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## The Social Significance of the History of Science and the History of Technology

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THE SOCIAL SIGNIFICANCE OF THE HISTORY OF SCIENCE  
AND THE HISTORY OF TECHNOLOGY \*

As historical sciences one can regard both those studying the story of human societies on earth, which are historical in the narrow sense of the word, and those investigating the history of the other organic and inorganic components of the universe, such as cosmogony, historical geology, paleontology *etc.*<sup>1</sup> Principally, these sciences are socially significant in a double sense.

On the one hand, by discovering laws and regularities in the development of the phenomena studied, these disciplines allow us to draw conclusions which make possible a deeper understanding of the present state that has resulted from such processes. Further, such conclusions make possible a better acquaintance with understanding of the processes currently developing within the given field as well as the forecasting of future developments. The results obtained in this way may be of considerable practical significance. If the phenomena under examination develop slowly (in relation to the span of human lifetime and the changeability of human societies), practical applications which result from a better understanding of the present reality are of greater significance. For instance, in geology investigations of historical nature (especially palaeogeographic and stratigraphical) constitute essential starting-points for the researches for new deposits of raw-materials. On the other hand, in the case of sciences which study much more rapidly developing phenomena, especially the social sciences, it is the understanding of the cur-

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\* The ideas contained in this article have already been included in a larger article on the perspectives of the development of the history of science and the history of technology in Poland ("Perspektywy rozwoju historii nauki i historii techniki w Polsce," *Kwartalnik Historii Nauki i Techniki*, 2, 1967).

<sup>1</sup> In these considerations the otherwise essential differences between social processes and the processes evolving in the non-social elements of the universe could be disregarded.

rent processes which is of practical importance, since it makes possible the management of these processes or the preparation for encountering their effects. Thus, for instance, studies in economic history make possible the establishment of a theory of economic growth, which in turn permits us to shape consciously the current stages of this development in the particular countries; or, researches in demographic processes make possible the elaboration of population forecasts and the appropriate adjustment of perspective plans of social and economic developments to them, *etc.*

The conscious shaping of social processes realized in the socialist countries by means of perspective, long-run and annual plans—and which is gaining in importance also in countries with different political systems—requires an understanding of the essence and conditions of the development of these processes. This can be achieved by the current observation and analysis of these processes and by the historical study of them. Thus, together with the development of planning the importance of the historical sciences (in the narrow sense) for the management of social processes increases.

On the other hand, the achievements of the historical sciences are important starting-points for educational efforts intended to shape both a scientific world-outlook and social and moral attitudes. The scientific world-outlook is based primarily on the understanding of the processes evolving within the social, natural and technological reality, and social and moral attitudes are being shaped to a wide extent by assimilating definite behavioural patterns, which are offered in abundance by observation of the existing environment and the history of both the particular nations and all mankind. And the social role played by the shaping of the historical consciousness increases together with the growing importance of the historical applications which has been indicated above.

#### THE IMPORTANCE OF THE HISTORY OF SCIENCE AND TECHNOLOGY FOR THE SCIENCE OF SCIENCE AND THE SCIENCE OF TECHNOLOGY

Within this general framework, what are the perspective tasks of the history of science and technology, which has recently shown a rapid development in many countries? This development is by no means contingent, for it results from essential social demands, which—it is to be expected—will be growing in importance within the ensuing decades.

The importance of the history of science grew together with the growing social significance of science itself. Already Francis Bacon, who established the theory of science associated with practice, demanded the establishment of the history of knowledge “without which the history

of the world seemeth to me to be as the statua of Polyphemus with his eye out; that part being wanting which doth shew the spirit and life of the person" (this demand was repeated by d'Alembert more than a century later).<sup>2</sup> In the twentieth century the interest in the history of science and technology grows in consequence of the vehement increase in the importance of science, which gets more and more closely involved with technology and other fields of practical applications, and which in the economic life wins the position of one of the fundamental productive forces.

Thus, the importance of the planning of scientific and technological progress grows more rapidly than that of the other elements of contemporary life. The growth of the social and economic consequences of the development of science is accompanied by a rapid increase in the financial outlays on scientific and technological researches which in the advanced countries, currently amount to several per cent of their respective gross national products, as well as by the growth of the manpower engaged in these researches, which currently constitutes several per thousand of the world's total population. Therefore, both the effects expected from scientific researches and the fact of a considerable number of personnel with highest qualifications being engaged in these researches, as well as the employment of still more considerable financial outlays induce increasingly both the planning of researches and the current management and organization of such researches so as to attain the socially optimal effects with the lowest investments of human and material resources.

