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STALIN`S INVENTORS: LEONID ZHEREBOV AND SOVIET PULP INDUSTRY, THE 1940S-1960S[2]

This paper examines Soviet engineer Leonid Zherebov, an inventor of continuous pulp cooker. After twenty-five years of experiments, Zherebov's design failed, and Soviet factories began to produce pulp using imported Swedish digesters. This article examines the biography of Leonid Zherebov and continuous pulp cooking in order to better understand the nature of Russian technological innovation and its failures. It emphasizes the communication between different institutions involved as well as a range of technological, social, economic and political factors. The paper contends that technological failures were emerged from the failure of Soviet forestry as a technological system due to a lack of open discussion between its builders and the scarcity of resources required for innovation.

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Introduction

Leonid Zherebov was a Soviet engineer who designed a continuous pulp cooker, an unprecedented invention for cooking pulp continuously. Zherebov was born in tsarist Russia in 1863. He graduated from Moscow University and gained first professional experience at a paper factory in Kamensk, not far from Moscow, and afterwards worked as a director at the plant. After continuing his education at Moscow Higher Technical School, Zherebov moved away from practical engineering and devoted his time to the theoretical examination of timber for manufacturing pulp and paper. He was among few researchers who continued to work under the Bolsheviks, managing to build an excellent career and escape the repressions of the 1930s. During these years, he received patents for his inventions and founded several educational and research organizations. For example, in 1926 he received a patent for producing galipot from resinous wood, a project he had finished eleven years earlier. [1]

The list of his achievements under the Soviet government is formidable: in 1919 Zherebov was a co-founder of the Moscow Institute of Forestry Engineering; nine years later he helped found the All-Union Timber Research Institute, which was subsequently divided into several institutions, including the Central Research Institute for the Pulp and Paper Industry (TsNIIB), the Central Research Institute of Forestry, and the Central Research Institute of Wood Machining. In the 1920s, he was involved in the scientific reforms initiated by Bolshevik leadership, which included the creation of a network of research institutions.[2] In 1938, Zherebov became the head of the All-Union Engineer Society of Workers of the Paper Industry. He received many awards for his research activities, including the Order of Lenin and Order of the Red Banner of Labor for deeds that served the Soviet state and society. In the volume celebrating the hundredth anniversary of his birth, his students and colleagues wrote that his life "was full of creative search which all was aimed to develop paper and cellulose, hydrolyzed, and wood chemical industry." [3]

Indeed, Zherebov worked on different aspects of wood chemistry and pioneered uses of wood in industrial production. One of his major inventions was a method for the continuous cooking of pulp, which he proposed as early as 1884 in an article on chemical aspects of manufacturing sulfite pulp. His idea was similar to Kamyr in that it moved raw materials through the digester with the ability to regulate the temperature of cooking throughout the apparatus. The key difference between Swedish and Soviet inventions was related to the temperature and time needed for mass to move through the digester. In Zherebov`s model it took only 20 minutes, as the digester worked at very high temperatures, ranging from 200 to 220 C^0. To compare, the

Kamyr digester required about 60 – 90 minutes at 170 degrees, while batch cooking used lower temperature and took six to seven hours to produce cellulose.[4] However, the project remained on paper until the early 1930s when Zherebov managed to find support for his invention from the Soviet leadership. This was a period when the Soviet government tried to develop new technologies and industries, as well as significantly increase the production of pulp and paper. While the same search was happening in other counties, in the USSR the problem of pulp production was considered urgent at the state level.

Although right after the revolution the Bolsheviks chose to industrialize Soviet industry rapidly, the number of new pulp plants remained small. In the pre-war period, several factories were constructed near water basins in forested areas, including Balakhna in 1925, Kondopoga in 1929, Vishery in 1931, Maryisk in 1938, Segezha in 1939, and Solikamsk in 1941. To a large extent they were equipped with foreign technology, and launched the construction of dependant industrial mono-towns near them.[5] The capacity of these new plants, however, did not match that of the rapidly developing international pulp industry. Despite huge forests, the Soviet pulp and paper industry processed only five percent of cut trees, while the American industry used 35 and the Canadian 40 percent of wood.[6] Also, archival materials often show new plants as miserably undersupplied and lacking modern equipment or experts. For example, plants were often built in areas that were rapidly deforested and, thus, were a long distance from supplies of wood. Compared to many other industries, before WWII the pulp remained rather marginalized.[7]

However, Zherebov`s method was supported by officials at the highest level. The invention was unique in the context of Soviet policy in innovations: Zherebov was one of few scientists strongly supported by the state in the non-military industry. Although the construction of digester resistant to high temperatures was expensive, it could satisfy two needs of the Soviet government: solving the problem of insufficient and bad quality pulp, as well as the shortage of labor, since the new technology reduced the number of workers needed in a pulp factory.[8] Batch cooking did not allow engineers, research institutions and, finally, the main consumer of pulp, the Soviet state, to fulfill set aims and norms of production. Therefore, Zherebov offered a promising invention, one which could help improve the performance of pulp production and to some extent contribute to Stalin`s ambitious tasks in surpassing the West and make the country the leading inventor in the world.[9]

The initial experiments done by Zherebov himself were quite successful: first, at the Moscow Central Heating and Power Plant and then at the Dobrushsky Pulp and Paper Plant in Belorussia in 1936. There he constructed an experimental digester and managed to produce pulp of good quality via continuous cooking. Three years later, a new pulp and paper plant in L`gov began production by continuous method. As early as 1938, the head of the People`s

