasingly essential to destroying the monopoly positions of imperialism in the developing countries and utilising international scientific and technological progress to speed their social and economic development.

While unfolding new vistas before the developing countries, the scientific and technological revolution confronts them with numerous complex problems. It has set afoot novel, often extremely contradictory processes in these countries. In the present age the economic lag can be rapidly removed only if these countries introduce radical socio-economic reforms, abolish archaic relations of production, carry out democratic agrarian reforms, eliminate foreign monopoly domination, put the social and political life on a thoroughly democratic basis, increase the economic intervention of the state, introduce effective economic planning on a national scale, and draw the bulk of the people into the process of social development.

THE SCIENTIFIC AND TECHNOLOGICAL REVOLUTION AND BOURGEOIS ECONOMIC THEORIES OF SOCIALISM

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The ideological struggle between socialism and capitalism asserts itself with special force in political economy. Marx wrote that "... the development of political economy and of the antithesis to which it gives rise keeps pace with the *real* development of the social contradictions and class conflicts inherent in capitalist production".[1] The antithesis to bourgeois political economy that Marx had in mind was the political economy of the working class.

In our time the development of bourgeois political economy, as also that of its antithesis—Marxist-Leninist political economy—keeps in step not only with the development of the contradictions of production under modern state-monopoly capitalism and with the class battles in the capitalist countries but also with the growth of the world socialist system of production, with the changes in the balance of power between capitalism and socialism. This compels bourgeois scholars to evolve their own "economic theories of socialism" to counter the Marxist-Leninist political economy of socialism.

There are three basic trends in the bourgeois economic theory of socialism. The first trend, which was known already in Marx's time, attempts to pass off bourgeois relations as socialist relations or something very similar to them. This is bourgeois socialism, which, as the *Communist Manifesto* points out "... requires in reality that the proletariat should remain within the bounds of existing society, but should

[1] K. Marx, *Theories of Surplus-Value*, Part III, Moscow, 1971, p. 501.

cast away all its hateful ideas concerning the bourgeoisie".[1]

The advocates of the bourgeois socialism of those days understood changing the material conditions of life by no means as ". . . abolition of the bourgeois relations of production, an abolition that can be effected only by a revolution, but administrative reforms, based on the continued existence of these relations. . .".[2] They had no objection to certain reforms that would cure some of the social ills of those days, but the meaning and purpose of these reforms was to consolidate bourgeois society. The advocates of this type of socialism regarded capitalism with a few adjustments and renovations as the best of all possible worlds.

The development of pre-monopoly capitalism into monopoly and state-monopoly capitalism has been accompanied by a significant evolution in bourgeois concepts of socialism. In a number of countries theories are being widely developed in which the transition from free competition to monopoly, the regulation of economic life to reduce unemployment and crises, and the steps towards nationalisation undertaken by the bourgeois state are presented as "socialisation" of the capitalist economy. The reforms which in a number of instances the bourgeois state has been compelled to introduce through fear of the growing influence of the socialist countries and intensified struggle by the working class (unemployment benefits, old-age pensions, etc.) are being presented by bourgeois economists as "socialist" measures. Capitalism is described as the "welfare state" and the "consumer society", in which incomes are supposed to have been levelled and exploitation and antagonism between classes eliminated. Some bourgeois and Right-wing socialist economists try to present the very system of state-monopoly capitalism, with its state intervention in the process of reproduction and its adoption of methods of programming and forecasting, as "semi-socialism" or the "Western form of socialism", thus reducing socialism to a mere series of administrative reforms.

Whereas in Marx's time theories of bourgeois socialism remained outside the framework of bourgeois political economy, they have now become an integral part of it.

The second form of bourgeois economic theory studies the

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[1] K. Marx and F. Engels, *Selected Works*, Vol. 1, p. 133.
[2] *Ibid.*

economic relations in existing socialist society. Bourgeois political economy has always regarded the capitalist system as the absolute and ultimate form of social production.

The time has long since passed, however, when bourgeois economists could declare the socialist form of ownership and the planned socialist economy as something contradictory to human nature and the laws of economic progress, when Hayek, Mises and others preached the inevitable economic collapse of socialism merely because it had liquidated the sacred bourgeois right of private property, capitalist profit and the vagaries of the market as the motive forces of the economy.

The founding and consolidation of a socialist system based on social ownership and on economic laws fundamentally different from those of capitalism has undermined the traditional pillars of bourgeois political economy. Bourgeois economists have accordingly set out to evolve their own "political economy of socialism". They create theories explaining from the bourgeois standpoint the existence and operation of the economic laws of socialism, planning in socialist society, the cost accounting of socialist enterprises and commodity-money relations, and the peculiarities of socialist reproduction. The works of these economists are permeated with bourgeois prejudice and prove that they are unable and unwilling to understand the economic laws of the new society. Compelled in the interests of the monopolies and the ideological defence of capitalism to study socialist economy, they do so with the deliberate aim of condemning communism, of giving a distorted and falsified picture of the economic laws of socialism.

The advocates of the third trend of the bourgeois economic theory of socialism, which emerged in the late fifties, endeavour to prove that the modern capitalist and the socialist systems of economy resemble each other, and that any remaining distinctions will disappear in the course of further economic development. This "new society" of the second half of the 20th century, bourgeois ideologists maintain, will be a "mixed economy", preserving private property as its basis.

The emergence of this group of "economic theories" is a specific reflection in the bourgeois political economy of the third stage of the general crisis of capitalism. Compelled to

acknowledge the invincibility of the world socialist system and its deep-rooted vitality, the bourgeois economists can no longer openly and consistently defend capitalism as a system of economy fundamentally different from socialism, and they try to justify monopoly capitalism and its alliance with state power on the grounds that the socialist and capitalist forms of production are basically identical.

Naturally, the advocates of such bourgeois economic theories of socialism attack the Marxist political economy of socialism, which analyses the socialist mode of production, reveals its specific laws of development and how they differ from the laws of the capitalist mode of production.

R. Dubs, the West German economist, writes: "Marxist political economy divides this science into two mutually isolated fields—the political economy of capitalism and the political economy of socialism." This division, if adhered to, he continues, will "never lead to a drawing together of the Western and Eastern economic systems". The Marxist world outlook with its historical materialism, "sets relatively narrow limits to the development and adjustment of the political economy of socialism".[1]

Thus, R. Dubs proposes that Marxists should give up studying the laws of socialism and instead seek its points of "identity" with capitalism. On the other hand, he urges bourgeois economists not to entertain any illusions about the possibility of the economy of the USSR turning capitalist as a result of economic reform. This, he says, is ruled out as long as the leaders of the socialist countries "continue to cling to Marxist dogma" on the laws of the development of socialism as a new socio-economic form of production. Dubs accordingly advocates discarding dogma and ideology as a means of converting the socialist economy into a capitalist one.

To reveal the nature of the new trend of bourgeois economic theories of socialism, we must make a brief survey of the changes that have come about in the productive forces since the Second World War, while the two world systems —socialism and capitalism—have been coexisting and com-

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[1] R. Dubs, "Konvergieren die Wirtschaftsordnungen in Ost und West?", *Aussenpolitik*, Januar 1967, S. 10.

peting, changes which are usually summed up as the *scientific and technological revolution.*

Bourgeois political economy lost no time in using this revolution as an apology for capitalism and inventing new bourgeois theories of socialism, the specific feature of which at this new stage is that they endeavour to strip the productive forces of any definite social character. The question of who owns the means of production is declared to be of no importance, while the scientific and technological revolution is elevated to the status of some self-sufficing essence, which can develop unobstructedly and endlessly both under capitalism and under socialism.

Daniel Bell, for example, declares that thanks to the scientific and technological revolution both the socialist and capitalist economies will provide "full abundance for all". This marks the emergence in bourgeois economic science of the trend which treats the economic development of both social systems merely as scientific and technological progress. According to bourgeois economists, under capitalism this progress becomes an instrument for the attainment of "universal welfare", "universal affluence", and the "affluent society". The antagonistic classes—the proletariat and the bourgeoisie—"disappear" because workers at enterprises and owners are supposed to be equally interested in increasing productivity. According to these economists, the scientific and technological revolution will bring about class harmony under capitalism, while socialist society will acquire features resembling those of capitalist society.

The bourgeois technological theory of the "industrial society", which is widely used against Marxism as a counterweight to the successes of the socialist countries, is a synthesis of bourgeois theories of the "socialisation" of modern capitalism and bourgeois theories of the economy of socialism. Such an economic theory of socialism could emerge only because socialist industrialisation has transformed the USSR into the second largest industrial power in the world, while the hopes of the capitalists that the socialist states would go economically bankrupt have failed to materialise, and because it has become obvious to everyone that socialism cannot be destroyed by force of arms.

The term "industrial society" appears to have little meaning. It is defined merely as a "society with a developed

industry". However, its meaning is more profound than would at first glance appear.

The champions of this theory set out to depict socialism and capitalism as variants of the same type of society, based on a high development of the productive forces. They base this argument on the conditions modern science and technology create both under capitalism and under socialism. On these grounds R. Aron considers the capitalist variant of the "industrial society" just as progressive as the Soviet, socialist variant. The aim, of course, is to substantiate the view that it is unnecessary to replace capitalism by socialism and, hence, there is no point in fighting for such a cause.

Some of the champions of this theory advocate parallel existence of the two systems, so that they will never clash, but, as Bell writes, "flourish" side by side. This means that if the capitalist form of the "industrial society" is progressive, capitalism should be consolidated in the name of "progress", and not fought. Capitalism, it appears, need only be "improved" and all fundamental differences between capitalism and socialism will vanish. Here we have the real, underlying class meaning of the latest forms of bourgeois socialism.

The champions of the above theory see the essence of the two variants of the "progressive industrial society", socialist and capitalist, in the fact that in both there are huge factories and technological division of labour in production, that in both of them industrial enterprises accumulate capital and pursue a policy of reducing costs, that in both of them workers are concentrated in individual enterprises, efforts are made to use labour, science and technology in the most rational manner, to raise the educational level, to improve managerial organisation, to raise productivity, etc.

One could enumerate such common features ad infinitum. Undeniably, in this sense both socialist and capitalist society are industrial. But this implies that socialism is possible only if industry and the productive forces have reached the high level of development which capitalism creates. And yet, no matter how great the similarity of the two opposing systems as regards their productive forces, it is not this that is decisive to a knowledge of the economic laws of the development of socialism and capitalism, to an under-

industry". However, its meaning is more profound than would at first glance appear.

The champions of this theory set out to depict socialism and capitalism as variants of the same type of society, based on a high development of the productive forces. They base this argument on the conditions modern science and technology create both under capitalism and under socialism. On these grounds R. Aron considers the capitalist variant of the "industrial society" just as progressive as the Soviet, socialist variant. The aim, of course, is to substantiate the view that it is unnecessary to replace capitalism by socialism and, hence, there is no point in fighting for such a cause.

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standing of the qualitative, fundamental differences between the two economic systems.

