

Beginning of Soviet Broadcasting and First Soviet Radar Projects as Example of State Influence on Innovations

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Abstract—High technologies develop successfully in those countries that create corresponding conditions: innovative potential, innovative climate, innovative culture. But the history of science and technology gives evidence of a deeper essence of innovative mechanisms. The paper will try to clarify this issue by addressing the Soviet broadcasting of the 1920s and the Soviet radar of the 1930s, state influence on innovations, linear and nonlinear (synergetic) model of innovative development.

Index Terms—broadcasting, radar, innovation, state influence, synergetics, history of science and technology, Soviet broadcasting of the 1920s, Soviet radar of the 1930s.

I. INTRODUCTION

Innovation theory is a young science. The main terms and concepts haven't been formed properly as they quickly become outdated. Lack of an accurate terminology database doesn't mean that innovations don't take place in real life and doesn't interfere with application of innovative approach in historical research. A famous economist Y. Shumpeter who developed his own theory of economic development in the 1930s, was the greatest contribution to development of innovation theory. He thought that changes constitute the specific essence of an innovation, and that the main function of innovative activity is change management function. Innovations as something introducing new elements (types, ways) into peoples' lives, and something increasing productivity of activity have existed for thousands of years. It is the most general and broad view at innovations.

Broadcasting is the innovation which received an embodiment in the form of the new products used in practice. Broadcasting appeared in the early 1920s as a technological innovation due to development of wireless communications. Later broadcasting was developing not only as a technological, but also as a social and cultural, political innovation.

Radar as a technological innovation became possible (in the 1930s) due to the development of VHF range and the invention of magnetrons. As everybody knows, rapid development of radar-ranging was caused by World War II. Two military tasks could be solved with radar: first, it became possible to warn when enemy planes were approaching, and, secondly, it became possible to measure target positions. The

range of peaceful application of radar (realized in 70 post-war years), as known, is huge and is constantly extending.

The traditional model of innovative process includes three stages: conception (idea), construction (idea implementation) and marketing (bringing a product to the consumer). Many factors influencing success of each stage, as well as innovations in general, are under study, judgment and detection of regularities.

The general potential contains as well as its main components – engineering and manufacturing, scientific and technical, financial and economic, personnel and the innovative potential itself representing the core of all potential and integrally being part of each component.

On the one hand the following statement is the fact that has obtained general recognition: "High technologies develop successfully in those countries where there are conditions suitable for perception of an innovation: innovative potential, innovative climate, innovative culture". On the other hand, the history of science and technology gives evidence of a deeper essence of innovative mechanisms. We will try to clarify this issue by addressing the Soviet broadcasting of the 1920s and the Soviet radar of the 1930s. There were no internal and external prerequisites for development of high technologies in the young Soviet state of that period. Theoretically Soviet Union had to be among the outsiders in regards of not only innovative, but also simple technological development. In real life, the Soviet Union successfully implemented a number of innovative projects and laid the foundation for future researches in space and nuclear power industry.

II. ROLE OF THE SOVIET STATE IN THE BROADCASTING PROJECT

The beginning of the Soviet broadcasting was comparable with the abroad.

Abroad. The first broadcasting station constructed under the leadership of F. Conrad started working in 1920 in Pittsburgh (the USA). The foundation to a regular broadcasting in Great Britain was laid by G. Marconi, BBC went on air in December 15, 1922. Broadcasting in Germany began at the end of 1923. Regular French broadcasting began in the early 1920s from the Eiffel Tower where the first radio station was situated. 1925 – start of regular broadcasting in Japan, etc.

Beginning of broadcasting in USSR. 1922 – Central Communist International radiotelephone station opens in

Moscow. 1924 – daily broadcasting begins taking place from Moscow. 1924 – experimental broadcasting started from Leningrad for the Northwest region. 1925 - local radio stations started working in 5 cities. 1926 – local radio stations were working in 30 cities. 1927 – 38 operating radio stations, 20 radio stations in a construction stage. 1929 –All-Union Central Council of Trade Unions 100 kilowatts radio station is constructed. 1930s – construction of powerful radio stations 100 kilowatts, 500 kilowatts; development of short-wave radio.

Broadcasting became one of the first successful state Soviet projects implemented along with the developed technological countries, at the time when USSR was in the conditions of political, economic, financial and scientific and technical blockade.

