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**WAYS TO FORM OF THE SCIENTIFIC-TECHNICAL PERSONNEL
RESOURCE IN AN ELECTRICAL MACHINE-BUILDING AT THE
KHARKIV ELECTROMECHANICAL PLANT DURING THE 1920S**

The article restores the general historical picture of the process of forming of the scientific-technical personnel resource in an electrical machine-building at the Kharkiv Electromechanical Plant in the 1920s, when within its implementation were developed appropriate ways, applied later by the Ukrainian branch of electrical machine-building in a whole. It has been established that only at the beginning of the 1920s this process was carried out systematically, taking into account objective and subjective conditions that make it possible to maintain the quantitative-qualitative balance of the studied resource at a level that enabling to ensure the outstripping paces of development of scientific support for the processes of creating electrical machines at the enterprise. Since 1924, the choice of ways to form an electrical machine-building scientific-technical personnel resource has become situational, focused on the current, rather than the perspective, state of the making process of electrical machines at the plant. In the absence of an adequate base for the training of qualified electrical machine-building scientific-technical personnel, this led to a shift in the quantitative-qualitative balance of the corresponding personnel resource towards its quantitative component, that which became the basis for the subsequent

extensive development of the factory sphere of scientific support for the processes of creating electrical machines.

Keywords: *electrical machine-building, electrical engineering, scientific-technical personnel, personnel resources, "practitioners", "re-qualified persons", scientific support*

ШЛЯХИ ФОРМУВАННЯ ЕЛЕКТРОМАШИНОБУДІВНОГО НАУКОВО-ТЕХНІЧНОГО КАДРОВОГО РЕСУРСУ НА ХАРКІВСЬКОМУ ЕЛЕКТРОМЕХАНІЧНОМУ ЗАВОДІ ВПРОДОВЖ 1920-Х РОКІВ

У статті відновлена загальна історична картина ходи процесу формування електромашинобудівного науково-технічного кадрового ресурсу на Харківському електромеханічному заводі впродовж 1920-х років, під час якого були напрацьовані шляхи його реалізації, застосовані пізніше в усьому українському електромашинобудуванні. Встановлено, що лише на початку 1920-х років цей процес проходив планомірно, із зваженням на об'єктивні та суб'єктивні умови, що дозволяли підтримувати кількісно-якісний баланс досліджуваного ресурсу на рівні, який надавав спроможність забезпечувати на підприємстві випереджаючі темпи розвитку наукового забезпечення діяльності із створення електричних машин. З 1924 р. вибір шляхів формування електромашинобудівного науково-технічного кадрового ресурсу став ситуативним, орієнтованим на поточний, а не перспективний стан виробництва електричних машин на заводі. В умовах відсутності адекватної бази для підготовки кваліфікованого профільного персоналу це призвело до зміщення кількісно-якісного балансу відповідного кадрового ресурсу в бік його кількісної складової, і заклало підвалини наступному екстенсивному характеру розвитку заводської сфери наукового забезпечення процесів створення електричних машин.

Ключові слова: *електромашинобудування, електротехніка, науково-технічний персонал, кадровий ресурс, «практики», «перекваліфіканти», наукове забезпечення.*

Introduction. In the organization of scientific support for the production of technical means, one of the basic roles is played by the quantitative-qualitative characteristics of that part of the personnel component of the scientific-technical potential of the relevant industry branch, which, in fact, is entrusted with the function of maintaining the effective scientific-technical development of the profile industrial activity. The level of powerful of the existing scientific-technical personnel resource to the same extent as the level of organization of its use determines the current-

perspective capabilities of industry branches and individual enterprises to manufacture products in the required volumes, quality, and accessibility that would meet the objectively presented requirements of scientific-technological progress. Thus, the problem of forming of this kind an effective resource always remains a key one in the measures taken to strengthen the industry branches and factory scientific-technical potentials. It is especially sharpened at the stages of intensive expansion of the specter of consumer requirements for products produced by the corresponding sector of the industry with a simultaneously increasing degree of knowledge intensity of these products. Based on the above, the studies of the experience of organizing ways to form a scientific-technical personnel resource in industry branches and enterprises mastering the production of fundamentally new science-intensive products have a permanently **actual**.