At the beginning of our century, in response to social demands a new scientific discipline started emerging—the science of science. The field of activity and the intrinsic structure of this new discipline—which, to a wide extent, consists of isolated sectors of other disciplines such as the psychology of scientific creativity, the sociology of scientific research centres, the economics of researches, the theory of research organization *etc.*—have not yet been fully cristallized, and they are being extensively discussed. But it is already obvious that just as in the other social sciences, in which the importance of experience is small and considerably inferior to that of observation, one of the principal bases of establishing laws in the science of science is the observation of historical phenomena and processes, *i.e.*—the history of science.

The needs of the science of science are much in line with the current trend in the development of the history of science. This trend was outlined as soon as the beginning of the twentieth century, when the discipline turned from the mere describing of facts, analysing particular disco-

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<sup>2</sup> F. Bacon, *Advancement of Learning*; J. Le Rond d'Alembert, *Discours préliminaire de l'Encyclopédie*.

veries and compiling biographies of scientists to the searching for regularities in the emergence and the development of scientific problems and for general laws of the development of science in its feed-back relationships with social and economic factors.

This trend can be derived from the idea of the *histoire générale des sciences* put forward by Comte in the 1830's,<sup>3</sup> and which was developed in the first years of our century by Paul Tannery, "whom we all look to as the true founder of the modern history of science movement" for "like Comte, he saw in the progress of science a key to modern history; and he discerned, more clearly than Comte, that a general history of science must be, first and foremost, a history of scientific thought, of scientific ideas, and not merely a chronology of great men, or... a genealogical compendium of discoveries in the several sciences."<sup>4</sup>

The Second International Congress of the History of Science (London, 1931), at which the Soviet scientist B. Hessen read his report which bore the then provocative title "The Social and Economic Roots of Newton's *Principia*," can be recognized as the next turning-point of the history of science (as some English historians and researchers in the science of science do<sup>5</sup>). It was a turning-point in that it was a concretization of the linkage of the history of science with the development of social and economic relations.

The third turning-point can be located in the years 1963—5. In this period the following events organized by Polish historians of science took place: the international symposium at Jabłonna near Warsaw devoted to the general problems of the history of science and technology, and the 11th International Congress of the History of Science at Warsaw and Cracow, which included one symposium entitled "Le passé et l'avenir de la science"<sup>6</sup>. At these two symposia, the problems of the history of science have been approached in close connection with the science of science for the first time.

Although in the twentieth century science is increasingly fusing with technology, the science of science cannot comprise the problems connected with the regularities of the development of technology. The scientific discipline, however, which could be called the science of technology has not actually been formed yet. The retardation is due to the

<sup>3</sup> Comte asked Guizot, who was Minister of education then, to found a university chair devoted to this subject.

<sup>4</sup> H. Guerlac, "Some historical assumptions of the history of science", in *Scientific Change. Historical studies in the intellectual, social and technical conditions for scientific discovery and technical invention from antiquity to the present (symposium on the history of science, University of Oxford 9—15 July 1961)*, ed. by A. C. Crombie, London 1963, pp. 807.

<sup>5</sup> Cf., e. g., A. L. Mackay, "The «Science of Science» Debate," *Science of Science Foundation Newsletter* (mimeographed), 2, 1966, p. 7.

<sup>6</sup> The materials of the symposium at Jabłonna were published in *Organon*, 1, 1964, and those of the symposium "Le passé et l'avenir de la science" in *idem*, 2, 1965. On the significance of the 11th Congress cf. A. L. Mackay, *op. cit.*

retardation of the history of technology in relation to the history of science, which seems to result from the difficulties of establishing the specific regularities characteristic of the development of technology which are greater in this field than in the history of science, technology as a field of human culture being much less autonomous than science, for it is much more closely linked to the economic conditions and the production relations.