A few facts from history of broadcasting: 1917 - October revolution (slogans «Down with a monarchy!», «Long live republic!»), portraits of an imperial family were toppled, revolution, civil war; 1918 - civil war brought chaos and ruin; the wire telegraph is almost completely destroyed. Since November, 1917 new authorities had been using radio telegraph to transfer decrees of the Soviet government, Lenin's performances, news. There was a poor radio facilities (only 4 low power civil transmitting stations and 67 reception stations) at the disposal of post-telegraph department. It was not enough for huge territory of the former Russian Empire which extends across the whole of northern Asia and 40% of Europe, spanning through 11 time zones.

The Bolsheviks became owners of the huge multinational and multilingual, semiliterate rural country which had to be operated. What was to be done? Traditional means of propagation (meetings in cities, work of propagandists in village, distribution of newspapers) cannot be effective on such a huge territory. In 1918 Vladimir Lenin, the leader of October revolution, answered the question «What was to be done?». «We should find ways of direct dialogue with the most godforsaken peasant. Without bureaucratism, delays – in the solitude. And it will be made by the radio». Broadcasting («a newspaper without any paper and without any distance») is necessary for the young Soviet republic (as Lenin said). Thus, the head of the Soviet state, Lenin, initiated the creation of the Soviet broadcasting and constantly controlled this process. It was important in the conditions of total deficiency.

Despite insufficient innovative potential in the country, one cannot tell that the Soviet broadcasting arose from scratch. There were scientific and technical prerequisites, as well as radio engineers. There were A.S. Popov (radio inventor)'s successors from 1895; World War I (1914) served as an incentive to refuse from the foreign help and to develop domestic researches and manufacture. Success in manufacture of powerful radio stations and research of electron tubes was achieved. The first Russian generating lamps were constructed in 1914 by N.D.Papaleksi for the radiotelephone transmitter in Tsarskoye Selo. M. A. Bonch-Bruyevich's experiments (invention of «grandmother» lamp) were at radio station in Tver (1915-1917).

Revolution took place in November, 1917, and in several

months in 1918 the Soviet Union already headed for creation of the domestic radio industry (foundation of the first research and industrial centre «Nizhniy Novgorod radio laboratory» in Nizhni Novgorod). The best human resources, direct organizational and technical support from the first persons of the government (everything that was possible in the conditions of war, ruin and hunger) was mobilised. Different phenomenal achievements became a basis of material base of the Soviet broadcasting. They had been providing periodic broadcastings, since 1919 and regular broadcasting, since 1924.

1924. Beginning of regular broadcasting. The decision of the USSR National Commissioners Council (July, 28th, 1924) «About private radio receivers». Private users were allowed to have radio receivers, and radioamateurs were allowed to design radio receivers. Earlier similar activity was considered to be illegal. Decision stimulated expansion of industrial base on produce of broadcasting receivers.

Performances of statesmen became traditional for the Soviet broadcasting. Political propagation for some time had been an unique impulse owing to which the Soviet broadcasting was developing. Cultural motives were then added. [1].

1925. «The Radio News» newspaper questionnaire: What does the USSR await from the radio? The results: «From the radio I await more communication of the centre with the suburbs, of a city with a village, influences of the cultural centers on godforsaken places». Thus the radio conceived as means of a political propagation, became a conductor of knowledge and culture over the huge territory of Russia. Slogans of that time: «Listen! Moscow is speaking», «Radio at home, Radio-relocation – for rest!», «Radio receiver in each log hut-reading room, school and working club!». Thus the idea of Soviet state to use broadcasting in political purposes led to dissemination of culture in huge territory of semiliterate Russia and to phenomenal development of domestic technologies of broadcasting.

In the early 1920s the problem of electrification of the country was the most acute. On the posters of that time it is written: «Councils and electrification are the foundation of the new world». Some years later the need for increase of cultural and educational level of the semiliterate population of the country put problem installation of broadcasting system (especially in the village) to the forefront. It stimulated development and construction of the receiving sets, transmitting radio stations.

In 1927 the Soviet economists started developing the first five-year plan which provided complex development of all areas and use of all resources, including radio, for industrialization of the country.

«Who will win? To catch up and overtake» was actual slogan of that time. Fast pace of industrialization was dictated by external and internal conditions of development. The Soviet government thought that the country considerably lagged behind technically advanced capitalist countries therefore «it is necessary... to catch up and overtake these countries... in the technical and economic relation. We will achieve it, otherwise we will be pushed into the background».

Polemic was developed on the newspaper pages: what radio stations are necessary to the USSR, whether centralization is necessary, etc.

Young Soviet republic needed powerful radio stations for not only installation of broadcasting system in the country, but also for broadcasting for the whole world. It was necessary to make foreign audience familiar with the achievements of the first five-years soviet periods, to tell about socialist transformations in our country, to explain foreign policy of the USSR.