Commissariat of Forestry Industry Mikhail Ryzhov (who would die in the Stalinist repressions just few months later) issued a decree ordering that the method must be turned into industrial use throughout Soviet industry. Following this decree, nine years elapsed in which the industrial launch of the cooker was apparently forgotten. The reason was likely the Second World War, since military actions in Soviet territory resulted in immense damage to factories, the evacuation of research institutions, and left industry in disarray even after the war's end. The destiny of the experimental digester seems to be unknown, but it is probable that it was lost or deconstructed in the war period.[10]

In the era of overt tension with capitalist countries and intensive militarizing on the eve and after WWII, the Soviets became more concerned with producing pulp for military purposes. In these terms, the pulp industry gained more meanings and became of higher priority than before. As Bruce Parrott notes, the Soviet technological strategy defined its foreign politics.[11] Some authors even contend that, Soviet leadership initiated the war with Finland in order to receive its modern industrial capacities for pulp and paper production near the Finnish-Soviet border.[12] Indeed, during WWII the Soviet Union annexed several plants on the Karelian peninsula and Ladoga Karelia, as well as factories in the Baltic States and Japan.[13] However, because war actions caused a significant damage to the enterprises when the Finns evacuated machinery (which was returned gradually after the war, but often installed very chaotically), the annexation did not automatically bring a radical improvement to the Soviet pulp and paper industry. It was clear that improving existing technology would be more efficient than expanding production via new factories. As a result, introducing intensive methods of pulp production was seen as a priority and encouraged by state officials. The ministry decided to continue Zherebov`s project and recognized it now as "the towering achievement of a Soviet scientist."[14]

Implementing Zherebov`s method after WWII

Two years after the war, the Minister of the Pulp and Paper Industry Leonid Grachev published a decree on Zherebov`s invention. It stated that now "it was urgent to create an experimental digester for continuous cooking of pulp", and then put the experiment into industrial production immediately.[15] For these purposes, the Ministry allocated a large sum.[16] If Richter gained support from a private company, Zherebov`s idea was supported by state officials, who would play a leading role in organizing and controlling implementation of continuous cooking after the war. The invention was registered as an author right (*avtorskoe svidetel`stvo*), the basic form of intellectual property which inventors could use in the Soviet

Union. It implied that the inventor, as Soviet sources formulated it, "relied his idea to the Soviet society" (practically, the state or, more precisely, to institutions responsible for innovating). The author right meant that the inventor was recognized as an author, could work on his project, but was not an exclusive owner of the invention.[17] The project was, from the beginning, monopolized by the state, supporting the argument that "resource allocation and decision making in the USSR were significantly more centralized than the mobilization of science in Nazi Germany and in Japan under Hirohito."[18]

Thus, not Zherebov, but ministerial officials selected the location for the first industrial application of pulp by continuous cooking, the Enso (in 1951 its name was changed to the Russian *Svetogorsk*) pulp and paper plant. It was located on the border with Finland and annexed by the Soviet Union after the Finnish-Soviet war in 1944. This plant was chosen probably because of its capacity and comparatively modern equipment, as the former owner - Finnish company Enso-Gutzeit OY – had completed a basic renovation of the facilities shortly before the war. As a result, it was the most updated plant in the Soviet Union, despite all the new factories constructed in the previous decade.[19]

The Ministry assigned the responsibilities for experimenting with and implementing continuous cooking to the plant`s administration. However, in post-war Enso, the intentions of Moscow did not incite strong enthusiasm, since they required finding qualified engineers and proper raw materials. After the war Finland returned evacuated equipment, but there was still a problem with installation, finding additional equipment, and locating engineers capable of working with the new machinery. In addition, damaged equipment required maintenance, but not all the parts and components were manufactured in the Soviet Union. The first Soviet chemical machinery factories were launched in the late 1920s, but they could produce only some technical parts because of a lack of technology and facilities.[20] Large-scale production of chemical equipment commenced only in 1942, when the Research Institute for the Construction of Chemical Machinery was founded with the task of renovating old plants and constructing new equipment. Its capacity was not sufficient, and in 1960 a new plant was opened in Petrozavodsk to manufacture equipment for the pulp and paper industry. This was a result of the 1960 Soviet campaign to overcome the backwardness of the pulp and paper industry. Still, manufacturing pulp producing machines and parts was a significant problem during the whole Soviet era and required technological improvement.

To provide expertise, a technical college was founded in Svetogorsk, the settlement nearby the plant (later, an industrial town). Most lecturers came from factories and universities in Leningrad, a technological center that also delivered newly minted engineers to the plant. Local engineers, in particular those who worked in the scientific-technical society (*nauchno-*

tekhnicheskoe obschestvo) had ties with Leningrad`s research organizations, including the Central Research Institute of Paper and Pulp (TsNIIB). Such societies were voluntary organizations in many factories, with a general aim of assisting technological progress and improving production.

Some members of the society, a small group of engineers, shared the main responsibility for the project. They included the head of the plant, Afanasii Sil`chenko, chief engineer Konstantin Malyshkin, three more engineers, and twenty skilled workers who played technical roles and maintained the digester. The specialists and workers were to participate in the project alongside their main work. [21] In the first years of the project the supervision was conducted by Zherebov's construction office located in Moscow and the Central Administration of the Sulfite Cellulose Industry or Glavsulfittselliuloza (in 1948 changed to the Central Administration of Cellulose Industry or Glavtselliuloza).