The theory of the "industrial society" is a bourgeois interpretation of the peaceful coexistence of the two socio-economic systems. By referring to the "technological" or "scientific" society bourgeois economists seek to excuse the existence of capitalism, using coexistence of the two systems as its apology. At the same time, ignoring the form of social production, they try to counterpose the "united" socialist and capitalist "industrial societies" to the developing countries.

These principles were advanced in a general form by R. Aron and have been elaborated by H. Mayrzedt and H. Romé, whose views may be summed up as follows. In the course of their coexistence, and as a result of scientific and technological progress, the industrial capitalist and socialist countries tend to converge. At the same time these industrial countries of the northern hemisphere become estranged from those in the southern hemisphere. The contradiction between capitalism and socialism is thus being replaced by a "global" contradiction between North and South. The champions of this view hypocritically call this phenomenon the "class struggle" of the last third of the 20th century. "We have attempted," Mayrzedt and Romé write, "to counter the class struggle between the capitalist and socialist countries, the class struggle being propagandised by the Communists, with a conception of class struggle . . . between the industrial and developing countries, between North and South."[1]

Thus, the theorists of the technological form of bourgeois socialism endeavour to alienate the Soviet Union, the socialist community, from the developing countries, their natural allies in the struggle against imperialism.

The theory of the "industrial society" is part of the technological trend, the methodology of which is mechanistic materialism. This trend rejects subjectivism and psychologism, the basis of most schools of bourgeois political economy, and also the descriptive method of the historical school and of the institutionalists.

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[1] "Drei Thesen zur 'Konvergenz' der Wirtschaftssysteme in Ost- und Westeuropa von H. Mayrzedt und H. Romé", "Koexitenz zwischen Ost und West. Konflikt, Kooperation, Konvergenz", *Europaische Perspektiven*, 1967, S. 234.

Not only has the technological revolution led to the emergence of new applied economic subjects (the economics of education, the economics of management, economic programming, etc.). Embracing, as it does, all aspects of the productive forces, it has spread even to the general theory of political economy and given birth to new trends there. A major role in this process has been played by John Galbraith, who in 1967 published the book *The New Industrial State*. In this book he uses the methodology of the technological trend to consider the politico-economic problems arising out of the scientific and technological revolution.

This work argues the "identity" of modern capitalism and socialism, and for this reason alone it can be considered the most developed bourgeois economic theory of socialism in recent times. This "identity" is based on the development of the modern productive forces, especially technological progress. Already in *The Affluent Society*, published in 1958, Galbraith attempted to prove that modern developed bourgeois society (notably US society) had reached a level of development that ensured abundance to all. In his last work he rejected the thesis because he could not deny that there was poverty and unemployment in the USA. Now Galbraith includes in the "industrial system" only the five or six hundred biggest corporations in the USA. In this cleverly restricted "industrial society", the author believes, the basic laws of capitalist society have been transformed as a result of the scientific and technological revolution into non-capitalist laws: technology transforms capitalism into a variant of socialism.

Galbraith admires technology, almost deifies it. "Technology, having an initiative of its own, is the logical point at which to break in. But technology not only causes change, it is a response to change. Though it requires extensive organisation it is also the result of organisation." Under the pretext that modern technology demands increased capital for accumulation, and a longer cycle of turnover, the author asserts that modern giant corporations are nothing but a product of technology. He describes corporations of the General Motors type as essentially socialist enterprises existing in conditions where capitalist relations are only formally operating. Modern technology, Galbraith writes, leads to planning and abolishes the market mechanism. He includes

in a single category both internal planning by individual firms and state control and programming. The author maintains that technology compels the corporations to seek a union with the state. "Technological compulsions, and not ideology or political wile, will require the firm to seek the help and protection of the state. This is a consequence of advanced technology. . . ."

"Industrial society," Galbraith continues, "is the product, result and expression of technological progress. Since both capitalist and socialist societies are industrial states, both systems are subject to the imperatives of industrialisation. This for both means planning."[1] And since the plan expresses the essence of socialism, Galbraith believes that socialism is also inherent in developed capitalist countries. Bourgeois economists attempt to pass off the trend towards planning evolved by capitalist socialised production as socialism, that is, to pass off what are actually capitalist relations as socialist relations.

In identifying capitalism and socialism Galbraith goes further than the theoreticians of the industrial society of the Aron type. Modern corporations, according to his theory, are managed by a scientific and technological élite, the "technostructure", which strips the industrial system of its capitalist features and endows it with socialist features. This, he says, is expressed primarily in the disappearance of the main aims of production, which have guided capitalists for ages past.

Thus, Aron's "industrial society" pursues no special aims, while Galbraith's does. For the capitalist and the capitalist system as a whole, Galbraith says, maximum profits were the main aim. The modern corporation, however, which is a managed "technostructure", pursues different aims—it strives for the public weal, seeks to raise living standards and promote economic growth. The managers of corporations, Galbraith claims, are not interested in raising the dividends of the shareholders because they themselves are not shareholders. Modern corporations seek to achieve quite different aims from those which the individual capitalist of the 19th century, and even the corporations of the first decade of the

[1] J. K. Galbraith, *The New Industrial State*, New York-London, 1967, pp. 20, 332.

20th century, sought to attain. The "genius of the industrial system", Galbraith says, advances aims reflecting his requirements: the effective production of the good things in life, the constant expansion of their output, the constant expansion of their consumption, preference of the good things to requirements, the unlimited striving for changes in technology, the autonomy of the technostructure, corresponding with the requirements of technological progress, the provision of skilled and educated labour power, which is coordinated with the virtues and enlightenment of people.

This same "genius of the industrial system", that is, the progress of the productive forces, removes the antithesis between the proletariat and the bourgeoisie, since it abolishes exploitation and the rule of the capitalists, replacing it by the rule of the "technostructure", which is devoid of capitalist properties. The class structure of capitalism disappears and society becomes a union of groups with non-antagonistic interests. Thus, in Galbraith's opinion, modern capitalism acquires essentially socialist features.

From the point of view of the bourgeois economist Galbraith's theory of the "industrial society" contains a certain internal harmony, since it strives to explain modern capitalism as a product of the scientific and technological revolution. Its picture of modern capitalism, however, is a distorted one. Declaring that the rule of capital, the monopolies and the finance oligarchy has been destroyed, it attempts to pass off monopoly and state-monopoly capitalism as a form of socialism.

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Another variant of the third trend in the bourgeois economic theory of socialism is that of the "convergence", or "hybridisation" of socialism and capitalism. There are two sub-trends in this theory. The champions of the first strive to prove that a convergence of the two socio-economic systems will result from the economic policies of the socialist and capitalist countries, from the drawing together of the aims set by the bourgeois and socialist states. The champions of the other, the "technological" trend, deduce convergence from the scientific and technological revolution.

The founder and most prominent spokesman of the first

variant of the convergence theory is Jan Tinbergen, the well-known Dutch economist. He is supported also by Thalheim, Linnemann, Pronk and others. They claim that convergence takes the road of linear programming and economic methods of planning, forecasting, tax policy and even inflation, which, they allege, lead to an "equalisation" of incomes and thus remove the antithesis between the poor and the rich in capitalist society. Tinbergen emphasises the importance of economic policy and the aims by which government is guided towards convergence.[1] He says that socialist society develops in a capitalist direction through economic reforms, which, he holds, weaken centralised planning, develop the profit motive, strengthen the role of the market and lead to a growth in administrative personnel.

Some authors assert that the convergence theory is not linked with the "industrial society" theory. However, ever since the latter emerged it has endeavoured to prove that a union, a synthesis and convergence of the two systems, is possible as a result of technological development in socialist and capitalist countries. Thus, as regards their theoretical basis, the "technological theory of convergence" is the logical continuation and development of the "industrial society" theory, which has been most clearly expressed in Galbraith's recent work.

The above brief description of Galbraith's theory shows that he attempts to pass off capitalism as a variant of socialism. He himself claims that his theories are intended to replace the bankrupt theory of "democratic socialism", the watchword of the Right Socialists. "The misfortune of democratic socialism has been the misfortune of the capitalist,"[2] he writes. The Right Socialists preached the theory of the "growing of capitalism into socialism" through the merger of state-owned, nationalised property with private property, a union in which private property would play the decisive role. In the post-war years the reformist theory of socialism was reinforced by Keynes's belief in the saving power of state intervention in, and regulation of, the economy. On this basis the Social Democrats declared that capi-

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[1] *Disarmament and World Economic Interdependence,* ed. by E. Benoit, New York-London, 1967, pp. 246-47.

[2] J. K. Galbraith, *The New Industrial State*, p. 103.

talism had to some 50, or perhaps even 75, per cent already grown into socialism. In Galbraith's opinion, the theory of "democratic socialism" is no longer viable and must be replaced by a theory according to which capitalism has been transformed by the technological revolution. All his arguments are aimed at proving that since the socialist countries are but a variant of the "industrial state", they are related to the capitalist as regards economic structure. Since, he argues, modern progress leads to planning both in capitalist and in socialist countries, and technology and planning demand the union, convergence of the socialist and capitalist "industrial states"—"both systems are subject to the imperatives of industrialisation".[1]

The requirements of technology, the development of the productive forces are used by Galbraith to conceal the fundamental, qualitative differences between the relations of production in capitalist and in socialist society. He needs the myth about the existence in the USSR and the USA of a "technostructure", which is supposed to exercise economic power, in order to underpin the convergence theory by an imagined similarity of the social structures in the USSR and in the USA. "The technostructure in the cases of both public and private ownership assumes similar powers and uses the same group methods for arriving at decisions. That it looks very much alike (in capitalist and in socialist society—*I.D.*) is not surprising."[2] Galbraith believes that it is not necessary to fight the rule of the monopolies, the finance oligarchy, since the technological revolution and technological progress have, according to him, already destroyed their power.

Thus, to make the socialist and the capitalist systems appear similar, Galbraith endeavours to deprive the relations in socialist society of their social definiteness and describes them simply as a function of technological progress. He is always bringing to the fore the techniques of management and control, which are closely linked with the present level of the productive forces in general.

In the extension of the rights of socialist enterprises in the Soviet Union under the economic reform Galbraith sees

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[1] J. K. Galbraith, *The New Industrial State*, p. 332.
[2] *Ibid*, p. 100.

an important symptom of convergence. Naturally, he argues, the activities of socialist enterprises are determined by a state plan, but capitalist enterprises (corporations, which he regards as the ideal form of organisation) likewise have a planned programme of action. He thus presents the capitalist form of organisation, which is the result of the socialisation of production, as socialism, and endeavours to depict the extension of the rights of the Soviet enterprises as a form of development that is making them resemble capitalist corporations. He calls these processes "autonomy of the technostructure", which he alleges is inherent both in capitalism and socialism. "The autonomy of the technostructure is, to repeat yet again, a functional necessity of the industrial system."[1]

The only true thing about all this is that the modern productive forces with their link-up between science and production, and the creation of giant power and industrial combines, require new forms of organisation and management, the use of computer techniques, a more sophisticated division of administrative work, and a certain independence of productive complexes. However, Galbraith ignores the interrelations between the enterprise and the state, between the owner of the means of production, and the factory, office and other workers, etc. Under capitalism, these relations are expressed in the appropriation by the monopolies of the surplus labour of the working class, while under socialism they are expressed in the rational distribution by the state of the surplus product in the interests of the entire nation. The fact that Soviet enterprises are given greater rights by the reform certainly does not mean that the relations between the director and the trade-union committee, between the management and the state come to resemble the relations between the monopolists, their managers and the state in the USA.