During the 1920s, in the Ukrainian SSR, as in the entire Soviet Union, one of the most knowledge-intensive industries with an intensively growing scope of its products was electrical machine-building. This was due to both the accelerated electrification deployed at that time by the Soviet government and the active development of the world's electrical science itself, as a result of which electrical machines received new consumer properties that made it possible to use them in more and more types of technical activities. However, the policy pursued by the central Soviet government in Moscow regarding the development of this industry in Ukraine initially ruled out its existence in this republic altogether, and by the mid-1920s it was changed to the concentration of such production in the Ukrainian SSR at the *Kharkiv Electromechanical Plant* (KhEMZ), which during selected chronological framework bore the names: *Elektrosila No. 1* (until 1925) and the *State Electric Machine-Building Plant* (until 1930). As a result, the remaining electric machine-building plants that existed on Ukrainian lands in the pre-Soviet period either ceased to exist in the early 1920s or changed their profile of activity, and new ones were created only by the end of this decade. Therefore, we can safely say that the trends in the ways to form the scientific-technical personnel resource of the entire Ukrainian electrical machine-building industry originated and developed precisely at KhEMZ,

and later were applied to other Ukrainian enterprises in this industry. This moment (to assess the Ukrainian branch policy regarding the development of a specialized scientific-technical personnel resource in the 1920s as a whole) makes sufficient the **purpose** of the proposed scientific work is to restore the historical picture of the passage of such a process at the KhEMZ only. The **tasks** to be solved, in achieving this purpose, are to determine the main sources of a complement of the studied personnel resource, general: the chronology and causes of their occurrence, as well as the trends laid down as a result of their use.

The historiographical analysis of the issue raised in this article shows that it has not been studied, and, to a certain extent, was considered only in the works of O.E. Tverytnykova [1–3] and in the second part of the collective monograph edited by A.A. Voznesenskyi "Essay on the history of the Kharkiv Electromechanical Plant" [4]. However, O.E. Tverytnykova paid attention only to the scientific and pedagogical workers of the Kharkiv Technological and Electrotechnical Institutes, who combined their activities in these institutions with research work at KhEMZ. And the monograph [4] mentions only individual outstanding specialists in the field of electrical machine-building, who worked during the studied period at KhEMZ, among which there are also the scientists considered by the previous one researcher. Thus, the total staff of scientific-technical specialists by factory's electrical machine-building, whose personal career data have come into the view of historians today, is no more than a dozen people, while according to the information about such specialists contained in the archive files of the plant [5–8], their the total number during all the 1920s was at least 168 people. That is, in historiography, the issue raised in this article in its entirety was not considered at all, and the individual data available in it are extremely scarce, and do not allow us to achieve our purpose.

Research methods. The study is based on the principles of historicism and objectivity, using the problem-chronological, comparative-historical and source studies methods, as well as the method of periodization.

Results and discussion. In 1919, there were only 10 people at KhEMZ scientific-technical personnel (STp), engaged in scientific support exactly of

electrical machine-building production. Of these, only two were graduates of the local Kharkiv Technological Institute (KhTI), who went to work at KhEMZ after, evacuating the plant from Riga to Kharkiv in 1915. One of the employees (A.A. Maize) did not have a higher education, since he did not have time to complete it before the evacuation of the plant, and the rest of the specialized specialists received their education in educational institutions in St. Petersburg or abroad. That is, before the beginning of the period we are considering, the recruitment of the electrical machine-building scientific-technical personnel resource at KhEMZ occurred mainly at the expense of specialists with higher electrical engineering education, but from KhTI the influx of such specialists began only after the evacuation of the plant. In small quantities (about 10% of the total number of STp), it was allowed to involve employees who had not completed their specialized higher education in the work on scientific maintenance of the processes of creating electrical machines at the enterprise. Meanwhile, it should be noted that in addition to V.A. Izyurov, who was educated in the USA and worked in the field of production and operation of traction electric motors until 1917 in this country and at the Dynamo plant in Moscow, the rest of the employees had no experience in independent design and introduction of electric machines in production. This is explained by the fact that until July 1917 the studied plant was a subsidiary of Allgemeine Elektrizitäts Gesellschaft (AEG) and before the start of the Great War it received all the new design and technological information it needed from Germany. The factory's electrical machine-building STp only controlled the introduction of the received developments into production, that, based on the essence of the introduction processes, reduced its scientific-technical work to clarifying the specific capabilities inherent in this enterprise to adequately implement these developments, corrected if necessary, the initial design and technological documentation in agreed with the developers corresponding changes [9, p. 309]. During World War I, when ties with the parent company in Germany were lost, STp KhEMZ was engaged in adapting the designs of those components and parts of electric machines produced by electrical companies of the allied countries of Russia, which, with minimal production