Although the Ministry initially decreed that the project would be fulfilled within one year, in 1947 it failed. The main reason was a lack of technical parts and equipment. The Ministry board blamed the factory's leadership, claiming that they had an irresponsible attitude towards the project, i.e. "the most significant innovation of Soviet science". In addition, the head of Glavsulfittselliuloza Malytin wrote to the head of the plant that "to a large extent, the delay in implementation of continuous pulp cooking is happening because of you." Malytin specified that the leadership of the plant "did not take any concrete measures to order the equipment."[22] Sil'chenko explained that he was not able to find the appropriate parts as they were not produced in the Soviet Union. As the historian Donald Filtzer shows, Soviet "engineering factories, that made machines, simply did not make the spare parts for them," and even some construction enterprises functioned at the time. It was much easier to acquire a new machine than a spare part for an old one.[23] In fact, the plant requested permission to import equipment from Finland, which had close trade connections with the Soviet Union.[24] However, purchasing parts from abroad was not a simple task and required the involvement of the State Committee on Introducing Modern Techniques to the People`s Economy of the Soviet Union and organizations of foreign trade. Moreover, finding the parts required identifying appropriate suppliers in foreign professional literature, requesting help from engineers who had travelled abroad on research trips, or soliciting foreign companies, then negotiating with foreign partners on the inter-state level. Getting parts thus included considerable negotiation, followed by long delays.

I could not find data regarding where the Enso plant found spare parts, although there were a number of suppliers of foreign equipment to the Enso plant in the following years.[25] In 1950, the plant received some tools for an experimental digester, but the launch was delayed because other necessary parts were missing, in particular high-heat pumps. In October 1950, the

Minister issued a new decree, complaining that the work of implementing continuous pulp cooking was moving at an "impossibly slow pace."[26] In response, Sil'chenko said that "the plant was not blame." He specified that they now lacked expertise, as the skilled engineers in the plant as well as the workers lacked training in continuous cooking and simply did not know what to do with the new equipment.[27] This problem seems to concern not only pulp cooking, but present a general lack of training in the industry. Thus, a local newspaper contains dozens of notices published by specialists and workers who complained that some did not want to learn new technologies and did not know how to work with modern machinery.[28]

In 1950 an anonymous report (probably prepared by one of specialists who worked on the project) on Zherebov`s digester observed that "there was no any sign of motivated research."[29] Other engineers complained, "The digester was a secret project, and it was not discussed widely by other specialists of the plant. There was a narrow circle of people who solved all the questions."[30] Indeed, in trying to launch a revolutionary technology, the Soviet leadership was eager to keep the digester secret in order to prevent its leak to the West. This might explain why even despite having no resources for the development of the technology, the Ministry did not seek foreign expertise openly. Instead, during the first three years of the project, all the responsibility was put on domestic potential – specifically, on a small group of engineers working in the plant. As mentioned above, pulp was a dual-use technology and had shared purposes with military industry. The Soviet Union had a large military sector, and hundreds of factories "produced dual-use products which were immediately capable of or easily adaptable to defense use."[31] In this sense, the plant in Enso/Svetogorsk was a periphery of the military-industrial complex.[32] As a result, the flow of information about technology was complicated. This issue appears often in local documents as criticism and explanation of why the project did not work in practice.

The group of specialists worked on the digester had connections with Zherebov`s development laboratory in Moscow, which dealt primarily with improvements to the initial project. In the early 1950s, a specialist from the laboratory, Khutolev, came to the plant, but his participation, as some local engineers complained, was not active enough.[33] In the same year, the administration of the plant tried to initiate an agreement with the Leningrad branch of the Research Institute of Chemical Machinery in order to find help in implementing Zherebov`s project. The institute responded by saying that they did not have specialists able to fulfill the task.[34] However, archival sources demonstrate that slightly later this institute did work on continuous cooking, using Finnish machinery.[35] This story illustrates the competition between different institutions in the Soviet Union; specialists of the research institute who were not

formally responsible for implementing Zherebov`s method, did not feel obliged to share their experience with the Enso plant.[36]

In 1951, the Ministry assigned the above-mentioned TsNIIB the task of assisting with implementation.[37] The institute`s engagement in Enso/Svetogorsk was not initially very active. For example, engineers at the plant tried to find technical literature on continuous cooking from TsNIIB, as the local library was not equipped with papers on the method. It seems probable that works published by Richter were not easily accessible, although specialists on the project were aware of the inventor. And despite the fact that the Enso project was supported at the highest level, the plant did not receive detailed materials or instructions on Zherebov`s method. The documentation given by Zherebov`s research board was enough to explain the basic principles of his complicated technological process, but could not provide the answers to specific questions. In 1951, in a letter to the head of TsNIIB Sergey Puzyrev, Sil'chenko wrote that from all the materials on continuous cooking "there was only a project of installation of digester and a short technical description."[38] It is noticeable that the letter was marked as secret and proved that only few people knew about the project. Using his position as the head of the plant Sil`chenko asked for the loan or purchase of technical literature on continuous cooking. In particular, he asked about articles by Richter which, he assumed, should have been in the institute's collection.[39] The answer from Puzyrev was rather astonishing; he indicated that there was translation of a paper by Richter and Otto on continuous cooking, but that he could not provide a copy. The reason, Puzyrev explained, was that there was only a single copy of the required volume and all the typists were too busy to make a duplicate.[40] As a result, it was only possible to read the book in the reading room of the library. I cannot say if Sil'chenko finally found the articles elsewhere or managed to get a copy from the institute's library, but crucial here is the strong divide between the industrial organization and research institution, even when both were assigned to work on the same project.