Having discovered in the scientific and technological revolution a convenient basis for explaining the phenomena of modern monopoly and state-monopoly capitalism from bourgeois positions, Galbraith and his followers think they have succeeded in "proving" the identity of the two systems. They consider the fundamental differences an invention of

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[1] *Ibid.*, p. 393.

Marxists. They relate these differences to the sphere of politics and ideology and not to the economic sphere, which, in their opinion, is only a function of technology. "There is a broad convergence," Galbraith writes, "between industrial systems. The imperatives of technology and organisation, not the images of ideology, are what determine the shape of economic society." Or, as he says further on, "Ideology is not the relevant force."[1] Galbraith considers that it is not monopoly capitalism that harbours the "ills of mankind", but Marxism, which, he says, advanced the question of power with unprecedented force a hundred years ago. He is echoed by Allan G. Gruchy who also considers industrial technology "ideologically neutral" and regards the distinction between the economic systems only a matter of ideology and political institutions.[2] Since technology is neutral, economics, he argues, should be reduced to technology, while the actual distinctions between socialism and capitalism should be declared a Marxist invention, or be relegated to the political sphere. Such are the methods of the "technological theory of convergence".

Actually, however, neither the technological revolution nor state-monopoly capitalism, whose main laws are regarded in the "technological theories" as being derived from the technological revolution, are able to do away with the antithesis of the two socio-economic systems.

No matter how extensively monopoly and state-monopoly capitalism resort to regulation of the economy and to state intervention in the reproduction process in modern conditions, they continue to be a system based on the exploitation of hired labour, on the appropriation of monopoly superprofits, on poverty for the broad mass of the people, and on the exploitation of backward countries. To transform state-monopoly capitalism into socialism there must be a socialist revolution, and the power of the monopolies must be eradicated. No theoretical conjuring is able to do this.

The latest variant of the "technological" bourgeois theories of socialism is the theory of the "post-industrial society" elaborated by Boulding, Bell and Riesman. Its most recent

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[1] J. K. Galbraith, *The New Industrial State*, pp. 7, 390.

[2] A. G. Gruchy, *Comparative Economic Systems*, New York, 1966, pp. 4-6.

expression can be found in theory of the "technotronic society" by Brzezinski. This theory, as distinct from the "industrial society" theory, proceeds not from the first stage of the technological revolution, but from the all-round automation of production, that is, from the second stage of the scientific and technological revolution (which in its perfect form is incompatible with capitalism and demands the establishment of communism—the higher phase of social development).

The new "technological" bourgeois theory of socialism strives to present the future of the capitalist countries as capitalist communism, as a society of leisure and universal abundance, ruled by a technocratic élite. This theory, as expounded by Brzezinski, tends to justify the United States' claim to world leadership.

A distinctive feature of the theories of the "industrial society" and of "convergence" is their dual ideological role. Many supporters of these theories (Galbraith, for example) advocate peaceful coexistence, but at the same time the logic of the class struggle and the contradictions between the two systems have made these theories a weapon in imperialism's struggle against socialism.

TWO ECONOMIC SYSTEMS: THEORY OF CONVERGENCE

Enokh Bregel, D. Sc. (Econ.)

The term "convergence" is borrowed from natural science. In biology it means the acquisition or development of similar characters by different groups of organisms due to similarity in habits or environment. By analogy a number of bourgeois economists and sociologists apply the idea of convergence to the capitalist and socialist systems, which are supposed to be gradually losing their former contradictory character and acquiring certain common features that make them increasingly resemble each other.

The convergence theory bears a certain resemblance to other modern bourgeois conceptions, notably, Walt Rostow's teaching on the stages of economic development and the "single industrial society" theory which has gained acceptance in the West. But they are not identical. Admittedly, the advocates of all these theories strive to detect similarities between the socialist and capitalist economies and to relate them to one and the same "stage" (in the case of Rostow—to the "movement towards maturity" stage) or to one and the same "industrial system". Nevertheless the convergence theory should not be confused with the general thesis that certain similarities exist between the socialist and capitalist systems. While many bourgeois economists maintain that such similarities do exist, by no means all of them may be called adherents of the convergence idea. Allan G. Gruchy, the American economist, for example, says that "although economic systems reveal many special features there are often common trends in their development".[1] Yet he sees

[1] A. G. Gruchy, *Comparative Economic Systems*, 1966, p. 883.

no convergence of the two systems and believes that "there is now no prospect of any ultimate convergence between economic systems with these basically contradictory ideologies".[1]

What propositions, one may ask, distinguish the convergence theory? We believe that there are three.

One is the proposed existence of a *growing similarity* between the two economic systems, with a particular accent on its growth. If there were similarities while the fundamental differences persisted there could be no question of any convergence. No biologist would speak of convergence in regard to the lion and the sheep just because both are mammals. Thus, the convergence theory emphasises not any static similarity but the progressive accumulation of common features.

The second proposition is the gradual disappearance of the differences between the two systems as a result of a *mutual* drawing together. Note the stressing of *reciprocity*. Bourgeois ideologists have previously claimed that a capitalist "regeneration" is taking place in the Soviet economy, but this has never gone so far as the convergence theory. Only those economists and sociologists may be classed as proponents of convergence who maintain that while the socialist system is gradually acquiring some of the features of capitalism, the capitalist system is also coming more and more to resemble socialism.

And, thirdly, there is the far-reaching conclusion regarding the *tendency towards a merger* of the two systems, their transformation into a single socio-economic system of a "mixed" type, which synthesises some features of modern capitalism with elements of socialism.

In his *Theoretical Economic Systems. A Comparative Analysis*, published in 1958, Walter S. Buckingham, an American economist and one of the founders of the convergence theory, writes that one of the main conclusions of his study was that the actual, functioning economic systems were growing more similar than dissimilar.[2]

Among the advocates of the convergence theory the most

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[1] *Ibid.*, p. 890.

[2] W. S. Buckingham, *Theoretical Economic Systems. A Comparative Analysis*, New York, 1958, p. 26.

energetic and consistent is Jan Tinbergen, the Dutch economist. In 1961 he published an article entitled "Do Communist and Free Economies Show a Converging Pattern?".[1] His answer to the question was yes. In 1965, Tinbergen produced a new series of articles on the subject, which were published in the Belgrade journal *Medunarodna Politika.* In these articles he arrives at the conclusion that "both systems are developing and that many of the changes occurring in them show a converging pattern". He even claims it can be argued that "both systems are moving towards a certain optimum, that is to say, towards a system which is better than pure capitalism or pure socialism in the accepted sense of these terms".[2]

There are two variants of the convergence theory. One is the *economic* variant, which is based on the thesis that the two economic systems are gradually drawing closer and that the differences between them are disappearing. The other is the *sociological* variant, which holds that not only the economic but also the social systems, including the entire range of economic, political and other social relations, reveal this trend towards mutual drawing together and will eventually merge into a single system.

The most prominent advocates of the sociological variant are Raymond Aron, the French sociologist, and Pitirim A. Sorokin, the American sociologist.

Aron, the author of many sociological studies, writes in his *Eighteen Lectures on Industrial Society* that the socialist and capitalist systems are two variants of an "industrial society" and that both are gradually drawing closer to each other.[3] In another book he expresses the view that "all industrial societies will in future grow more and more alike but the resultant universal society will hardly have to make the radical choice between planning and market, between public and private property".[4]

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[1] *Soviet Studies*, Vol. 4, No. 4, April 1961, p. 333.

[2] *Medunarodna Politika*, June 5, 1965, p. 9.

[3] See Raymond Aron, *Dix-huit leçons sur la société industrielle*, Paris, 1962, p. 246. Aron's views are somewhat contradictory: at the end of the book he voices doubts about the convergence theory (see p. 374).

[4] R. Aron, "La theorie du développement et l'interprétation historique de l'époque contemporaine" (*Le développement social*, Paris, 1965, p. 99).

Sorokin develops the convergence theory in the broadest manner in his *Basic Trends of Our Times*, published in 1964. He studies convergence in its following aspects: (1) natural sciences and technology; (2) social sciences and humanities; (3) philosophy; (4) ethics and criminal law; (5) education; (6) sports and recreation; (7) fine arts; (8) religion; (9) marriage and family; (10) economic system; (11) social relationships; (12) political system. In all these fields he attempts to discover a rapprochement between the two systems. Sorokin draws the conclusion that "if mankind avoids new world war and can overcome today's grave emergencies, the dominant type of the emerging society and culture is likely to be neither capitalist nor communist but a type *sui generis* which we can designate as *integral type*. This type will be intermediary between the capitalist and Communist orders and ways of life".[1]

A general sociological study of the convergence theory is beyond the scope of this article, which is intended as a critical study of that theory only in its economic aspect. However, since sociologists, too, often touch upon economic questions, their works must also be referred to.

The proponents of the convergence theory hold that economic systems can achieve a rapprochement primarily by: (a) gradually overcoming their own shortcomings; and (b) by adopting the positive features of the other system. "On the one hand," Tinbergen says, "each system is learning from experience and trying to overcome some of its weaknesses. On the other hand, the systems begin to influence each other more and more."[2] This idea of "borrowing from each other" is stressed by many advocates of the convergence theory.

Their arguments follow two basic lines. One maintains that technological progress is spreading to the countries of both systems and drawing them closer together. The other proceeds from the thesis that the two systems are beginning to resemble each other in certain socio-economic respects as well. This is said to be manifested in the following developments: the economic role of the state is growing in the

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[1] P. A. Sorokin, *The Basic Trends of Our Times*, New Haven, 1964, p. 78.

[2] *Soviet Studies*, Vol. 4, No. 4, April 1961, p. 333.

capitalist countries, while it is becoming somewhat weaker in the socialist countries; planning is developing in the capitalist countries, while in the socialist countries its importance is supposed to be on the wane owing to the development of market relations; a trend towards the mitigation of economic inequality in capitalist society is supposed to be at work, while in socialist society inequality is alleged to be on the increase.

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In respect of the role of technological progress the convergence theory agrees with the "single industrial society" conception. The development of modern technology, the proponents of both theories say, engenders similar processes in the economies of the two systems: the scale of enterprises grows, the share of industry in the economy increases, manpower is drained from agriculture, etc. These identical processes, they say, diminish the difference between the two economic systems and increase their similarity.

John Kenneth Galbraith prefers the concept of the "modern industrial system" to the concepts of "capitalism" and "socialism". He thinks that it is irrelevant to classify modern industrial societies according to the principle of social system. In his view, it is much more important to understand the general demands made by technological progress in the countries of both systems.

