

TRANSPORT AND SCIENCE

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Abstract: Transport was a symbol for the progress in science and technology in the 19th and 20th centuries and at the same time a priority field in applying their achievements. On its part, it has always been stimulating the development of research, innovation and economy as a whole. Nowadays transport is of great importance both for implementing the integration policy in Europe and the process of globalization.

1. Railways and automobiles as symbols of the 19th and 20th centuries

Of all technology innovations, the steam engine and rails illustrate most the economic progress in the 19th century. Before their invention the lack of convenient and comfortable transport hindered the industrial growth both in Europe and the USA. Railways overcame the limitation within the local markets, which offered small possibilities for specialization and extension of production. The new mode of transport not only provided faster and cheap transportation, but during the period of the most intensive railway network building (from 1830 to the end of the century) it stimulated the consumption of steel, coal, timber, building materials as well as the development of machine manufacturing as a whole.

Railways turned up the space-and-time vision of the mobility of people and conveyance of goods. Rails passed over rivers, crossed the mountains through tunnels and connected the shores of seas and oceans. Not separate lines but a common railway network was built in Britain and Western Europe and despite its length, it was successfully competed by the railway construction in North America.

The achievements in rolling stock development were also impressive. Although from a contemporary point of view it looks like primitive, during the time of its operation it was the latest novelty of science and technology. The huge steam engines possessed a power to reach a speed of 80 miles an hour, which went beyond the human imagination then. It was a jump concerning the rapidness of movement as up to the end of the 18th century it had taken the same time to move from a place to another as in ancient Greece.

Moreover, the borderline between the two ages faced much bigger challenges such as diesel and electric locomotives but they were not the main feature determining the 20th century as a new stage of human mobility. At first, it was characterized by the appearance of automobiles as a new symbol of scientific and technology progress. Their mass production changed the situation on the transport sector breaking the

monopoly of railways. транспортния отрасъл нарушава монопола на железниците. Soon the speed competition was joined by planes and after a few decades by rockets, both much surpassing all means of land transportation. The progress in the latest history can most clearly be presented by the acceleration of continental and transcontinental traveling:

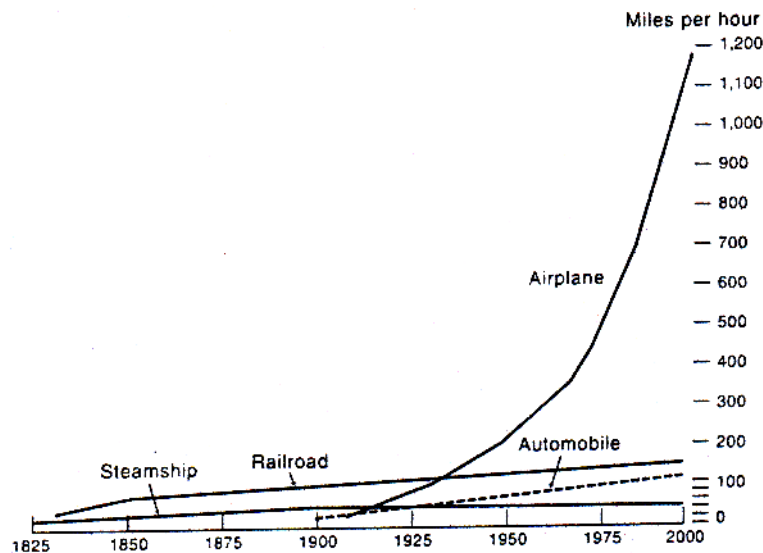


Fig. 1. Range of practical speeds

2. Education relevant to the level of science and technology

The development of the railway transport embodying the connection between science and practice put the requirement of higher educational level of the staff as well as in all modern sectors in the 19th century. The increasing needs of qualified specialists resulted in establishing engineering departments and even specialized technical universities. France was the first European country that made educational innovations in compliance with the industrial age. Of the newly-opened engineering schools, Ecole Polytechnique and Ecole Normale Superieure became the most popular ones. Although being outside the system of classical universities (reorganized for training professionals and officials by Napoleon), they provided not only modern education for university degrees but also developed a considerable amount of research. Their sample was followed everywhere in Europe (except for the Great Britain) and in the USA the alumni of the French polytechnics were those who established the Military Academy in West Point, the first American technical college.

As for Germany, the reforms carried out included both modernization of the existing universities and establishment of new ones. They borrowed much from the curricula and methods of scientific teaching of Ecole Polytechnique but unlike the French schools were accessible for much more students. Thus the country got ready for the time when science became a decisive factor of the industrial level. Because of that the Americans chose the German model especially to follow in the process of reforming their system of higher education in 1870s.