This case is more indicative if to remember that the cooperation between Enso/Svetogorsk and the Institute happened in the context of a state program on strengthening connections between research and production. However, it was not a successful project, a fact recognized by the administration of the Institute. As Larin, the vice-head of the scientific department of the Institute responsible for the relationship, said in 1951, "in the first years of cooperation there were significant problems. In particular, specialists of the Institute simulated their activeness in this deal and just came to plants to give lectures and papers, sometimes even not strongly connected thematically with the pulp and paper industry."[41] Larin also stressed that excessive technical aid to factories might distract specialists from "pure theoretical research" (here he probably meant the investigations of research scientists). This conclusion contradicted

his critics, by expressing the unwillingness of researchers to work in industry – a fact illustrated the pattern of communication with Enso/Svetogorsk described above. As Kendall Bailes noted, industrial scientists generally visited factories only occasionally in order to give instructions and left soon thereafter.[42]

During the summer of 1951, the engineer-in-chief of the plant Konstantin Malyshkin corresponded with Glavtselliuloza complaining about a lack of machinery and electrical equipment needed for the upper section of the digester, despite regular requests to the central offices for industrial management.[43] The typical answer he received said that "there are no facilities in the warehouses" and at the same time a contradicting statement "take decisive measures to finish the works."[44] All this produced delays in launching the digester, first until late 1951, then into 1952. The digester was finally completed in December 1952, but its functioning revealed defects, mostly because of improper assembly. In particular, the testing devices did not work correctly because of mistakes made during installation. The head of the State Committee on Science and Technology, the organization responsible for science and technological development in the Soviet Union, wrote that quite often assessments of Svetogorsk machinery were mostly done by eye and depended on the qualification and experience of operating personnel.[45]

In 1953, the plant received additional funding to finish the project and start industrial production.[46] This meant that the state was still investing its hopes in the project, relying on the existed resources. In 1953, Malyshkin reported to the Ministry that the digester was checked and installed, but again described a number of technical problems.[47] In the following two years, engineers were involved in repair and attempts to overcome deficiencies in the equipment.[48]

De-Stalinization and the end of the project

The Khrushchev era encouraged the society to express their views more openly including some topics, the change called the "thaw".[49] As John Barber et al indicated, in the de-Stalinization era secrecy was reduced and basically limited to defense and national security.[50] It influenced the digester project, particularly as the participation of TsNIIB became more active.

So, in 1955, when the Zherebov`s digester was installed, specialists in Svetogorsk made one more attempt to launch continuous cooking as an industrial process. It was now technically successful but failed to produce pulp of good quality. The basic problem originated from the impossibility of cooking pulp at 200 degrees necessary to produce mass of good quality. To examine the failure, a group of specialists from TsNIIB visited the factory in December 1955.

After inspection, they organized a joint meeting in Leningrad with the engineer-in-chief of Svetogorsk, Konstantin Malyshkin, to discuss the results of the trip. Among other issues, the specialists stressed technical foul-ups and mistakes made while installing the digester. Thus, in her report, Institute specialist Galina Kosaya complained that the digester was installed completely improperly by factory engineers.[51] As previously, Malyshkin said in response that the problem was in the bad quality of Soviet parts, and control instruments that did not function properly. For example, he asserted that the engineers in Svetogorsk did not have a functioning apparatus to use as an example for important parameters or the cooking time of pulp in the digester.[52] Indeed, the digester was a closed apparatus in which loading, cooking, and washing were done simultaneously – making the use of automated controls extremely important in managing the complicated process.[53]

In early 1956, yet another delegation came to Svetogorsk to check the digester, this time comprised of engineers and managers from administrative institutions including the State Committee on Science and Technology, the Ministry of Machine Making, and the Ministry of Paper and Wood-Working Industry. They concluded that construction was done mostly on the basis of existing materials borrowed from the other parts of the plant while the quality of pulp was low and did not meet standards.[54] The delegates decreed that the digester had to be fixed by May 1956, but it was now also important to introduce and investigate the continuous cooking digesters already installed and operating in Sweden and Finland. They recommended the engineers in Svetogorsk intensify their study of a Kamyr digester already purchased from Finland in 1955, installed but still not functioning in the Marysky pulp and paper plant – one of the most updated Soviet factories at that time, but located quite far from Svetogorsk.[55] The commission said that travelling to Finland was urgent in order to examine their digesters and speed up research in the Soviet Union. It was also important, they said, to send some experienced engineers from Svetogorsk to the Marysky plant to assist in launching a Kamyr digester there. Finally, "it was necessary to investigate thoroughly this digester and transform this experience into Zherebov`s parameters."[56]

This trip to check the plant seems to be among the last attempts from the leadership to introduce Zherebov`s method, and shows the turn on the part of the Ministry and related institutions toward transferring foreign technologies instead of developing domestic variants. Indeed, in 1955, the Kamyr installation was purchased by the Soviet Union, its investigation was included in the chief plan of development and implementation.[57] The purchase of foreign technology was the result of the state's campaign to achieve rapid modernization to large extent based on foreign experience.