Raymond Aron's views closely resemble those of Galbraith. He, too, attaches prime importance to the concept of "industrial society", defining it as "a society where industry, i.e., large-scale industry, is the most characteristic form of production".[1] True, Aron admits that there are "two types of industrial society", capitalist and socialist, which differ in some respects. However, these differences, he maintains, are decreasing, while the similarity between them is growing. Pitirim Sorokin points to technological progress as one of the factors contributing to convergence of the two economic systems. Comparing the USA and the USSR, he writes: "Technologically, both countries have already become essentially similar to each other. Both nations use similar tech-

[1] R. Aron, *Dix-huit leçons sur la société industrielle*, p. 97.

niques of production, up to the introduction of the techniques of automation and mass production."[1]

All these arguments suffer from the basic methodological fault of taking a technological approach to economic systems. The existence of similar technical and economic processes in the countries of both systems is regarded as proof of their gradual "rapprochement" and "convergence".

In the course of the discussion technology and the phenomena directly connected with it are substituted for social production relations. But neither technology nor the branch structure of production determine a society's economic system. Even with similar technologies and a more or less similar branch structure of production the economic system of the socialist countries differs radically from the capitalist system because of their different production relations. Social ownership of the means of production is the antipode of their private ownership; socialist labour for oneself and for society is the opposite of hired labour for private exploiters; production with the aim of ever fuller satisfaction of the needs of all members of society is the opposite of production for the sake of profit, and so on. Taking economic relations out of their social context and reducing them to technology condemns the theory of convergence to completely false conclusions.

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The growth of the state's economic role in modern capitalist society is emphasised by all advocates of the convergence theory. Thus, W. S. Buckingham declares that "all democratic capitalist governments already have enormous powers at their disposal for regulating economic activity".[2]

Galbraith attaches great importance to the economic role of the state under modern capitalism. At the same time, wishing to substantiate the thesis of the growing similarity in the economic role of the state in capitalist and socialist countries, he refers to the trend towards so-called decentralisation observed in the Soviet Union and East European countries. He claims that as a result of decentralisation

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[1] P. A. Sorokin, *Op, cit.*, pp. 119-20.
[2] W. S. Buckingham, *Op. cit.*, p. 488.

certain economic functions in the socialist states are being transferred "from the state to the firm", and that the growing autonomy of industrial enterprises approximates their status to that of enterprises in capitalist countries.

Raymond Aron considers growing state intervention in the economy of the capitalist countries a symptom of a process of "socialisation". He maintains that "states consider themselves today responsible for the functioning of the economy and cannot tolerate deep depressions. In this sense the Western capitalist economies include definite mechanisms which, in the West, are usually regarded as being of a socialist nature".[1]

It should be noted right away that the thesis on the growing role of the state in capitalist economy is not in itself objectionable. However, by recognising this role, bourgeois economists are saying nothing new. Half a century ago Lenin pointed out that monopoly capitalism was gradually being transformed into state-monopoly capitalism, and explained the nature of the latter. Extensive state intervention in the economy is truly characteristic of modern capitalism. However, the interpretation given to this phenomenon by the proponents of the convergence theory is entirely erroneous.

To begin with, they gloss over the crucial question: *What is the social nature* of the state and *in whose interests* does it intervene in the reproduction process? The bourgeois state, representing the interests of the monopoly bourgeoisie, is one thing, while the socialist state, representing the interests of the working masses, is quite another. The former influences its economy in order to ensure direct benefits for the capitalist monopolies, that is, to ensure them maximum profits, and also to serve the general interests of the bourgeoisie by saving the capitalist system. The influence exerted by the socialist state on its economy is of a fundamentally different nature, and this is just what the theorists of the convergence theory pass over in silence. The socialist state, which serves the interests of the people, sets itself the task of building a communist society and raising the living standard of the working people.

In this connection it should be pointed out that it is wrong

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[1] R. Aron, *Dix-huit leçons sur la société industrielle*, p. 308.

to view the growing economic role of the state in capitalist countries as "socialisation". When bourgeois and reformist ideologists do so, they deliberately ignore the social nature of the state. Extensive utilisation of economic regulation by the state does not change the essential, exploiting nature of capitalism.

Secondly, no matter how much the economic role of the bourgeois state may grow, it is still unable to direct the economic development of society. To direct economic development means to determine the growth rate of the national economy and its most important proportions; to ensure the continuous expansion of production and a corresponding expansion of consumption; to play a decisive role in the distribution of the material, financial and labour resources between the different branches of production; to ensure complete utilisation of the labour force, etc.

Under capitalism, where the bulk of the means of production is private property, and production is conducted not to satisfy the requirements of society, but to assure maximum profits to the capitalists, all these things remain impossible. Capitalist ownership of the means of production and the scramble for profits set definite limits to the economic role of the bourgeois state. During the past decades this role has, undoubtedly, become greater, though it is not dominant.

The fact that capitalism has still been unable to end cyclic fluctuations of production and prevent the rotation of industrial booms and crises is a manifestation of the bourgeois state's inability to direct economic development, even though state intervention in the economy has mitigated the crises. Another manifestation of the bourgeois state's limited ability to influence its economy is continued mass unemployment despite all promises to guarantee "full employment".

Thirdly, any attempts to prove not only that the capitalist system is drawing closer to socialism in terms of the economic role of the state, but also that socialism is in turn approaching capitalism, are groundless. The proponents of the convergence theory who make such claims usually refer to the "decentralisation" of industry in the USSR, which is associated with the economic reform that gives enterprises wider rights. It is fundamentally wrong, however, to interpret the economic reforms in socialist countries as a weakening of the state's economic role. The Soviet state

continues to run its economy, and the transfer of some functions of the central bodies to enterprises is not tantamount to their transfer "from the state to the firm", as John Galbraith puts it. A Soviet factory is a state enterprise and not a private firm. Therefore, any adjustment of functions between the central economic bodies and individual enterprises is an adjustment within the state sector, not its weakening. As regards the functioning in the USSR, at the present stage, of centralised planned economic management concurrently with the continuing development of the initiative and autonomy of enterprises, that is an indication not of any approximation of Soviet economy to capitalist economy, but of a more effective application of socialist principles of economic management.

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The view that the development of planning within the capitalist framework is a decisive factor working for the rapprochement of the two economic systems figures prominently in the convergence theory.

"Planning and socialism are not the same things at all," says Buckingham, ". . . economic planning is part of the very texture of the government in all industrialised countries."[1]

Jan Tinbergen regards the development of planning as one of the most important recent changes in the capitalist system. In this connection he writes: "The policy in question like any other one must necessarily be planned; this element of the socialist system has now been universally adopted. This is one of the channels for the penetration of socialist ideas. Both western and southern countries, one after another, are introducing a definite type of planning. . . . True enough, their type of planning is less rigid than in the eastern countries. But both types are changing and we are looking for the 'best' method of centralisation in planning."[2]

Galbraith derives planning from technological progress. Technology under all circumstances leads to planning, he says. He considers the corporation the main planning body

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[1] W. S. Buckingham, *Op. cit.*, pp. 458, 463.

[2] J. Tinbergen, "How to Improve International Policy of Development", *Medunarodna Politika*, September 20, 1965, p. 9.

in capitalist countries. However, he admits that definite limits are set to corporation planning because it cannot control demand, ensure the training of skilled personnel and finance large-scale technological and scientific research. The functions that corporation planning cannot perform are taken over by the state.

Concurrently with the view that the capitalist economic system is increasingly becoming a planned system, the proponents of the convergence theory maintain that the trend observed in socialist economy is for the role of planning to decrease as a result of developing market relations. Some bourgeois newspapers and journals have been particularly emphatic in connection with the preparation and subsequent implementation of the economic reform in the USSR. Thus, after the September 1965 Plenary Meeting of the Central Committee of the CPSU, the British *Daily Telegraph* triumphantly wrote, "the planning mechanism is in large part to be dismantled and a market economy installed in its place".[1]

Despite such predictions, however, the role of economic planning in the USSR is not diminishing but, on the contrary, constantly increasing. At the 24th Congress of the CPSU socialist planning was described as "the central element, the core of national-economic guidance".[2]

In criticising the convergence theory it would be an oversimplification to say that capitalism excludes all planning. Engels was among the first to point to elements of planning under capitalism. Lenin, who created the Marxist theory of monopoly capitalism, said that the concept of plan could no longer be considered alien to trusts, and that monopolies were keeping rough records of raw material sources and the size of the market.

A new phenomenon in modern capitalist economy is the fact that planning has to a certain extent exceeded the framework not only of individual enterprises but also of individual monopoly associations. At present some bourgeois states are implementing economic programming on a national scale and referring to it as "planning".

Capitalist programming differs essentially, however, from

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[1] See *Daily Telegraph*, September 29, 1965.
[2] *24th Congress of the CPSU*, Documents, Moscow, 1971, p. 80.

socialist national economic planning. To begin with, it pursues entirely different aims, since it is designed to strengthen monopoly capitalism. Then again, the bourgeois states do not control the key positions of the economic apparatus and, therefore, the economic development plans or programmes drawn up by them are essentially in the nature of recommendations which are not binding on private capitalist firms and corporations.

The feasibility and effectiveness of socialist economic planning is ensured by the concentration in the hands of the socialist state of all key positions in the economy. The programmes and plans drawn up by capitalist states have no such basis, and some bourgeois scholars feel compelled to admit this.

It should also be noted that the proponents of the convergence theory often contradict themselves. Thus, in his articles on convergence Jan Tinbergen writes about the rapprochement between capitalist and socialist planning, while in his monograph on *Central Planning* he admits that "in countries with a large private sector, sector plans will be more in the nature of forecasts than of plans".[1]

In refuting the convergence theory it should be pointed out that planning as practised under modern capitalism does not transform modern capitalism or equate it with the socialist system. Nevertheless it should not be overlooked that programming in the capitalist countries is linked with a network of bodies which study economic development trends, collect a large volume of useful data, organise statistics on national economic relations, etc. This is a new element of socialist prerequisites currently maturing under capitalism, though not a "convergent movement", i.e., not a penetration of socialist elements into the capitalist economy.

Finally, as we have seen, there are no grounds whatever for the assertion that "deplanning" is taking place in the USSR and other socialist countries. Bourgeois economists and journalists making such assertions confuse the role and nature of planning with the problems of improving its efficiency. The decrease in the number of indices established by the central bodies and the extension of planning at the

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[1] J. Tinbergen, *Central Planning*, New Haven and London, 1964, p. 15.

lowest level (at the level of enterprises and their associations) is wrongly depicted by them as "deplanning", as "dismantling of the planning mechanism", etc. Actually, however, the economic reforms in the USSR and other socialist countries are designed to improve planning as much as possible. Many indices are now established by the enterprises themselves, since they are in the best position to take due account of their reserves and potentialities. At the same time the central planning bodies are concentrating their attention on the key indices and are thus able to improve the quality of centralised planning.

The views of the proponents of the convergence theory on planning and market relations reveal one of the main methodological errors of that theory: *formal reasoning* and a resulting *undifferentiated approach* to economic phenomena and processes.