The engineering programs attracted international students as well, including some from countries like Bulgaria where industry and railways were making first steps. Graduated from technical universities in Western Europe and Russia, the specialists who returned occupied the leading position in railway network building and railway operation in the restored Bulgarian kingdom. The first line after the Liberation in 1878 Vakarrel – Sofia – Tsaribrod (1885-1888 г.) was designed and built under the supervision of Bulgarians most of who had got diplomas from prestigious higher schools. The main team of the newly-established national railway administration under the name of BDZ (Bulgarian State Railways) consists also of Bulgarians. The principle adopted in it was to appoint foreigners for once, with the lack of other applicants. That was the reason because of which the Ministry of Finance, including the Railway Department in its structure at first, to ask the Russian government to enroll about 10 Bulgarian students in railway programs at the universities in the empire. As for the middle- and low-level staff according to the classification accepted at that time, they were trained within specialized military department and later, after the World War I, at the State Railway School established in 1922.

The increasing requirements to the qualification of railway specialists, which was a common feature in Europe and the USA between the two world wars, resulted in changing the status of professional training in Bulgaria as well. With a decree from 1941, the State Railway School became a college giving an associate degree, which was awarded to all graduates during the previous 13 years. The main reason to take such a decision was the good level of training provided by the high-educated teaching staff at the school. The academic spirit existing there was kept by the 19 alumni of prestigious universities in Western Europe and Russia (from 31 full-time teachers and part-time lecturers in total).

It is important as well to note that the transition into an educational institution of a college type was not considered the final aim but a stage in the school development. That was proved by the decree, which provided a possibility for the excellent students to continue their studies at universities in Bulgaria and abroad on the account of the government. That corresponded fully to the universal view becoming more and more popular at the time that the effective participation in the new scientific and technological matrix would depend most on the degree of education. It was proved by the growing number of students in university engineering programs, including the ones coming from the less developed countries in other regions. However, many of them never returned to their native places, so the phenomenon called “brain drain” resulted in further increase of the difference in the level of the science and technology in Western Europe, the USA and the rest of the world.

The reforms in the Bulgarian educational system unavoidably affected the one of professional training as well. According to the Soviet model, the State Railway School was transformed to the lower level of a specialized technical school (technicum) although it did not meet the temps of the implementation of scientific and technological achievements in transport. That irrelevance was removed at the end of 1958 when the school was reorganized into Railway College giving the post-secondary degree of Associate after a three-year period of study. During the following more than two decades it was developing an adequate school equipment and traditions both in

teaching and research activities that grounded the natural transition to an institution of higher education in 1984.

Nowadays, in the process of the democratization of society as a whole and particularly of the educational system, the demilitarized in 2000 Higher School of Transport has been working successfully according to the new Law of Higher Education. The ambition of the teaching staff is to achieve the harmonization with the European and world standards required keeping the traditions and the good reputation of the school. The documents awarded, namely of the institutional accreditation and the certificate of ISO 9001:2000, have already objectified the first positive results towards the final aim. The next important step will be made soon: with the forthcoming acknowledgement as Transport University.

3. Science as a factor for transport development

In most countries the expedient governmental policy of railways construction and rolling stock improvement included the involvement of the national intellectual potential as a substantial attribute. A great number of the most famous scientists, engineers and specialists in building and machine manufacturing from Europe and North America reoriented and oriented their efforts to the field of transport field.

Railways present a typical example of the tendency symptomatic for the 19th century, namely the total penetration of science into practice. More and more the discoveries had been turning to be a prerequisite of the business development. That does not mean that scientists would leave the laboratories to go to factories, and vice-versa: that businessmen took up particular research problems. But the integration between scientists, engineers in practice and entrepreneurs became a necessity for a number of economic branches, including transport. The large-scale operations of constructing locomotives and carriages as well as of building railway lines required uniting many researchers and specialists in different fields under the coordination of managers. Having no relevant competence in engineering, they succeeded to direct the world scientific potential to the key problems of the production and operation of transport means.

According to the European model, the policy of governmental protection of railways became a basic principle in the restored Bulgarian kingdom. The development of the national railway network was a significant part of the whole course to the modernization of the country. It should be acknowledged that the railway officials with a university degree in engineering considerably contributed to the implementation of the transport projects. They were not simply competent specialists who worked selflessly in favor of the native country and society. Most of them were high-educated professionals who were trying not only to keep but also to improve their qualification by official and personal contacts with the institutions where they had received a university degree. The references from Western Europe and Russia in Railway Collection (the first specialized journal of that type in Bulgaria) showed the existing interest in the world achievements in science and technology and the eagerness to apply them if possible. Moreover, the journal published in 3 000 copies with the railway staff of 868 in 1996 had a strong impact on much mode readers than

the professional ones creating a favorable public opinion on solving the problems of transport.