modifications, could be used in AEG electric machines manufactured at the plant, without worsening their consumer characteristics [10, p. 34]. In other words, in the pre-Soviet period, the experience in the scientific support of the processes of creating electric machines, which had all electrical machine-building STp of KhEMZ did not go beyond the limits of design support for repair and restoration production. That is why, an attempt by V.A. Izyurov to organize "from scratch" in the factory technical bureau the design of a traction electric motor ended unsuccessfully: the engine, although it was designed in 1918, but with very low technical and technological characteristics [11, p. 43].

All of the above gives us reason to assert that in 1920 the electrical machine-building STp of KhEMZ in all its mass, neither in quantity nor in quality, enabled the plant with the opportunity to organize the production of its own, rather than borrowed, designs of electric machines. Considering this factor, as well as: 1) the pace of accelerated electrification of the country taken by the Soviet government that came to power; 2) its aggressive opposition to the rest of the industrialized powers and the resulting need to eliminate dependence on them in providing the specified electrification with technical means, the question of the formation at KhEMZ, as the largest electromechanical plant in the former Russian Empire, of a powerful electrical machine-building scientific-technical personnel resource in 1920 acquired the most acute relevance. However, the Soviet government, guided primarily by the Marxist approach dogmatized by it to assessing the essence of the processes of territorial concentration of production, decided to concentrate electrical machine-building activities in Moscow and Petrograd, despite the fact that the production capacity of KhEMZ exceeded the capacity of all the plants supposed to participate in this activity combined. This allows us to assume that the lack of an appropriate scientific-technical personnel resource at KhEMZ, capable of at least to some extent independent scientific support for the processes of creating electric machines, played an important role in shaping the opinion among certain circles of the Soviet government about the need: either to close, or the transfer of this plant (again on the basis of a dogmatized Marxist approach to the issue of concentration of production)

into the category of an enterprise that mainly performs repair and restoration work of electric machines for the whole country [12, s. 1].

This formulation of the question determined the current way of forming an electric machine-building scientific-technical personnel resource at KhEMZ in the direction of strengthening its capabilities to provide scientific support for repair and restoration production. So, the requirements for the corresponding STp increased in terms of adapting the designs of the repaired machine elements to the existing production conditions at the plant, which led to the almost complete exclusion from the sphere of activities of scientific-technical workers of research and development work and their employment only in design-technological process. As a result, during the implementation of design work, the need of the plant for design engineers, determined by the production program, remained unchanged, and the need for research engineers was replaced by the need for process engineers, therefore, out of 4 HTI graduates hired at KhEMZ in 1921, only 1 had an electrical education, and the rest – in the field of general engineering technology. This trend did not change in 1922, as did the tendency to recruit scientific-technical employees mainly from among the KhTI graduates, as a result of which their share in the total number of the factory's electrical machine-building STp increased to 36% from 15.4% in 1920. However, by the end of 1923, the growth rate of KhTI graduates in the electrical machine-building personnel resource of KhEMZ decreased, which is explained by a change in government plans regarding the profile of the plant, which returned it the status of an enterprise for manufacturing new products. As a result, the question arose of the need to organize at KhEMZ in the near future opportunities to develop their own designs of electric machines, which, in turn, required an influx of specialized research personnel to the plant, the training of which was concentrated in Moscow and Petrograd, and from where they were distributed by the government to job in Kharkiv [5–8].

In 1921–1922 at KhEMZ, a tendency was laid to involve in scientific-technical work not only persons who are in the process of obtaining specialized higher education, but also those with secondary and even primary education. The last of