The following two syllogisms used (directly or indirectly) by many bourgeois ideologists may serve to illustrate such formal reasoning:

Syllogism One. Major premiss: planning is inherent in the socialist economic system. Minor premiss: planning is used on a growing scale in the capitalist economy. Conclusion: the capitalist system is moving nearer to the socialist.

Syllogism Two. Major premiss: market relations are inherent in the capitalist economic system. Minor premiss: commodity-money, market relations are developing in the socialist countries. Conclusion: the socialist system is moving nearer to the capitalist.

Both syllogisms exhibit a formal, undifferentiated approach to economic phenomena: the first—to planning, and the second—to commodity-money relations. In other words, they ignore the fundamental difference between capitalist and socialist planning and between capitalist and socialist commodity-money relations. As we have shown above, the development of planning elements in the capitalist countries does not make the capitalist system socialist. On the other hand, both under capitalism and socialism there exist commodity-money relations, but their nature is different, and, therefore, the development of commodity-money relations and markets in the socialist countries is by no means an indication of their development in a capitalist direction.

Another typical methodological error of the convergence theory is the *primacy of the quantitative approach* to economic phenomena over qualitative analysis. To understand economic systems it is essential to reveal the specific properties of each. Yet the proponents of the convergence theory accentuate not the particular but the general, and give preference to a quantitative approach over qualitative analysis. In an attempt to efface the fundamental differences between capitalism and socialism, Jan Tinbergen, for instance, sees only quantitative differences between the state regulation of the economy in capitalist countries, on the one hand, and socialist economic planning, on the other.

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Some proponents of the convergence theory see a rapprochement between the two systems in the distribution sphere as well, and assert that while incomes are being distributed in the capitalist countries ever more evenly, inequality in the distribution of incomes is growing in the socialist countries. Buckingham writes of the Soviet economic system that "it is collectivist . . . but it is probably less equalitarian than that of the United States".[1] Jan Tinbergen cites as one of the major changes in the USSR a short-lived attempt "to equalise incomes in a drastic way. The well-known consequences of such equalisation by decree forced the regime to introduce a wage system which makes wages largely dependent on productivity. Strangely enough, this was then labelled 'socialist wage policy' ".[2]

Pitirim Sorokin, going even further, speaks of the rapprochement as embracing not just distribution of incomes but the entire aggregate of social relations within the two systems. He believes social relations may be subdivided into (1) family relations, (2) contractual relations, and (3) coercive relations. The first type of social relations is based on mutual love, devotion and sacrifice, the second on mutual benefit, and the third refers to relations imposed by one party on the other contrary to its will and interests. According to Sorokin, even though the first and third types of

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[1] W. S. Buckingham, *Op. cit.*, p. 480.
[2] *Soviet Studies*, April 1961, pp. 333-34.

relations are more developed in the USSR than in the USA, and the role of the second type of social relations is greater in the USA than in the USSR, a rapprochement is evident in this sphere, too. To prove his point he refers to the steps the US Government has had to take in the sphere of social security, taxation, education, public health, etc., under the pressure brought to bear by the working people.

First of all, it must be stated emphatically that the allegations of growing inequality of incomes in the socialist system are completely false. On the contrary, the current trend here is not towards an increase but towards a decrease of such inequality. Thus, in the USSR lower-paid workers are the first to get wage increases and these increases are larger than for any others. Thus, the gap in the remuneration of the different population groups is being eliminated.

Another important factor is the growth of the social consumption funds, which are used for the extensive development of education and public health, payment of pensions, etc. Those in the lower income brackets have wide access to these funds, and this increases their real incomes. Obviously, the growth of the incomes of lower-paid groups does not constitute a transition to wage levelling. Different wage scales for skilled and unskilled, heavy and light labour and also for labour of different productivity continue to exist in the USSR (and in other socialist countries). Despite Tinbergen's claim, this practice is no deviation from the principles of socialism. On the contrary, it is realisation of the socialist principle of distribution according to the amount and quality of labour.

The assertion about "equalising" trends under modern capitalism is also entirely unfounded. It is typical that none of the above-mentioned authors cite any concrete data to substantiate this assertion. The facts, however, contradict it.

Speaking of the alleged growth, in the capitalist countries, of the importance of "family relations" at the expense of contractual relations, Sorokin refers to the social measures being implemented by the bourgeois state. In some capitalist countries, including the USA, the government, under pressure from the working people, has been compelled to introduce unemployment insurance, social security for the aged, etc. This has naturally somewhat improved the position of

the working people under capitalism but it has not changed it radically. The fact that the unemployed are receiving small benefits and that aged workers draw a pension does not "equalise" the position of the working man with that of the capitalist. Finally, Sorokin's interpretation of the relations between the working people and the bourgeois state as "family" relations completely distorts the actual situation. In fact, only certain measures adopted by the bourgeois state are dictated by the interests of the working people, while its overall policy serves the selfish interests of the monopoly bourgeoisie, rather than the interests of the people. This is clearly expressed, for example, by the wage freezes, anti-labour laws, etc.

Thus, the thesis of the convergence of the distribution systems of the two economic systems and even more so of the aggregate social relations is in flagrant contradiction with reality. It is an apology for modern capitalism and a distorted portrayal of the socialist economy.

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In criticising the convergence theory (and other modern bourgeois theories as well) we must not treat them as a collection of absurdities or pure fiction. We should be guided by Lenin's following important methodological explanation: "Philosophical idealism is *only* nonsense from the standpoint of crude, simple, metaphysical materialism. From the standpoint of *dialectical* materialism, on the other hand, philosophical idealism is a *one-sided*, exaggerated development (inflation, distension) of one of the features, aspects, facets of knowledge into an absolute, *divorced* from matter, from nature, apotheosised."[1] This statement, made in the context of philosophical questions, may be applied equally well to the criticism of bourgeois politico-economic theories.

The convergence theory is a reflection in ideology of certain actual features and phenomena of modern economic life. The theory can be compared to a convex or concave mirror in which the image loses its true proportions. But such a mirror does not invent the person standing in front of it; it simply reflects him, though in a distorted way,

[1] V. I. Lenin, *Collected Works*, Vol. 38, p. 363.

exaggerating some of his features. Nor has the *convergence theory* simply conceived its propositions out of nothing: it has *reflected, though in a distorted manner, some of the features of modern capitalism.* What, we may ask, has it drawn from life and what belongs to the realm of distortions and illusions?

In our opinion, the convergence theory reflects the following actual phenomena of the modern capitalist economy: (1) the progressive socialisation of production in connection with the scientific and technological revolution, (2) the growing economic role of the state, and (3) the introduction of elements of planning.

The development of productive forces inevitably leads to the increased socialisation of capitalist production. Capitalist enterprises are getting larger and larger; they employ thousands of workers and their output supplies the requirements of hundreds of thousands and even millions of people; the social division of labour is developing, and new branches of production are evolving. The modern technological revolution has vastly intensified this socialisation process. The theorists of convergence have noted this aspect of the matter correctly. But by singling out this one aspect and considering it out of the context of all the relevant phenomena, they have given a distorted view of modern capitalist reality.

This distortion lies in their considering the steadily increasing socialisation of capitalist production in isolation from the private form of appropriation, whereas actually the two phenomena form a unity. No matter how the capitalist enterprises may grow in size or manpower, no matter how collective, or corporate, they become, the vast majority of them will remain private property. When Galbraith points out that the very nature of modern large-scale industrial corporations leads them to adopt decisions collectively, and then goes on to say that this is equally true both of the socialist system and of the capitalist system of free enterprise, he abstracts himself from the essence of the capitalist mode of production, that is to say, the private appropriation of social means of production. Between capitalism, which is based on private ownership, and socialism, which is based on public ownership, there always was and still is a deep chasm. Therefore, the basic concept of the convergence

theory, that of a "rapprochement" between the two economic systems, is not merely an illusion but a tendentious and harmful one.

The convergence theory further notes the growing economic role of the bourgeois state and the introduction of elements of planning in the capitalist countries. However, it reflects these new phenomena one-sidedly, in an exaggerated and, therefore, distorted manner. No matter what measures the bourgeois state may take to regulate and plan its capitalist economy, it will be unable to conduct the entire reproduction process according to plan; it can only exert a certain influence upon it. In this respect there is a fundamental, qualitative difference between the two systems, and any convergence is out of the question.

Is the capitalist system nevertheless drawing closer to socialism? The answer to that question is yes, though not in the sense implied by the advocates of convergence. The capitalist system is drawing closer to the socialist system in the sense that more and more of the material and organisational prerequisites of socialism are taking shape within its framework. Advanced techniques, progressive forms of production organisation, partial nationalisation of the economy, an apparatus of economic programming—all these prepare the ground for and hasten a transition to socialism. However, the fact that capitalism is moving in the direction of socialism does not mean that socialism is in progress within the framework of the capitalist system as such. As for the assertions that the socialist countries are moving towards capitalism, they are pure nonsense.

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As regards its social nature the convergence theory is a bourgeois theory even though it attempts to rise above both capitalism and socialism, advocating a species of "integral" economic system. The point is that the theorists of convergence *see the "synthesis" of capitalism and socialism as taking place on a capitalist basis, that is, on the basis of the private ownership of the means of production.* Typical in this respect are the views of Buckingham, who believes that "three of the four foundations of capitalism . . . seem likely to be carried over from pure capitalism and incor-

porated into the newly emerging economic system. First, private property in capital plant and equipment. . . . Second, economic incentives and profit motivation. . . . Third, the market system is everywhere reasserting itself as the principal mechanism for controlling the allocation of goods and services".[1]

For the sake of balance Buckingham does, admittedly, name three features which the future "integral" economic system is to borrow from socialism, namely, growing equality, workers' control over working conditions, and economic planning. Clearly, this list omits the most important feature: public ownership of the means of production. "Integration" and "synthesis" are thus essentially a smokescreen thrown up to conceal the intended absorption of socialism by capitalism.

The fundamental methodological error of the "synthesis" conception is its *idealist, wishful-thinking approach* to the long-term economic development of society. The proponents of the convergence theory reason as follows: modern capitalism has certain shortcomings but it also has certain merits; socialism, too, has its merits and drawbacks; clearly, people will understand this and, having done so, will synthesise the merits of both economic systems, remove their shortcomings, and create an "optimum" economic and social system.

Actually, however, the economic development of society is not a matter of free choice or free will; it is governed by objective economic laws. On the one hand, the operation of the economic laws of capitalism leads to the shaping, within the framework of the capitalist mode of production, of the material and organisational prerequisites of the transition to socialism, and, on the other, to exacerbation of the contradiction between the social nature of production and the capitalist form of appropriation, a contradiction that can be solved only by a revolutionary transition from capitalism to socialism. As regards the socialist system, the economic laws operating within its framework determine a gradual growing over of socialism into communism. Thus, the future belongs not to any visionary mixed-type economic system but to socialism and communism.

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[1] W. S. Buckingham, *Op. cit.*, p. 485.