Starting in the mid-1950s, the state turned to a strong critique of the project. In May 1955 at the meeting of the Central Administration of Cellulose Industry, vice-chairman P. Alekseev stressed that the reason of why it took so long to deal with the project was the fault of Ministry passivity.[58] A year later, the State Committee on New Techniques reported to the Council of Ministers of the USSR that the Ministry of Paper and Wood-Working Industry lagged behind in introducing new technologies and techniques. They admitted that twenty years ago Zherebov's method had been presented to the Moscow branch of the Central Research Institute of Pulp and Paper when there was no analogous research abroad. They stressed that the Ministry issued more than twenty decrees on the method, as well as included it to the state plan on techniques five times, and the total cost of the project was more than 20 million rubles, a large sum, but all this had zero effect.[59] In addition, they stressed that much later than in Enso/Svetogorsk, similar research was launched abroad and became widespread in Sweden, Finland and the United States.[60]

In these conclusions, given by industry administrators, we see responsibility put on the Ministry for its inability to supervise research, as well as the idea that Zherebov`s method came before more successful foreign experiments. Accusing the administrators of institutions, ministries or factories was a typical strategy in the Soviet industrial sector and reproduced the idea of bureaucratic irresponsibility. In this story, indeed, we see that the role of the Ministry in charge of the digesters was limited by decrees and resolutions, while the special board of the Central Administration of Cellulose Industry should have not provided expert and technical assistance. In many cases, neither this organization, nor the research office of Zherebov or TsNIIB provided much assistance to the Enso/Svetogorsk engineers.

1956 was also a turning point in the interactions between the institutions involved in the project. In August, a three day debate was organized in TsNIIB in Leningrad, involving not only specialists from the Institute and the plant, but also a wider group of participants, including professors from the S.M. Kirov Forest Academy in Leningrad and specialists from Zherebov`s office and the Research Institute of the Chemical Machinery. The decision to organize a general discussion was probably seen as a matter of urgency because the engineer-in-chief of the Svetogorsky plant was not notified about the format of the event. As he said at the beginning of his presentation, he did not expect to see so many people in the room and had anticipated a small group of specialists as before.[61]

The meeting publically exposed a conflict between specialists from different institutions which centered on the basic point of Zherebov`s invention – the temperature of cooking. It was the first time that Zherebov`s method was attacked as such: in particular, specialists from TsNIIB heavily criticized his innovative idea for cooking pulp at above 200 degrees. One of them,

Nikolay Rosenberg, argued that the project was not successful because the technical parameters of the digester could not be implemented in practice. He stressed that the Swedish company Kamyr could produce digesters on a by-order basis, but even they would not guarantee the digester if it was used to cook the pulp above 200 degrees as Zherebov insisted.[62] He concluded that Zherebov`s idea was impossible and proposed to construct a new digester based on a more rational approach. Zherebov, who had been supported by the Ministry for two decades, now seemed to have become an object of strong critique. Rosenberg was the first to attack the construction of the Svetogorsk digester not only because of problems in installation, but at the level of project design. As a result, he persuaded the audience that Zherebov`s project was unpromising, time consuming, and had become a goal in and of itself rather than contributing to real, functional, applied industry progress.[63] His presentation ended in outcries from the audience, demanding that Zherebov be invited to the meeting at once.[64]

Indeed, Zherebov arrived at the meeting the next day to deliver a public answer to Rosenberg. In his rebuttal, he asserted that in the past he had successfully cooked pulp at temperatures over 200 degrees and the failures of the digester in Svetogorsk were caused by improper construction (done by the plant and supervised by TsNIIB), rather than his method itself. He blamed the Institute, arguing that they wanted to stop implementation because of cost and time, but stressed the significance of his invention for the future. "No one engineer has a right to refuse from a project even if he failed more than twice," he said while contending that the Institute did not observe the conditions for proper installation.[65] In addition, Zherebov accused Rosenberg of interfering in the experiments at Svetogorsk, of changing the technical parameters of the project, and lowering the cooking temperature.

The meeting also exposed why Zherebov had little role at Svetogorsk. Indeed, I could not find any indication of his presence in local sources.[66] The absence was noted by the head of TsNIIB Sergey Puzyrev, who asked why Zherebov had not come to Svetogorsk and did not communicate with scientists before the 1956 meeting. Zherebov replied that his invention was of secret character and he felt obliged to be cautious, but also complained that TsNIIB monopolized the project and its oversight, excluding him deliberately from visiting the plant. Zherebov wanted Soviet engineers, rather than foreign experts, to complete the project.[67] In its turn, TsNIIB argued, backed by support from the Ministry, that Zherebov had monopolized the project and did not allow anyone to enter Svetogorsk.[68] These accusations illustrate that Svetogorsk`s engineers had to work alone, without the support of the research organizations theoretically involved in installing equipment at the factory. The explanation emerged from how the author of an industrial innovation had no responsibility to work on his project himself. In practice, we see that

neither TsNIIB nor Zherebov`s office (both state organizations) took an active part in the project, but all accused the other in monopolizing the invention.

Some recognized specialists from other institutions, such as Iurii Nepenin (the docent of the S.M. Kirov Forest Academy in Leningrad), that were not involved in the project, supported Zherebov and his method, although their number was quite small. However, those who participated in the practical implementation of the project were highly critical. Malyshkin, for example, stated loudly during the meeting that wood cooked at above 200 degrees produced dung, not pulp. [69]

Generally speaking, the argument at the meeting was divided between so called theoretical scientists, who conducted successful but limited experiments in their laboratories, and applied scientists, who were not successful in translating these experiments into industrial practice. The conflict seems to have arisen from how communication and labor were distributed during the project's construction. For example, if a part or technical aspect of the digester malfunctioned, the plant would replace it – but these engineers did not have a sense of the project as a whole, a matter relegated to the theoreticians. This division emerged from a larger conflict between research institutions that were generally isolated from each other and unable to communicate effectively. In practice, both Zherebov`s office and TsNIIB worked separately, and the meeting in 1956 was among the first joint discussions of the project.