The tendency to meet the European standards is a common feature of the railway policy carried out by all Bulgarian governments. With the chronic lack of financial resources, they could rely on the most important factor of the success of each activity: the national intellectual potential. Besides its official duties, the staff with engineering education in the system of BDZ were taking part in different forms of training where they were transmitting their knowledge and experience to the lower-level staff, were working on problems applicable in practice, were writing paper in the specialized and mass press and were developing volunteer activities in favor of the modern transport. The representatives of the railways were among the most active members of the Bulgarian Society of Engineers and Architects (BSEA), which was organizing and stimulating research in the period up to World War II.

Another public structure, although general in its character, is the Bulgarian Public Scientific Organization of Labour (BPSOL) established in Sofia by a group of prominent brainworkers. It appeared in 1929, only three years after the foundation of the International Committee of Scientific Management with a seat in Paris. The purpose of BPSOL was to rationalize the production process in big enterprises, so one of the committees established first and most active was the one with the Directorate General of Railway and Ports (DGRP). It is quite impressive to know that even before the experiments of E. Mayo in the factories of Western Electric in Hawthorn, that established the priority of human, the BDZ administration had already directed their efforts to both the selection of staff and the cares for people and their training. In fact, these two main principles in human resources management, had become a tradition in Bulgaria long before and they were figuratively in the second issue (1896) of Railway Collection: "The railway staff is, let say so, its soul because they give the pulse of this machine, which is complex and accompanied with big accidents, the right and useful development of the railways depends on the personnel and their reliability depends on the sufficient and rational number of people as well".

However, the public initiative in activating the intellectual potential turned to be insufficient for the development of science and technology in 1920s because their significance as a decisive factor in all social sectors had been increasing. It was necessary to establish administrative bodies to develop expedient national policy. The Bulgarian Railways Directorate was among the pioneers of this policy: in 1925 it established Scientific Committee on the purpose to organize competitions for theoretical and applied papers as well as specializations abroad. Although there were special regulations developed, the latter task was not completed due to the lack of financial resources. The few business trips were very short and on purpose (to participate in international forums, to purchase equipment, etc.) and the so-called "scientific" tours to examine the experience of the European railways administrations could not stand for the long-term training at educational and transport institutions.

The activities intended to make the national research in the field of transport more active were much more successful. In 1928 the yearbook called Archive of State Railways and Ports appeared and its purpose was to publish the papers that had won the competition and were mostly applicable in practice. To overcome the limits of the number of readers and the long period of publishing, the papers of greater importance

were adapted for printing in Journal of State Railways and Ports. Its circulation of eleven thousand (compared to the BDZ staff of 22 000 people) provided wide publicity of the Bulgarian scientific achievements on the background of the world tendencies in science and technology in the field of railways, transport and economic development as a whole.

The political changes in the country after the World War II imposed new organizational structures in the field of research and technology improvement. In 1950 the newly established Scientific and Research Institute of Transport (SRIT) joined the system of research and developing departments and organizations. It existed as a complex unit for 20 years, until accepting the principle of further specialization, when its railway departments were separated into Center of Research and developing activities (CRDA) with BDZ, which later was reorganized once again: into Scientific and Research Institute of Railway Transport (SRIRT). The publishing activities have increased rapidly: besides the books translated, there is a significant number of works, both monographic and in co-authorship, written by Bulgarian scientists and experts. The service of current information about latest news in science and technology has been carried out by bulletins, proceedings, etc., as well as by the popular journal Railway Transport, which has been renamed a number of times due to the administration reforms in the sector.

In 1960s the Railway College was developing more and more as another important scientific center in Bulgaria. The research activities of its teaching staff increased much after the reorganization of the institution into a specialized technical university called Higher School of Transport. The academic authorities established contacts with similar educational and research structures in the country and abroad although only within the Eastern-European region. There was exchange of students and teachers as well as results in research developed. The international scientific conferences organized almost every year since 1989 when the 100th anniversary of transport staff training in Bulgaria was celebrated are an attractive forum for a great number of foreign specialists in the field of transport. The number of the books published has been increasing as well as the participation in international projects within European programs.

The achievements of the Higher School of Transport in the field of science and technology are result of the developed creative potential of its teachers most of who are prominent specialists in their fields of research both in Bulgaria and abroad. The geographic range of their presentations, hence the school popularity, has been expanding by the increasing number of papers and articles published out of the country, participation in international websites and supporting bilingual Internet-site of the school.

In that respect the electronic scientific journal **Mechanics Transport Communication** gives a good possibility for all who work on their professional promotion in compliance with the policy of the Higher School of Transport to become a prestigious institution in the system of higher education in Bulgaria and Europe. The journal provides a modern connection with the world academic society. On their part, its members can obtain objective information about the research of the Bulgarian scientists and thus will be able to find reliable partners in solving the global problems of the 21st century.

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