those mentioned were skilled workers and craftsmen, with impeccable experience in their workplace, as a rule, more than 10 years, and have based on empirically obtained knowledge technical proposals, rationalizing production processes. This contingent of scientific-technical personnel was called "practitioners", and their main advantage was perfect knowledge of the technological capabilities of the production equipment used by the plant in those areas of work where each of the "practitioners" had to work. This knowledge made it possible to accurately assess the technological possibilities of copying on the equipment already available at the plant of certain parts of repaired electric machines or their newly manufactured borrowed designs as a whole. As a result of such assessments, if necessary, STp KhEMZ made design and technological changes to the copied prototypes, which most often led to a deterioration in the consumer properties of electrical machines manufactured or repaired by the plant, but made it possible to save money on the purchase of production equipment and materials. This moment was especially important for KHEMZ during the period of a general crisis of factory production caused by social upheavals in the former Russian Empire, which stimulated the emergence of the phenomenon of "practitioners" in the process of forming an electric machine-building scientific-technical personnel resource of the enterprise. Their share in it in 1922 was about 13%, that is, in relation to 1920 it increased by 3%, however, due to the more influx of specialists with higher education over the next year, by 1923 it decreased to 7, 3%, that is, in relation to 1920, it decreased by 2.7% [5–8]. These data allow us to say that the fact that in the pre-Soviet period into factory's electrical machine-building STp the presence of one employee who did not have a higher education in was really accidental, and the conscious recruitment of such employees to strengthen this scientific and technological resource began precisely in the early 1920s and was a situational trend.

Without disputing a certain current economic benefit for KhEMZ in the conditions of the economic crisis from the presence in the factory's scientific-technical environment of a layer of specialists with exclusively empirically obtained knowledge, it should be noted, what their lack of deep theoretical knowledge on the

subject of activity does not allow their vast majority to cover the problems being solved complex, in conjunction with other problems that determine the possibility of achieving the scientific purpose. Hence, the growth in the proportion of "practitioners" in research teams invariably leads to an increase in cases of ignoring by developers of certain areas of projects the searching a latent factors of the negative impact of their decisions on the results of scientific and technical decisions of developers in other areas, which, as a result, very often does not allow achieving the originally expected from the developed results projects as a whole. It is for this reason that "practitioners", based only on their experience, simplified the processes of creating electric machines as much as possible: determining the geometry of the parts being designed not so much by operational needs as by ease of manufacture; excluding from production technologies many technological transitions necessary to preserve or improve the physical and mechanical properties of work pieces as superfluous; guided in the choice of structural materials, first of all, by their low cost and low labor intensity in processing. There technique methodic to a reduction in the cost of manufactured products and an increase in the productivity of the plant without significant technological re-equipment, although it contributed to the deterioration of the technical level and product quality. However, by gradually phasing out the elements of market relations introduced by the New Economic Policy of 1921 from the mid-1920s, the Soviet government eliminated the very possibility of competitive relations, thereby making demand a predetermined supply, which allowed KhEMZ to sell its workable products in increasing volumes without special attention to its quality indicators. In turn, the government itself pursued the doctrine of initially quantitative saturation of the national economy with electric machines, intending to make a transition to their qualitative improvement only in the future. Thus, during the second half of the 1920s, the filling of the factory's electric machine-building scientific-technical personnel resource with "practitioners" received an economic incentive and their share in the team of such workers by 1928–1929 increased rose to almost 37% [5–8].

Eight out of 55 "practitioners" accepted during the 1920s received a specialized higher education before 1930, although only 3 people who completed a full course of study at KhTI on the job (evening-correspondence form) can be considered to have received a full-fledged higher education learning. The remaining 5 studied at the two-year electrical courses of the All-Ukrainian Association of Engineers (VUKAI), that is, the amount of theoretical knowledge they received was very superficial, although it allowed them to apply their experience more meaningfully in the future [13, p. 34]. At the same time, half of the electrical machine-building scientific and technical workers of KhEMZ available in the staff did not even have a secondary education, which allows us to speak of the above model of applied scientific support for the processes of creating electrical machines as finally became established at the plant during the 1920s, the improvement of which was allowed, but the change - No. Moreover, this model confirmed its high efficiency in Soviet economic conditions when introducing at KhEMZ borrowed from AEG, according to the agreement on scientific and technical assistance concluded in 1925 between the State Electrotechnical Trust of the USSR and this concern, the production of a number of several electric machines, allowed to reduce costs on the equipment necessary for this [14, p. 43]. Cost reduction was achieved through the maximum possible adaptation of the design and technological data received from AEG to the production conditions already available at KhEMZ, which significantly narrowed the range of new equipment purchased.