Although essentially bourgeois, the convergence theory differs from primitive bourgeois apologetics regarding the permanence of capitalism. Its proponents no longer proclaim boldly that the future belongs to capitalism; they now suggest that it belongs to an "integral" economic system, a synthesis of capitalism and socialism. This is noteworthy. The convergence theory is intrinsically ambivalent. On the one hand, it is a refined attempt to justify capitalism, since it makes capitalism the basis of its "integral" economic system; on the other, it is a forced admission of the strength and viability of the socialist system and a *de facto* rejection of the idea that the capitalist system in its "pure form" is immutable and eternal.

It is no accident, therefore, that the convergence theory has caught on among various groups of intellectuals in the West. Its advocates are a mixed bunch, some holding clearly reactionary views, others more or less progressive. Some of them associate convergence with the principle of peaceful coexistence between the capitalist and socialist countries. Thus, Tinbergen assumes that the most likely cause of a future general war is the contradictory views held by the Western and the communist worlds regarding the best socio-economic system.[1] He draws the conclusion that convergence of the two systems points the way to their coexistence. Similar views are held by John Strachey,[2] the prominent ideologist of Labourism, and some other Western theorists.

A positive element of the convergence theory is that it recognises the principle of coexistence between the two systems. We cannot agree, however, with the main line of argument of its proponents, namely, that peaceful coexistence is bound to imply convergence. The attempt to get convergence of the two systems accepted as the main condition and basis of peaceful coexistence should be flatly rejected.

Quite apart from the fact that conflicts and wars occur within the framework of the capitalist system itself, the advocates of convergence have adopted a fundamentally false approach to the problem of peaceful coexistence. The

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[1] J. Tinbergen, "Facing the Future", *Medunarodna Politika*, June 5, 1965, p. 8.

[2] See J. Strachey, *On the Prevention of War*, London, 1962, p. 303.

problem emerged as and continues to be a pressing one precisely because it is *a problem of coexistence of two different and even opposite social systems.* Theory and practice have proved that such coexistence is possible and that it is essential if mankind is to survive. Yet the way the problem is treated by Tinbergen and Sorokin, whatever their personal attitude towards the problem of peaceful coexistence, gives every advocate of the cold war and anti-communism grounds to declare that since there is no convergence of the two systems, it is idle to count on their peaceful coexistence.

The Marxist-Leninist approach to the problem of the peaceful coexistence of the two systems is entirely different: it admits that socialism and capitalism are opposite, regards the coexistence of states with different social systems as a form of class struggle, and at the same time recognises that peaceful relations between socialist and capitalist countries are possible and necessary.

MAN IN THE "INDUSTRIAL SOCIETY". IS HERBERT MARCUSE'S "CRITICAL THEORY OF SOCIETY" CRITICAL?

Yuri Zamoshkin, D. Sc. (Phil.)
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Recent years have seen a sharp increase in the demand for critical theories of society in the West. This is quite understandable in view of the fact that under the impact of the scientific and technological revolution the contradictions of social development in those countries take the form of striking paradoxes that are appreciated by the public at large. We may assume that as this revolution proceeds the interest in critical theories of society will continue to increase. One particular type of the current socio-critical theory is to be found in the work of Herbert Marcuse, a social philosopher who has won extensive popularity.[1]

According to this theory, the industrially developed countries, particularly the USA (Marcuse acknowledges that his theory is based largely on observations of the development of this country), show a tendency to develop a condition of society which he has called "one-dimensionalism".

The theoretical model of a "one-dimensional society" plays a key part in Marcuse's conception, for in "one-dimensionalism" he sees the main foundation of a critical attitude to social organisation.

In the sphere of production, Marcuse sees "one-dimen-

[1] Marcuse's conception is expounded in his book *One-Dimensional Man. Studies in the Ideology of Advanced Industrial Society* (New York, 1964), which has come out in many editions and has been translated into many languages, in his article "Socialist Humanism", edited by E. Fromm (New York, 1966) and also in the report "A Revision of the Conception of Revolution" at the UNESCO symposium dedicated to the 150th anniversary of the birth of Karl Marx (Paris, May 1968).

sionalism" in the merging of individual industrial units and branches in a *single organism*, all of whose parts are strictly subordinated to each other. This, he thinks, means that the advance to "totalisation" is decisive for the entire social climate. By "totalisation" he means the establishment of an all-embracing and integral *rationally regulated system* of industrial, managerial and educational institutions, all influencing each other, a system of a universal functional interaction of all the elements of social life. Technological economico-administrative "totality" and "one-dimensionalism", as Marcuse puts it, is continued in the "one-dimensionalism" of socio-political reality. In politics the external distinctions between the basic parties conceal an inner unity; opposition becomes a force that helps to preserve the equilibrium and self-reproduction of the existing system. In following this argument, Marcuse denies that revolutionary aspirations and revolutionary potentialities are inherent in the working class of the advanced capitalist countries. In essence, he reduces the role of the working class and its organisations to the function of a "pressure group" which, so he maintains, has the effect only of reconciling inner social contradictions and restoring equilibrium in the system of the state-monopoly bureaucracy.

Marcuse sees the main feature of the "one-dimensional society" as an ability to withstand the destructive social forces and changes, to preserve continuity and stability, the ability to "contain social change". This society and its state, he writes, have achieved a hitherto unknown "integration of opposites".[1]

According to Marcuse, present-day society is also marked by an unprecedented merging of the individual with the entire social and political entity. This is no longer a simple pragmatic "adaptation" to the social milieu as a reality that is external to the individual, but an actual identification of the individual with society, an "introjection" into him of social norms and rules, their conversion into an "internal" dimension of his personality. Marcuse sees in this one of the most powerful tendencies which operates absolutely automatically and moulds "one-dimensional man" (in strict conformity with "one-dimensional society").

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[1] H. Marcuse, *One-Dimensional Man*, p. XII.

The critical side of his conception stems from a realisation of all the highly dangerous consequences, destructive to society and the individual, created by a "one-dimensional" social condition.

Marcuse is convinced that a fundamental danger to mankind is presented by "one-dimensional" thinking in the USA and Western Europe, which often regards the condition of "one-dimensionalism" as possessing obvious advantages over previous social conditions, and sometimes even as embodying the ideals evolved by mankind through the centuries. By way of explanation, Marcuse lists all the "advantages" of the present-day level of social life achieved through the rapid development of science and technology.

The society he criticises has to its credit, according to Marcuse, the fact that it has given immeasurably expanded wealth to society as a whole, extended and deepened its power over nature, and provided it with a rational organisation of production and management and, in consequence, an enhanced material level of welfare and consumption for masses of people far greater than ever in the past. All this, Marcuse claims, produces a man with a "happy" consumer outlook, and such an outlook (the belief that it is the aim of the existing system to produce and supply material values) expresses and engenders social conformism. Specifically, it tends to justify the conformist stand. The rigid system determining the life and behaviour of the individual may deprive a person of freedom and the possibility of self-determination, but his general response will be as follows: "... there is no reason to insist on self-determination if the administered life is the comfortable and even the 'good' life. This is the rational and material ground for the unification of opposites for one-dimensional political behaviour."[1]

In a "one-dimensional society" it is generally held that the common interest of all members of present-day society lies in defence of the *status quo*, consolidation and perfection of the established social order, struggle against historical alternatives that threaten that order, and in conservatism and positivism. Also predominant is the idea that only rational forces of organisation and administration operate in that society, and that the relations between

[1] H. Marcuse, *One-Dimensional Man*, p. 49.

classes, groups and individuals are based on reasonable and firm foundations. In short, to the "one-dimensional man" society as a whole seems as the "embodiment of reason".

In a "happy" conformist consciousness, Marcuse says, we find a new inner property of social life, a new and, apparently, *spontaneously and automatically emerged social reality*. However, as he further emphasises, it should not be forgotten that such a reality is itself a product of *deliberate* administration and organisation, a result not only of the "objective order of things" but of a carefully planned and extensively implemented practice of the ideological manipulation of human consciousness and feelings, the practice of their "socialisation" and education in the spirit of the "generally accepted" and "standardised" norms and values.

Marcuse disagrees in principle with those who, like D. Bell and S. Lipset, consider that US society today demonstrates the "end of ideology". Unlike the prophets of the "end of ideology", Marcuse realises that ideology can exist not only in the form of conceptions directed towards a cardinal social reconstruction but also as a complex system of ideological principles, stereotypes, symbols and spiritual values designed to adapt members of society to the existing social relationships and the order of things. He pays special attention to the obvious fact that, in the United States of today, particular momentum has been acquired by that kind of *ideological* practice which finds expression in the activities of powerful mass media, educational institutions and so on.

The basic contradiction of our times, Marcuse holds, consists in the following: on the one hand, a society is developing with an internal, built-in and ineradicable "rationality" in the administration of things and people, a "rationality" which finds its most outstanding embodiment in "one-dimensionalism". Unlike the apologists of the industrial society, Marcuse considers this "rational one-dimensionalism" a *negative* characteristic of present-day society. But what is more important, he goes on, is that, on the other hand, "... this society is irrational as a whole. Its productivity is destructive of the free development of human needs and faculties, its peace is maintained by constant threat of war; its growth dependent on the repression of the

real possibilities for pacifying the struggle for existence—individual, national, and international."[1]

What follows, Marcuse asks, from direct, open and coercive control yielding place to administrative and psychological control, and from the character of labour changing and a certain rise in the standards of living becoming discernible? Present-day society is dominated by forces over which the individual exercises no control. What follows from the fact that the majority of people in this "one-dimensional" society fail to realise this dependence? "The slaves of developed industrial civilisation are sublimated slaves, but they are slaves."[2]

In the present-day industrial society of the USA and Western Europe, Marcuse continues, the growth of a "rational order" goes hand in hand with the progressive enslavement of man by a productive apparatus which ". . . ruins the lives of those who build and use this apparatus".[3] Thus, present-day capitalist society, whose achievements Marcuse is prepared to recognise as considerable, receives by and large in his conception a *distinctly expressed negative appraisal,* chiefly because the development of that society distorts the individual's will and abilities and dooms him to a slavery which is indubitable though camouflaged.

Because of all this, the balance of the "pluses" and "minuses" of a society which Marcuse himself characterises as "one-dimensional" seems to him a *negative* one. Moreover, he draws the conclusion that *such a society must be destroyed in a revolutionary fashion* and replaced by a society of a fundamentally new type. He believes in the social revolution, and this distinguishes him from many social critics of the liberal persuasion. But is Marcuse's conception really so radical and critical *in its essence and in its objective content*? In this article we shall attempt to provide a reply to this question and to this question alone. The aim of this article is to help destroy illusions existing today in the minds of many Western intellectuals sincerely aspiring to take part in revolutionary activities and accept-

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[1] H. Marcuse, *One-Dimensional Man,* pp. IX-X.
[2] *Ibid.,* p. 32.
[3] *Ibid.,* p. 144.

ing at its face value the *semblance* of revolutionary radicalism in Marcuse's conception.