Many participants said that it was important to discuss the digester project widely, since achieving such a technologically complex project in secret made any success hard to prove. The specialist Korotkov admitted, "it is ridiculous, but there are many rumors… many say the digester for continuous cooking is the digester of continuous repairs and reconstructions".[70] The need to publicize scientific knowledge to a large audience was part of a larger trend in the twentieth century, which saw science and technology become much more international. As Joseph Berliner argued, if the state did not participate in international intercourse, it lost in the promotion of technological progress.[71]

In its conclusion, the 1956 meeting decided that the "existing technological equipment of the Svetogorsk digester is not promising because of improperly executed construction and cannot be used for the creation of domestic digester for continuous cooking... This is why further work on the digester is not reasonable and must be stopped."[72] The meeting concluded that the Leningrad Research Institute of Chemical Machinery should work on a new project and present it to a wider audience.[73] It is probable that the decision to stop the project was also connected with the change in the supervision of technical innovations. Due to reforms of inventions, in 1955 the Ministry lost its responsibility for innovating, and it was the Committee on Innovations which was now responsible for overseeing new design and development. I assume that this

committee did not include such an ambiguous project in its program and chose to take care about newer innovations.

Still, shortly after the meeting, Zherebov sought support from the Minister of the Paper and Timber Industry Feodor Varaksin, claiming that the specialists from TsNIIB were very hostile towards his high-temperature cooking method, despite his successful experiments of 20 years before. He also reminded Varaksin that his project was supported by the Ministry extending back before the war and asked to continue the project, but exclude Rosenberg, Kosaya, and Malyshkin. Zherebov blamed them for not following his design specifications and for perpetrating the myth that his cooking methods were impossible. The meeting, he argued, had been planned in advance so that the discussions were not productive.[74] In addition, Zherebov explained that he was forced to act in secret and could not communicate with other specialist frequently as his method was classified by the Military Board of the Committee on Inventions in the very beginning. Again, although the project was later declassified officially, it was still treated as secret – even as TsNIIB began to involve to the project independently, without addressing Zherebov and his research office.[75] However, while Zherebov appealed to his previous relationship with the Ministry support in previous years, the new administration was immersed in Khrushchev`s campaign to catch up and surpass the West. Rapid modernization, under this campaign, increasingly relied on Western experience. Indeed, during Stalin`s time Zherebov had tight contacts with the minister who believed his idea. As Paul Gregory and Stuart Roberts argued, Soviet leaders invested in old-fashioned projects which resulted in manufacturing unnecessary products and supported certain production figures.[76] This probably explains why the project continued for so long despite many problems. In the beginning of the Khrushchev period, new leadership at the ministry ceased supporting Zherebov.

Khrushchev's new technological policy implied closer communications with Western engineers. Soviet leadership initiated rapid technological modernization in 1955, and industries were urged to "surpass and overcome America".[77] The government strived to fulfill this task by using Western achievements in technology, foregrounding the importance of borrowing from the West, and, thus, initiated a shift from autarky to cooperation with the outer world.[78] It meant not only more intensive trade connections, but collaboration between experts on the micro level. Among other practices, it implied engineers visiting from abroad vice versa. As a rule, these trips were organized by the State Committee on New Techniques within agreements on scientific-technical cooperation signed with foreign countries, the number of which had increased in the Khrushchev`s time.[79] For instance, in 1955, the Soviet leadership signed an agreement on cooperation in science and technology with Finland that included trips by Soviet engineers to Finnish factories and research organizations. In the pulp and paper industry the themes of

cooperation included learning new technologies, such as bleaching, production of viscose, etc. Based on their trips, delegates were to prepare reports which sometimes were very lengthy and full of details.[80]

In the early 1960s, some other Soviet plants used digesters of different design – modifications of Kamyr as well as alternative designs also purchased from abroad. In particular, in 1962 a Pandia digester delivered by Parsons and Whittemore was purchased for the Chersonese pulp and paper factory in Crimea. Like Kamyr`s digester, this apparatus was thoroughly investigated by Soviet engineers, in particular after some defects were revealed.[81] Local engineers replaced few technical components (feeders) with those produced in the Soviet Union because of splits, while the digester itself quickly became rusted.[82] By the 1960s, therefore, some replacement parts and modifications were already produced in the Soviet Union - however, it is not easy to say what parts were still not provided by the Soviet machinery industry. In any case, Western technological innovation was successfully introduced to Soviet manufacturing and used both for industrial purposes and research to modify foreign technology.

However, neither Zherebov`s project nor Kamyr digesters improved the performance of the Soviet pulp industry significantly. Despite a general growth of inputs (due to the enlargement of production), the technological level of the industry remained low.[83] In 1960, the Soviet leadership issued a decree which said about the need to liquidate "the backwardness of the pulp and paper industry." It outlined a program of changes such as reconstruction of factories, the implementation of modern technologies, increasing production -- essentially the same problems identified as early as the 1910s. In the following years, dozens of plants were renovated, but not the entire system. Problems in supplying the factories with machinery and raw materials remained, as did issues with product quality that first appeared when Zherebov`s digester was being installed. Nevertheless, these problems did not preclude some positive developments. For example, by the end of the Khrushchev`s era some new technologies were introduced to the industry enabling the production of producing viscose pulp, and the use of wood wastes in production, among others.