But it is just this linkage that determines the great importance of the history of technology as an essential—though still neglected—element of general historical researches. Already Marx drew attention to the particular importance of the history of technology not only for economic history but for social history as well. He wrote that “die Technologie enthüllt das aktive Verhalten des Menschen zur Natur, den unmittelbaren Produktionsprozess seines Lebens, damit auch seiner gesellschaftlichen Lebensverhältnisse.” He demanded that a “kritische Geschichte der Technologie” be written adding that “bisher existiert kein solches Werk.”<sup>7</sup> One of the results of the retardation in the development of the history of technology is that nowadays, a century later, this statement has not yet lost its validity.<sup>8</sup>

Much better developments are observable in the histories of the particular fields of technology and of the particular scientific disciplines. Researches of this kind, and especially researches in recent history, may be of considerable importance for the present technological and scientific progress. For it can be demanded that, for instance, studies on the future developments in the particular fields of technology should be based on the knowledge of the general lines of development in these fields; and the work on the improvement of the particular constructions and technologies should be based on the knowledge of both the previous work in this respect and on an analysis of the latest experience on the newest technical and scientific achievements. For technical ideas are more enduring than the particular constructions and technologies. These ideas pass over from one construction or technology to another, occasionally declining in conditions of an unfavourable general development of technology and, after some time, reviving in technology passing onto a higher level. The knowledge and analysis of these ideas could facilitate the work of constructors and technologists. The fact that presently this is very rare is attributable to both that researches in the history of the particular branches of technology rarely focus on the latest history and that engineers have very little knowledge of the history of their respective branches of technology.<sup>9</sup>

<sup>7</sup> Karl Marx, *Das Kapital*, vol. I, Berlin 1951, p. 389, n. 89.

<sup>8</sup> In spite of editions of such works as *A History of Technology*, 5 vols, Oxford 1954—8, or the Soviet *Istoria tekhniki*, Moskva 1962.

<sup>9</sup> One example of overcoming these difficulties is furnished by the work carried out jointly by historians of technology and builders of mining-machines at

Contrarily, closer interconnections between the current researches and the achievements of the past—and sometimes of the very remote past, too—occur in the particular scientific disciplines, especially in the social sciences; the representatives of these are much better acquainted with the past of their own disciplines than those of the other scientific disciplines. This contributes undoubtedly to deepening the methodological self-consciousness of the representatives of the social sciences.

#### THE EDUCATIONAL SIGNIFICANCE OF THE HISTORY OF SCIENCE AND TECHNOLOGY

In order to contribute to the formation of the scientific outlook and social attitudes, the historical material taught in schools and spread out by means of the mass-communication media must be adapted both to the educational objectives to be attained and to the interests of youth and the older generation. Because of the great immobility of the educational system and the long time needed for the preparation of the teaching and popularizing personnel, the historical sciences must immediately realize the significance of the forecasts of educational demands which will have to be satisfied in the last ten years of this century.

The anticipation of the world's political, social, and cultural situation in a quarter of a century from now cannot, of course, be precise. It is nevertheless indispensable in order to establish the present tasks of the historical sciences. It does not seem to be too optimistic to assume that the focal point of the situation will be shifting from political problems to economic and cultural ones, and that in the socialist countries of Europe the idea of a national history will insist not so much on the history of the liberation and class struggles as on the history of the raising of the socio-economic level.

Of course, one can be sceptical about such assumptions but they deserve at least being treated as one of the possible variants of the situation and, moreover, a variant which cannot be dismissed by the historical sciences.

At least in some countries, the programme of teaching history and that of its propagation will, if this assumption proves to have been right, include the problems of economic history and the history of culture rather than those of political history. Such a pattern of the programme will make possible a better interconnection of the teaching of

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a research centre of the Ukrainian Academy of Sciences at Kiev since 1964. By employing an electronic computer they made an evaluation of projects of improvements of one type of coal-combine since 1932. Cf. „Badania historycznotekniczne a cybernetyka,” *Kwartalnik Historii Nauki i Techniki*, 1—2, 1965, pp. 14—15.

history with the science of society and other human sciences, as well as with the natural and engineering sciences.

Together with the disciplines which will be gaining in importance one can classify the history of science and the history of technology, which results from the increasing role of science and technology in the social and economic life and from the necessity to spread widely a scientific culture of mind. One can also expect that the interests of the young people will run the same course, *i.e.* that this kind of teaching matter will appeal to them with increasing strength. This process will cause that the behavioural patterns passed over with historical matter will be based increasingly on the scientists and technicians, because, for instance, heroship in the service of science will be better suited to the situation and thus will have greater educational advantages than heroship in battle and war.

Therefore, the historians of science and of technology will soon meet the educationally important tasks: the elaboration of these disciplines in such degree and such form that the teaching and the diffusion of knowledge could dispose of a sufficient stock of basic materials in the history of science and the history of technology, particularly in the latest history, and be supported by the discovery of such aspects and events in this respect which could have the strongest educational effect.

How these tasks will be fulfilled in different countries—as well as the tasks resulting from the needs of the science of science and the science of technology—will of course depend on their respective conditions but the general character of these tasks will be analogous in all countries.