It should be borne in mind that Marcuse does not claim to be merely a publicist voicing a spontaneous mood of radical protest. He regards himself as a *theorist creating an original revolutionary system of world-outlook, a philosopher who has allegedly discovered and formulated methodological and logical principles of consistent revolutionary critical thinking.* In assuming this role, he attempts to exert, and indeed does exert, a certain influence on the consciousness of a section of student youth and the intelligentsia in the United States and Western Europe. Hence a reply to the question of whether Marcuse's "critical theory" is indeed revolutionary and consistent calls for analysis of the inner logical structure of his theoretical conceptions, the philosophical principles of his thinking, and the mechanism of the social vision that underlies the ideological models and methods of argumentation that he uses.

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Having proclaimed it his mission to stimulate the young minds of today to revolutionary and critical thinking, Marcuse declares the chief enemy to be the "one-dimensional, openly apologetic consciousness".

It should be noted that the conformist "one-dimensional" spiritual life of the present-day advanced capitalist countries, so scrupulously described and sharply criticised by Marcuse, is a real tendency that is linked with the development and consolidation of the part played by the state-monopoly bureaucracy. For instance, Marcuse shows very convincingly that, as a rule, present-day culture in the United States is in the hands of the bureaucracy, an "instrument of social conformism" and manipulation of human lives. Culture has dissolved into mass propaganda and big business, dominated either by business considerations or else the practical tasks of "total administration". All this corrupts people, makes them forget their actual non-freedom, and evolve a "happy" consumer consciousness. According to Marcuse, culture becomes "one-dimensional" also in the sense that it ceases to be "another critical dimension of reality". Even those works of art and literature which seem

to be propagating the idea of behaviour involving some violation of the social order (for example, gangster films or beatnik literature) are ultimately "an affirmation rather than negation of the established order".[1]

As Marcuse sees it, the sphere of social knowledge is in ever greater measure becoming an instrument of conformism and bureaucracy. In essence, it is becoming a knowledge of facts as such, of individual functions and situations, and not of essence, a knowledge of the methods set by the bureaucracy, not of the aims of social progress. It is static and non-historical, i.e., possesses all the symptoms of "one-dimensional" thinking. This knowledge is suited only to the functional rationalisation of individual processes in the bureaucratic apparatus. It conceals the general and, so to say, "substantial" irrationality of social life. That is why Marcuse so aptly calls positivism, operationalism and one-sided functionalism the "rational theoretical form of an irrational order". The social science now existing in the USA and Western Europe is also unacceptable, in Marcuse's opinion, because of its apologetic, reconciliatory and pragmatically applied character.[2]

As we see, the criticism to which Marcuse has subjected the present-day forms of concrete social knowledge in the capitalist countries is relevant. However, it has one big shortcoming—his appraisal and understanding of the highly contradictory processes taking place in the sphere of social science under present-day capitalism are themselves "one-dimensional".

Is it true that in these concrete historical conditions (the system of monopoly bureaucracy) economic science, sociology, and social psychology, which employ the methods of empirical investigation, in fact often serve certain practical and pragmatically utilitarian aims of the predominant social organisation? Yes, it is.

Is it true that in these concrete historical conditions there has emerged a dangerous gap and mutual alienation between socio-philosophical critical thinking that is orientated towards the humanist traditions and concrete social research? Yes, it is. But can one fully identify the inner contradictory

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[1] H. Marcuse, *One-Dimensional Man*, p. 59.
[2] *Ibid.*, pp. 8, 9, 17, 97, 107, and elsewhere.

logic of the development of concrete social studies—a logic which has of necessity led up to the development of the empirical methods and techniques, operational procedures and principles of functionalism—with *that real and concretely historical ideological function which such studies acquire in the given social set-up, in the conditions of consolidation of the state-monopoly bureaucracy, under the influence of a definite socio-class aim*? Can one simply dismiss the scientific devices and methods for the culling of representative factual material about certain concrete situations, mechanisms and phenomena in the consciousness of actually existing people, simply because such devices and methods are used by "factory inspectors", officials and "social engineers" for purposes formulated by the bureaucracy? No, one cannot.

Marx and Lenin, who gave classical examples of revolutionary critical theory, brought together and merged a philosophical interpretation and development of the traditions of humanist thinking with scientific concretely historical, economic, sociological and socio-psychological research into the most varied and contradictory real processes and phenomena that affect the posing and the solution of the problem of man. The intellectual traditions of the teachings of Marx and Lenin have acquired a special significance today, in an epoch when the system of social relations is becoming far more complicated and social process enormously accelerated. In this epoch of mass social movements mankind faces the need to take responsible and scientifically grounded decisions. There is a growing demand for the scientific elaboration of a system of social orientation of society and the individual, in which long-term programmes providing for the qualitative refashioning and humanisation of the entire system of social relations will be blended with a detailed and accurate knowledge of the varied mechanisms which are actually functioning today, at the given stage in the development of society, in the sphere of production, consumption, politics, culture, social and individual psychology and the like, that is to say, will be blended with a knowledge of the objective possibilities and limits of social practice at a given place and over a definite period of time.

One of the ideological consequences of the one-sided development of scientific social studies in the West is the

discrediting of sociology as a type of scientific knowledge in the eyes of those sections of society that defend the ideals of humanism and democracy. In this situation, socio-critical theories, that are (as we shall try to show) essentially a kind of "one-dimensional" reaction to the emergence of alienated forms of sociological research, are gaining popularity.

A one-sided and purely negative attitude to the methodology and practice of present-day social science may have grave consequences. Marcuse's conception is a case in point. Socio-critical theories are usually based on a description of the society which is the object of their criticism, a description of typical social relations, the mechanisms and patterns of individual behaviour, its motives, experiences and the like. If, in describing a society, the theorist rejects, in principle, the procedures and methods of professional scientific social research, he is more often than not obliged to work on the basis of his own subjective ideas, or ideas that exist in everyday consciousness and present themselves to him as certain obvious facts.

Marcuse rejects the use of the instruments placed at his disposal by present-day scientific research that could help him to verify and assess such ideas objectively, to establish, for instance, just how representative are certain striking facts that form the basis of current ideas. It may and often does happen that ideas which the critic sees as sufficiently characteristic of the state of affairs in present-day society are in fact imbued with fetishist illusions, distorted forms of consciousness, influenced by ideological standpoints, stereotypes, illusions, sentiments, a general frame of mind typical of the conformist thinking that is rejected by the social critic. These ideas may prove to be both a condition and a result of the narrowness and "one-dimensionalism" of that thinking, a "one-dimensionalism" conditioned first and foremost by the apologetic forms of the application of social knowledge, of the social target set by the bureaucracy, and the functional inclusion of that knowledge in the ideological atmosphere of a given society.

Let us illustrate this idea, taking some of Marcuse's theoretical constructions as examples. Marcuse is worried by the nature of the influence exerted on man and society by present-day industrial production and present-day tech-

nology. It is this influence which he considers the main source of the conformist "one-dimensionalism" of consciousness and the bureaucratic anti-humane forms of social organisation. Here Marcuse, in fact, accepts on trust the initial postulate of apologetic "scientist" thinking found in the schemes of Walt Rostow and other adherents of the theory of the "industrial society" which, as most people, including Marcuse, realise, is an expression of the interests of the state-monopoly bureaucracy. While criticising this theory as a typical manifestation of "one-dimensional", and "functionalist-technicist" thinking, Marcuse *in fact* borrows most uncritically from, and reproduces in his conception, the logic of argument typical of Rostow and similar officials and experts in the service of the US bureaucratic apparatus.

After all, any apology for present-day bureaucracy, conscious or unconscious, is usually based on the logic of technological determinism. It regards bureaucratisation as the necessary outcome and necessary condition of the effective and rational development of present-day industrial production and economy as a whole. The state-monopoly bureaucracy realises and reflects its own activities and its own organisation first and foremost in the concepts and terms of economico-technical solvency, and it imposes that internal evaluational approach on social studies as a restrictive framework and guideline for its development.

Both the "scientist" and the average man with their "one-dimensional" thinking that adapts itself to the bureaucratic organisation of society, see this very organisation as the symbol of material well-being and economic efficiency. And so does Marcuse himself, who has so energetically voiced his indignation at "one-dimensional" thinking. Marcuse, too, regards man's material welfare, the bureaucratic and dehumanised forms of organisation and present-day technology as a chain of cause and effect.

This mode of thinking conceals the objective links between bureaucratic and dehumanised organisation and the character of objective material relations. It also conceals the links between such organisation and the system of culture and values existing in a given society.

Karl Marx examined these links in volume III of *Capital,* in which he showed the *internal dualism of the forms*

of the management of socialised production under conditions of capitalism. He showed that in this situation management is subordinated not only to the objective needs of the rational conduct of present-day industrial production, but also—and this is of particular importance—to the class interests of the economically predominant social groups that hold sway over things and people. The choice of alternatives in the process of control, the choice of criteria of the efficiency of management, depends on the dominant system of values, and these ultimately reflect the actual socio-class structure and the historically conditioned type of culture in a given society.

Marcuse accepts on trust and even turns into one of the fundamental postulates of his "critical" thinking an idea that is a characteristic and essential part of the theory of the "single industrial society", the idea that there is no substantial difference between present-day capitalism and socialism. (See the interview granted by Marcuse to *Le Monde*'s correspondent on May 11, 1968.) This idea, which has a quite definite function in the present-day ideological struggle, plays down in the mind of the man in the street the private-ownership nature of capitalist relations and distorts the true essence of Marx's and Lenin's scientific socialism. It is no accident that, in Marcuse's conception, the notion of "present-day society" is usually identified with the notion of an "advanced industrial society" (which has also been uncritically borrowed from the theories of Walt Rostow, Raymond Aron and others), while the relation towards the means of production, to property is not included among the basic characteristics of society. When Marcuse gives a generalised description of the economic organisation of present-day society, he, like the adherents of the theory of "industrial development", takes as his initial model the organisation of production and managerial activities within the industrial enterprise of today, in which the socialisation of functions and departments is effected within the framework of a single and rationally regulated system of division of labour and interchange of activities. The political and economic foundations and characteristics of that organisation are totally ignored, which is also typical of bourgeois apologetic thinking.

Bureaucratically oriented social research has concen-

trated its attention on the problems of the management and "socialisation" of people to meet the functional needs of that management, and on a study of certain definite parameters and properties of the individual with which the operation of the mechanisms of conformism are connected.

All personal properties and mechanisms that contradict or go beyond these aims are either not subjected to professional scrutiny or are dismissed as malfunction and symptoms of "abnormal behaviour". All the emphasis is placed on the capacity of the consciousness to be managed and brought under control. The main task has been to gather and systematise all the empirical data that have fit into the existing "workable" formulas for manipulating people. This emphasis has also had a characteristically *ideological* significance. The same emphasis is to be found in the system of "reading", measuring and studying man and his social properties and qualities. It is this system which Marcuse has rightly enough dubbed "one-dimensional", a system that glosses over the actual contradictions and the duality in the nature of capitalist society.