Despite the failure of the project, Zherebov was still considered a significant Soviet inventor and author of an excellent idea by many engineers. Even before his death, various institutions published volumes devoted to his professional life. Some engineers, again, stressed that his ideas were developed earlier than similar concepts in other countries,[84] while others argued that his invention was adopted if not stolen by foreign engineers who could successfully adapt it for industrial production.[85] Zherebov died in 1959, three years after his invention was scrapped, and 25 years after its introduction.

Conclusions

This article examined the history of Zherebov`s project of continuous pulp cooking and discussed the interactions between research and industrial institutions as well as the interplay of political and technological factors that hindered Soviet innovating in the first post-war decades.

First, the nationalization of science and technology as well as militarized economy created obstacles for research. In Stalin`s period the state monopolized the inventions of military relevance and kept them secret not only from the outer world, but within the country. Zhrebov`s project was thus restricted to a small group of specialists, and was not widely known beyond it even at the plant. In the activities of this group we see a number of barriers, and learn about how the development of innovation was hindered at the institutional level. Monopolization and secrecy created a dilemma around the digester. Zherebov`s innovative idea to cook pulp at very high temperatures was not supported by the research institute TsNIIB, even though it was involved in the project. However, Zherebov's method was defended by the ministry, an umbrella institution for all the actors. Until the mid-1950s the disagreements between research institutions evolved implicitly as Stalin`s regime did not provide a space for discussions of the innovation and chose to support one side. This is why other institutions did not criticize the project and chose to act independently from Zherebov, working on decreasing the temperature. "The digester dilemma" showed that the state was focused on the result and supported technologically ambiguous projects. This support, however, excluded discussions and criticism of the invention by other researchers. In practice, as the example of Kamyr digester showed, such technologies as continuous cooking was difficult and required many iterations of experiments and improvements as well the expertise of a broader research community. Stalin`s regime undermined that the innovation process was international in character and national technologies should develop in a network of technical and information interchange.[86]

Scholars rarely address the shifts in research and design innovating in the Khrushchev period. The conflict between two research boards exploded in the "thaw" period in public discussions of the project. It also resulted in Zherebov, "Stalin`s engineer", losing his strong support from the ministry. New ministerial officials and new organs responsible for innovating sought easier ways to modernize. As a result, and with leadership support, they gravitated toward importing foreign technologies already available, further undermining Zherebov's project despite 25 years of investment. Khrushchev`s policy, however, went to the other extreme and relied heavily on foreign transfers. As a result, encouraged by a new state strategy, the Ministry chose to import foreign digesters and launch them for industrial use.

Second, even despite the military relevance of the project, the Soviet economy and industry were not capable of providing enough resources for a complicated technology. The set of technological factors in the history of Zherebov`s project illustrates the scarcity of resources needed to supply innovation, a problem which remained during the whole period.[87] The process of turning invention into industrial production and from testing to technological adjustments was lengthy and required what Hughes noted about large technological systems, that many actors are necessary to build a functional network. As a part of such a system, continuous cooking and, thus, the activities of engineers, depended on successful supplies of all the components, from good-quality wood to spare parts and professional literature. In practice, however, the project revealed problems in the pulp industry, one of most outdated in the USSR. As the story shows, the system continually suffered from one or more missing components. The Enso/Svetogorsky plant faced delays in acquiring technical parts, raw materials and even the books required for expertise. Although the project received substantial funding, purchasing parts and literature was complicated and sometimes impossible. The adaptation of Kamyr`s digesters, already functioning in a better (Western) technological system, did not improve the situation and the Soviet system remained backward for the whole Soviet period. Essentially, this case proved impossible to improve the system as a whole simply by replacing one aspect. This perspective – the industry as interconnected ensemble of components and actors in the system - is rarely considered in literature, although seems to be crucial for obstacle the innovation.

Undoubtedly, the political system defined the technological one, and these two sets of overlapping factors are connected to the question of the effectiveness of Soviet economy. One might say that the post-war autarky of Stalin`s economy and intensive technology transfer in Khrushchev`s time did not enable inventions to accumulate resources and were two polar strategies. The functions of both political and technological systems seem to provide a little space for successful innovation. This problem remained critical in later Soviet period, despite a number of political, social and economic changes.