The USSR was in the political isolation, but not in the technical one. The Soviet press of those years contained a lot of information on technical novelties from abroad. There were constant sections in the Soviet technical journals, such as "From foreign practice", "The world radio screen". Technical information from abroad was most often reflected in due time and objectively without reduction of foreign achievements. Let's look, for example, at first page of the "Radio News" newspaper (on May, 17th, 1925). «Powerful Loudspeakers» is heading. «The American "Western-electrician Company" managed to solve the problem of speech reproduction. There is no distortion of sounds, there are no rattles. The voice can be distinctly heard».

III. ROLE OF THE SOVIET STATE IN THE RADAR PROJECT

In the 1930s radio began to play a large role in industrialization of the USSR and in an increase of its fighting capacity in anticipation of World War II. In the course of industrialization domestic aircraft and everything connected with it started to be developed at a fast pace and the problem of detection of planes in air too. Thus the foundation of the Soviet radar was laid.

The optical and sound devices of detection used at that time in the conditions of continuously increasing speeds and heights of flights ceased to cope with the tasks. Cardinal new decisions were required. «Crazy» idea (according to scientists in the field of distribution of radio waves and radio engineers) to use radio waves for detection of planes appeared at the military structures of the National Commissariat of Defense (NCD). At the initial stage (in 1932) two managements of NPO dealt with these issues – the Head Artillery Department (HAD) and Management of antiaircraft defense (UPVO).

In the 1920-1930s the theoretical background of microwave technology and radar had been established in the Soviet Union: research of VHF propagation over the earth's surface (B. A. Vvedenskiy, A. G. Arenberg, V. A. Fock, L. I. Mandel'shtam, N. D. Papaleksi, A. N. Shchukin); soviet scientists created various antennas (M. V. Shuleikin, D. A. Rozhanskii, I. G. Klyatskin, A. A. Pistol'kors are known world wide); V. V. Tatarinov, M. S. Neiman, B. V. Braude, S. I. Naidenko, G. Z. Aizenberg, M. A. Bonch-Bruevich worked successfully in the field of HF antennas; the first articles of the Soviet scientists devoted to magnetrons have appeared in 1924. Thus the first Soviet radar projects were based on domestic development in the field of studying of HF and VHF communication, radio engineering and radio physics, the

microwave electrovacuum equipment. Pre-war radar projects in the Soviet Union were not worse (and in some directions better) than the foreign ones.

Radio direction-finding experiment was on 3rd January, 1934. The Central Radio Laboratory (CRL) made this experiment in Leningrad in Rowing port at Kronshpitsa of Galernaya harbour. The seaplane was found out on distance of 600-700 m at height of flight of 100-150 m. Based on the figures, it was a small distance, however in essence it meant a lot as the experiment made can practically be considered the date of birth of a domestic radar and an initial milestone of its subsequent brilliant development. Many soviet research institutes joined in work. [2]. Some experimental radar developed in the Soviet Union in the mid-1930s (1935, «Burya»; 1939, «B-3», etc.). This equipment used the continuous radiation and cavity magnetrons. Professor Mikhail Bonch-Bruevich, the scientific director of research institution number 9 (RI-9), directed these works. Research and development cavity magnetron centimeter magnetrons was made by Alekseev and Malyarov, employees of RI-9 NF on instructions and handwritten drafts of Bonch-Bruevich and under his leadership. Long ago in 1929, Bonch-Bruevich patented the idea of oscillating systems consisting of many units, to increase the capacity of tube generators. Here he applied this idea to create cavity magnetrons. In the article «Getting powerful oscillations of magnetrons in centimetre wavelength range», published in 1940, Alekseev and Malyarov summed up their development (1936-1938).

James E. Brittain, Fellow IEEE, wrote the following on this occasion. Cavity magnetrons were one of the main innovations during the years of World War II. Brought to the USA in 1940 by the British mission led by Tizard, magnetrons were applied in various radar systems developed during war. The privacy fog surrounding these devices started dissipating a little unexpectedly with the publication of an article in March release of Proceedings of the IRE for 1944. It was an English translation of an article by Alekseev and Malyarov printed in the Soviet "Journal of technical physics" in 1940 under the name of the "Getting powerful oscillations of magnetrons in centimeter wavelength range" generating in the stationary mode the power of 300 watts at the wavelength of 9 cm. Their experimental magnetron reminded the English cavity magnetron on a number of signs. Though, obviously, this device wasn't known at the time to have impact on the work of E. Booth and J. T. Rendoll, who successfully tested their first cavity magnetron in February, 1940. Rather informed readers knowing history of development of the magnetron after 1940 probably were surprised that that article was not banned. [3].