And yet, at the same time Marcuse accepts on trust the "one-dimensional" picture of present-day society and man's status in it; he agrees with the widespread idea that in this society only the one all-inclusive and omnipotent trend towards conformism is predominant, and that consciousness is becoming more and more controlled. It should also be remembered that in a number of Western countries, especially in the United States, social studies oriented by manipulation and historically linked with the organisation of mass commercial publicity, have focussed attention on the personality of man as *consumer and buyer*, on the study of the mechanisms that encourage buying and consuming (compensatory mechanisms, social prestige motives, and so on), and on the possibility of controlling man's consumer urges, stimulating them and achieving a definite psychological effect of their satisfaction.

These specific utilitarian-pragmatic forms of approach to problems of consumption on the part of bodies that allocate money for research, and on the part of researchers, have been ideologically justified by references to the growth of mass production of consumer goods, the economic necessity for maintaining high industrial growth rates, and the like.

A one-sided emphasis on the consumer expectations and habits of the individual, an emphasis which determines the nature of the working principles of the professional researcher, is thus internally linked with a specific ideological attitude to the modern man, with ideologically "one-dimensional" forms of seeing and interpreting his essence.

Marcuse, for all his great concern over the development of this consumer psychology and consumer attitude towards life, has nevertheless been uncritical in his perception of these "one-dimensional" forms of outlook. *He has taken the self-satisfied and "optimistic" ideology of mass commercial publicity far too seriously.* This has led to his theory being dominated by the "one-dimensional" idea of the developed industrial society of today, which, he alleges, is turning perfectly naturally (simply by virtue of its advancement) into a "consumer" society. And from this comes the one-sided, "one-dimensional" picture of the typical individual of that society—*Homo consumens*, with his satisfied or even "happy" consciousness.

What has actually happened is that the problem of the sources of poverty and of the sharp social contrasts in the standards of living in the countries of developed capitalism has remained beyond the field of vision of Marcuse's "critical thinking". The dialectics of requirements in response to the spiritual development of the individual has also escaped his notice. Also "one-dimensionally" interpreted are the obvious facts of public dissatisfaction with the level of consumption, which does not always indicate a narrow consumer attitude towards the world and very often springs from the perfectly legitimate needs of the toiling masses, needs that must be included in any programme of practical and theoretical humanism.

The primary working model used in the theory of structural-functional analysis evolved in the USA and in the research practice based on that theory is the "value-normative" model of society, which represents society as a *system of the most generally accepted and predominant values and norms* expressed in human expectations and character as objectivised in the institutions and forms of social action. This model was designed to represent society as an entity, but an entity of a special kind, one that is primarily to be regarded through the prism of mechanisms that are

working towards preservation of its internal relative stability.

This model was, indeed, built in *one definite* "dimension". It was unable to express, and certainly unable to interpret, the inner dialectics of social being and consciousness, or to explain the internal conflicts in the material basis of society that are characteristic of certain stages of its development and manifest themselves most clearly in a society where there are classes with clashing interests. This model could never claim to reveal the objective logic of the transition of certain social systems into others, the logic of the unfolding of internal contradictions that work against the integration and reproduction of the capitalist social system and engender social revolutions.

Thus, a one-sided emphasis on mechanisms inducing ideological uniformity, as recorded by a functionalist value-normative model, is reinforced by a dominant vision of present-day capitalist society as a "one-dimensional totality" in which any social opposites and conflicts can be reconciled and eradicated by a functionally rational organisation of the administrative apparatus and through manipulation of the human mind, emotions and desires.

Marcuse condemns this "one-dimensional totality" as incompatible with the free development of the human personality, individual capacities and initiatives. He calls it a camouflaged form of slavery. However, he has not been able to overcome the ideological "one-dimensionalism" in his own perception of the society around him, a "one-dimensionalism" which is also characteristic of one-sidedly functionalist and apologetic thinking. Unlike the direct apologists, however, Marcuse places a minus sign in front of that "one-dimensional" characteristic. His "social totality", which is one-dimensionally interpreted and uncritically accepted as the only reality, is just as one-dimensionally and totally rejected.

Though Marcuse has declared himself the heir of classical German philosophy and has called for a transition from the purely positivist mode of thinking to dialectical thinking, he does not understand the essence of dialectics as the algebra of revolutionary criticism. One might well apply to him Karl Marx's apt characteristic of Proudhon: in reading Hegel he went no further than simple negation.

In Marcuse's conception, criticism is *emotionally axiological* and is divorced from contradictory and multi-dimensional reality; it ignores the inner development of social science and systematic sociological, historical, economic and socio-psychological research into the manifold social processes and nexuses of our time. It is incapable of integrating in theory and interpreting from the standpoint of dialectics the *actual relationship and the struggle of different contradictory antagonistic trends* in the sphere of present-day material production, its social organisation, social and class structure and human consciousness and behaviour; it is incapable of revealing and accurately appraising the actual trends which already are (or tomorrow may become) a basis and nutrient medium for the practical social movements that are making the real, and not illusory, choices in present-day history.

Marcuse's conception offers a typical example of consciousness which, while critical in its subjective aspirations, fails to reappraise the false fetishes characteristic of the commonplace ideological consciousness that is predominant in the society it rejects. A mode of thinking that seems to be orientated towards a critical attitude to reality is, in fact, internally *fettered by an ideologically commonplace and non-critical schematism.* Marcuse accepts as reality a scheme of things that has been stripped of its actual and objective dialectical contradictions; he then furiously attacks this scheme, this model of society which has been idealised, flattened out by the "one-dimensional" consciousness.

The distinction between the apologetics of other sociologists and the "criticism" in Marcuse's writings is a distinction in the value he attaches (acceptance or rejection) to a social situation, *registered and considered by a non-dialectical method similar in principle to that of the apologists.*

A one-dimensional approach to the reality of today and to the trends in its development makes Marcuse incapable of seeing any possibility of progressing from the actual to the desired. *The desired is, therefore, presented only as a mechanical and complete negation of the actual.* This opposite condition, presented as ideal, is simply asserted and advocated, but without any research into the objective processes and possibilities of the transition to that opposite state, transition as a natural historical process.

Marcuse considers himself a socialist, but there is no trace in his writings of any systematic or logically substantiated exposition of a programme of socialist transformations. The descriptions of the socialist ideal given in his writings are vague and indeterminate in the extreme; as a rule, they are presented on an *abstract anthropological plane.* The economic or structurally organisational problems of socialism are, in essence, either not raised at all or relegated to the background. Much is said (again in a general way) of a "fundamental change in the direction of technological progress", "the total reconstruction of the technological apparatus", "the elimination of technological rationality" and the like. Marcuse does not deny that socialism calls for a high level of technological development, but he does not know, and admits to not knowing, how that development differs from the current process usually designated as the "scientific and technological revolution". He also admits his inability to reply to the question of which internal trends and potentialities of present-day production necessarily pave the way for the transition to socialism.

Marcuse realises—and this is noteworthy—that the general conceptions referring to cardinal social changes must be based on a scientific analysis of the trends of social development that already exist today, that are emerging within the framework of our times and are preparing those social changes. Speaking of the criteria for the evaluation and choice of various historical projects, he is quite right in saying: "These criteria must refer to the manner in which a historical project realises given possibilities—not formal possibilities but those involving the modes of human existence."[1] This correct idea, however, is only given lip-service and is constantly suppressed by habits of "one-dimensional" and basically metaphysical utopian thinking. In essence, Marcuse can only appeal to such evaluational concepts and "evaluational universalia" as "Freedom", "Beauty", "Happiness" and the like. At the same time, he is partially aware of the utopianism of any absolutisation of universalia as such, and their divorce from truly scientific and dialectical social analysis.

He dreams of the social, socialist revolution, but at the

[1] H. Marcuse, *One-Dimensional Man*, p. 219.

same time acknowledges (and this is implied in various forms in all his main writings of late) that he does not discern in the world of today any social forces that could be agents of a radical and genuinely socialist transformation of society. "Socialist theory, no matter how true, can neither prescribe nor predict the future agents of a historical transformation," he wrote in 1966.[1]

Marcuse's disbelief in the revolutionary possibilities of the proletariat in the industrially advanced capitalist countries is common knowledge. Today, however, he is often regarded as one who sings the praises of the "revolutionary energy" and the "revolutionary aspirations" of radically-minded students and intellectuals.

Indeed, Marcuse believes that the basic forces most clearly opposed to the corporate capitalism of today are, on the one hand, what he calls the "middle-class intellectuals", especially the students, and on the other hand, the oppressed ghetto population: the social groups and ethnic minorities that make up the lower depths of bourgeois society. While hailing the social rebelliousness of these groups, Marcuse acknowledges (and this must be emphasised), first, that they form a minority of the population and, second, that none of these groups can provide the "human basis" of social process in present-day production. Hence, he draws the conclusion that, by themselves, these forces of opposition cannot be regarded as "historical agents of radical change".[2] In Marcuse's opinion, the student movement and ghetto disturbances can at best result in the disintegration of existing society.

Although, in his *Le Monde* interview of May 11, 1968, Marcuse strenuously denied being a "defeatist", *his socio-critical theory can, objectively speaking, in no way evoke confidence and hope of victory in the hearts and minds of people who are today coming out actively for the revolutionary creation of a socialist society and the achievement of the ideals of socialist democracy and socialist humanism.* His theory provides no really scientific substantiation of the prospects of radical social reform, and, if regarded objectively, it becomes a utopia. It is no accident that Marcuse

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[1] H. Marcuse, *Socialist Humanism*, New York, 1966, p. 117.

[2] See the official text of his address to a UNESCO symposium in May 1968.

concludes his main book with the following words: "The critical theory of society possesses no concepts which could bridge the gap between the present and its future; holding no promise and showing no success, it remains negative. Thus it wants to remain loyal to those who, without hope, have given and give their life to the great Refusal."[1]

In dissociating himself from direct methods of defence of the capitalist system, and at the same time frankly voicing his disbelief in the victory of the progressive forces in the struggle against that system, thereby discouraging those who are engaged in that struggle in deed, not in word, Herbert Marcuse objectively leads his theory to its perfectly logical conclusion. Thinking that claims to be a revolutionary critical force leads merely to naively romantic phraseology or to helplessly speculative moralising.

In Marcuse's theory the critical rejection of present-day capitalist society has no real theoretical, methodological foundation or scientific basis. His criticism reaches its highest pitch only in its registration of the morbid sensations of the commonplace and undeveloped consciousness of various groups who are opposed to the state-monopoly bureaucracy. Marcuse merely gives a theoretical twist to this spontaneous process, which is in many respects anarcho-individualistic. If one disregards the "evaluational" condemnation of capitalism in Marcuse's doctrine, all that remains is a depiction of capitalist society which repeats many stereotypes of present-day ideological apologetics and is a "critically framed positivism", "positivism in reverse". In Herbert Marcuse's conception, *one-dimensional thinking fights itself*. Capitalism is rejected on the basis of present-day bourgeois fetishist consciousness.

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[1] H. Marcuse, *One-Dimensional Man*, p. 258.

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