A large amount of labor-intensive work to adapt various products to the conditions of production at KhEMZ, carried out throughout the first half of the 1920s, required an increase in the share of specialists in the general technology of mechanical engineering into the factory electrical machine-building personnel resource. Therefore, in parallel with the increase in the number of "practitioners" involved in scientific-technical work, in 1924–1926 KhTI graduates were recruited, mostly educated in this field of activity. And until 1926, almost 90% of the replenishment of the STp factory's team with narrow-profile specialists in electrical machine-building was carried out, as before, at the expense of graduates of higher

educational institutions in Moscow and Leningrad. However, the organization in 1925 at KhTI of the relevant specialized training at the Cathedra of Electrical Machine-building made it possible, since 1927, to train half of such specialists annually requested by KhEMZ in Kharkiv. The more volume of specialists the training potential that available at KhTI did not allow training, since its growth rate was significantly inferior to the growth rate of KhEMZ's need for scientific-technical personnel in electrical machine-building, which increased almost threefold in 1929 compared to the average annual need of previous years. This was due, first of all, to the sharply increased knowledge intensity of the processes of creating electric machines at the plant due to the development of foreign knowledge obtained by STp KhEMZ under scientific and technical cooperation agreements, first with AEG, and since 1929 with General Electric. In view of the lack of experience in the such STp, as well as the almost complete absence at the enterprise until 1927 of the necessary material and technical support for research work, with subsequent rather insignificant rates of its growth, the required speed of mastering the entire volume of knowledge received from foreign partners by the factory's electric machine-building scientific-technical personnel resource was achieved physical increase of this resource. This, in fact, led to the rapidly growing need of KhEMZ for specialists in electrical machine building, significantly exceeding in terms of its growth rates the objective possibilities of their training that existed at KhTI.

Conclusions. During the 1920s at KhEMZ established two ways of forming the scientific-technical personnel resource of the factory's electrical machine-building, which during this period increased from 10 people in 1920 up to 160 people in 1929. The first of them was a classic one - at the expense of specialists who received the appropriate higher education both at KhTI and other higher technical institutions of the USSR. The second became a derivative of the "Soviet" way of organizing the management of the development of industrial production, and consisted in attracting to the scientific and technical work of persons who had extensive experience in the field of materialization of an intellectual product, but did not know the methods of its creation - "practitioners". Graduated specialists, with the exception of individual

personalities, had no experience in designing electrical machines, since in the pre-Soviet period, domestic electrical machine-building was ensured by foreign scientific support. In addition, in Ukraine, until 1925, systematic training of scientific and technical workers in the field of electrical machine-building was not organized, as a result of which, until 1927, the KhTI graduates who replenished the electrical machine-building personnel of KhEMZ were in their vast majority specialists in general engineering, and the electrical engineering profile mastered already working at the plant - they became "re-qualified persons". During this period, KhEMZ received up to 90% of ready-made specialized specialists from Moscow and Leningrad, however, with the development of higher education in electrical engineering in Ukraine until the end of the 1920s, their annual volume was reduced by more than half. At the same time, the almost complete absence of specialized specialists with experience in the design of electrical machines in the factory's electrical machine-building personnel resource, a large proportion of "re-qualified persons" and "practitioners" in it, led to deterioration in the quality of this resource. The weak laboratory base of KhEMZ did not allow him to improve his qualification level directly at the enterprise, in connection with which 12.5% of the electrical machine-building scientific and technological department improved their qualifications by internships in 1926-1929 at AEG, and another 3.1% at VUKAI electrical courses. The somewhat belated start of organizing systematic training of specialists in the field of electrical engineering at KhTI led to the fact that until the end of the 1920s the institute did not create the necessary capacity of a specialized scientific and pedagogical resource capable of training a sufficient number of qualified specialists.

Thus, the choice of ways to form an electrical engineering scientific and technical personnel resource at KhEMZ during the period under review was carried out systematically only in the early 1920s, in accordance with the available objective and subjective possibilities to maintain its optimal quantitative and qualitative balance. This was due to the applied concept, according to which the pace of development of scientific support for the processes of creating electric machines had

to outstrip the pace of development of their production. However, by 1924 this concept had changed to the exact opposite, which made the choice of ways to form an electrical machine-building scientific and technical human resource situational, focused on the current rather than the future state of the production of electrical machines at the plant. In the absence of an adequate base for the preparation of a qualified electrical machine-building STp, this led to a shift in the quantitative and qualitative balance of the corresponding personnel resource towards its quantitative component and became the basis for the subsequent extensive development of the factory sphere of scientific support for the processes of creating electrical machines.

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