By the beginning of war there were two types of soviet radar systems (RUS-1 with a continuous radiation and pulsed RUS-2) in the air defense army.

The disadvantages of state Influence on innovations shown in the first radar projects:

--First, duplication of many works and absence of objective criteria to choose the best results.

--Second, the State's (as customer) uncertainty in what radiation method to choose for radio detection – continuous or

pulse. It was a huge brake on the way of practical implementation of the first radar projects. Both directions were financed.

--Third, Priority of the military structures (not scientists and engineers) in decision-making. As shown in an above example it led to refusal of further development of the cavity magnetrons of increased power, to the fact that the unique results of works of Alekseev-Malyarov were made publicly available, and subsequently – to the USSR's need to purchase such cavity magnetrons abroad.

IV. IDEOLOGICAL ASPECT AS SYNERGETIC FACTOR

Characterizing in general two projects of the pre-war period about which I told, it is possible to recognize the Soviet state as a successful innovator. It mobilized all types of the resources influencing innovative potential and made what from the point of view of a classical (linear) model of innovations (even with a feedback) can't be explained. The modern scientific community widely shows the increasing commitment to nonlinear (synergetic) style of thinking. Synergetics arose in the field of physics and chemistry, then mathematic and quickly enough was beyond these sciences. Synergetics, by definition of the scientist who offered this term in 1970 for the first time - Herman Haken, is a «joint action», when a whole consisting of interacting objects develops new properties by creating social resonance and animated effect. Figuratively speaking, it is when two multiplied by two is not four, but six, eight and more, and when you add two atoms of hydrogen to one atom of oxygen and get water.

Moving in this direction, the Soviet state also became an effective innovator. Ideological aspects of Soviet state Influence on innovations became the synergetic factor which provided dynamic innovative development. Political posters of that time perfectly illustrate this thesis. Let's look at some examples.

«Staff is everything!». From the first days of its existence the Soviet state followed N. Machiavelli's saying, impacting people consciousness: "Never conduct troops into a battle until you raised their confidence and you are convinced that they are arranged well and aren't afraid of the enemy. Never begin the battle if you don't know if your troops believe in a victory".

Grand mass campaigns targeted at acceleration of socialist construction rates were developed. Attack went according to the rules of military operations with declaration of front lines: «front line of industrialization», «front line of collectivization», «ideological front line», «cultural front line», «antireligious front line», «literature front line», etc. It was offered to operate decisively on all fronts: «Down with kulaks!», «All to the library!», «Down with illiteracy!», «Down with religious holidays!», «With a mighty labor blow we will destroy bonds of devastation!».

«Technology into the large sections of the people!». The idea of mastering technology, developing of the creative beginning in all social groups of society was put by the Soviet state in the forefront. Slogans for workers: «Improve your

skills!», «Rationalize production and labor!», «Invent. Road to mother wit!».

The Soviet scientists and engineers were stimulated to penetrate deeper into production issues. For example, such poster «Your Lamp, Comrade Engineer ! (from office - into a mine, into a field)» and slogan «It is a matter of honor for the Soviet experts – to give their experience and knowledge to the socialist production!».

The high-powered work became especially famous. Socialist competition took root not only at plants, mines, collective farms, but also at scientific institutes. Huge attention was paid to the spirit of collectivism, consolidation of efforts.

Additional incentives for speeding up industrialization were economic and political isolation of the country, as well as the task «to shore up defences of the first-ever state of workers and peasants». Such slogans, as «There Are No Such Fortresses Which Bolsheviks Could Not Take!» helped Soviet people to gain confidence in implementation of the most difficult innovative projects.

The Soviet state took control of not only a labor time, but also of their personal time. Many posters and slogans reflected this subject - from the «Down with kitchen slavery!» till the posters about the creation of conditions for bringing up and educating children. Conditions for mastering knowledge, vocational training, improvement of cultural level, sports activities and technical creativity were created. The youth could learn the foundations of the pilot's profession, by being part of aero clubs: «Each collective farm, each plant will add a pilot to our air fleet!».

The Soviet state ideology put forward ideas of social justice and equality. It is not inheritance and property that matter. Achievements of an individual (education, qualification, talents, business qualities) matter.

V. CONCLUSION

Despite of all the difficulties, scale of social and economic transformations in USSR of the 1930s gave rise to the feeling of optimism, feeling of being part of a great era and became a source to the synergy promoting implementation of innovative projects.

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