Notes

[1] *Baza patentov SSSR.* In the NEP period, between 1924 and 1931, the Soviet state encouraged partial capitalism and allowed patents as a form of private intellectual property. See more in Kolesnikov, "Vekhi otechestvennogo izobretatel`stva," 62.
[2] Graham, *Science in Russia*, 174.
[3] *L.P. Zherebov (K 100-letiu so dnya rozhdenia)*, 2.
[4] M. Serdiukov, M. Popov, A. Vasilenko. Dokladnaya zapiska po voprosu o nepreryvnoi varke tsellulozy na Svetogorskom ZBK Ministerstva bumazhnoi i derevoobrabatyvaiushchei promyshlennosti, 1956 god (Report on continuous pulp cooking in the Svetogorsk pulp and paper plant of the Ministry of Paper and Wood Processing Industry)// RGAE. F. 9480. Op. 2. D. 146. L. 5-6.
[5]On foreign factor in Soviet modernization see Schattenberg, *Stalins Ingenieure;* Zhuravlev, *"Malen`kie liudi";* Golubev et al. *The Search*, among others.
[6] Doklad GNTK SM SSSR "O sostoianii i tekhnicheskom urovne tsellulozno-bumazhnoi promyshlennosti", 20.09.1957 (Report by the State Committee on Science and Technology "On the pulp and paper industry and its technical level", 20.09.1957) // RGAE. F. 9480. Op. 3. D. 1154. L. 57.
[7]Even in high priority industries there was a low level of mechanization and a scarce array of products. Thus, as Robert Campbell says, although the Soviet Union possessed rich energy resources, the development was tempered by a lack of new technologies. See Campbell, *Soviet Energy Technologies*. Also, see *The Technological Level*.
[8] Reducing labor was a logical outcome of automation of industrial production in all over the world. The mid-twentieth century witnessed a rapid automation in many fields, the process closely connected with the development of computing and cybernetics.
[9]Bailes, *Technology and Society*, 343.
[10]Richter`s invention was likely interrupted by the war.
[11]Parrott, *Politics and Technology.*
[12] Kilin, *Karelia v politike*, 42. Kilin argues that the war with Finland was initiated by the Soviet government because of two reasons: it wanted the Finns not to enter into alliance with Germany and annex the Finnish territory near the Leningrad military district.
[13] A comprehensive list of Soviet pulp and paper enterprises in different regions is given in Barr , "Regional Variation," 47-48. The authors counted that of 186 plants working in 1965, thirty seven were that moved to the Soviet Union between 1940 and 1945 as the result of territorial expansion in the Baltic States, Kaliningrad, areas annexed from Finland, and the Sakhalin region.
[14] Prikaz Ministerstva tselluloznoi i bumazhnoi promyshlennosti SSSR ot 6 dekabria 1947 goda (Decree of the Ministry of Pulp and Paper Industry of the USSR issued on 6 December 1947)// LOGAV. F. R-180. Op. 1. D. 7. L. 27; Prikaz Ministra tselluloznoi i bumazhnoi promyshlennosti (Decree of the Minister of Pulp and Paper Industry)// LOGAV. F. R-180. Op. 1. D. 13. L. 42. The Ministry of Pulp and Paper Industry was reorganized in 1948 when it was unified with the Ministry of the Forestry Industry into the Ministry of Forestry and Paper Industry until 1951. Then a new Ministry of Paper and Wood Processing Ministry was created.
[15] Prikaz Ministerstva tselluloznoi i bumazhnoi promyshlennosi SSSR ot 6 dekabria 1947 goda (Decree by the Ministry of Pulp and Paper Industry of the USSR issued on 6 December1947)// LOGAV. F. R-180. Op. 1. D. 7. L. 25. The Ministry of Pulp and Paper Industry was reorganized in 1948 when it was unified with the Ministry of the Forestry Industry into the Ministry of Forestry and Paper Industry until 1951. Then a new Ministry of Paper and Wood Processing Ministry was created.
[16] Perechen` stroitel`stva ustanovok po nepreryvnoi varok i nepreryvnomu gidrolizu (List of facilities for continuous pulp cooking and continuous hydrolysis)// LOGAV. F. R-180. F. 1. L. 24.

[17] Kolesnikov, *Istoriya izobretatel`stva*, 5. The exception was the NEP period which allowed private intellectual property in the form of patenting. After the war, inventing was centralized and put into responsibility of a special Committee on Inventions (functioned between 1946 and 1947) and the Committee on Implementing New Techniques into the Economy (1947-51) usually acted through ministries. In 1951-55 inventions were given directly to ministries, which opened departments focused on innovations

[18] Kragh, "The Soviet Enterprise," 367.

[19] Laine, "Modernization," 29.

[20]In 1930, a factory in Nikolaev in the Ukrainian Republic, produced the first domestic pulp digesters, which were installed in new pulp and paper plants. In 1934, the factories of the Central Administration of the Chemical Industry (a body within the People`s Commissariat of Forestry Industry) in Suma and Kiev began the production of digesters and furnaces designed after plans of foreign companies and "foreign professional literature." Vybor obosnovania konstruktsi i tipov vysokoproizvoditel`nogo oborudovania dlia proizvodstva polutsellulozy i tsellulozy iz trostnika (Choosing the construction and types of highly-efficient equipment for making semi-pulp and pulp from reeds)// RGAE. F. 9480. Op. 3. D. 1178. L. 68-69.

[21] Stenograficheskiy otchet 28 sessii Uchenogo soveta instituta o resultatakh eksperimental`nykh rabot, provedennykh v 1955-1956 gg. na Svetogorskoi ustanovke dlia nepreryvnoi varki sul`fitnoi tselluilozy (Stenographic report of the 28th session of the Institute on the results of experiments held in 1955-1956 with the digester for continuous cooking of sulphite cellulose in Svetogorsk)// RGANT (Sankt-Peterburg). F. 303. Op. 13. D. 281. L. 57.

[22] Pis`mo i.o. nachal`nika Glavsul`fittsellulozy Maluitina direktoru Enso, 1947 (Letter to the associate director of Glavsulphittselluloza Maliutin to the head of Enso)// LOGAV. F. R-180. Op. 1. D. 11. L. 4.

[23] Filtzer, *Soviet Workers*, 26.

[24]Actually, the Soviet Union had intensive trade connections with a number of Western and developing countries. Among huge literature on this issue, see more in Cain, "Economic Statecraft".

[25] Akty po priemke importnogo oborudovania (Lists of received foreign equipment)// LOGAV. F. R-180. Op. 4. D. 57. L. 60, 77, 91.

[26] Prikaz ministra lesnoi i bumazhnoi promyshlennosti SSSR ot 16.10.1950 g. (Decree by the Minister of Forestry and Paper Industry of the USSR, issued on 16 October 1950)// LOGAV. F. R-180. Op. 1. D. 15. L. 6.

[27] Pis`mo direktora Svetogorskogo TsBK Sil`chenko zamestiteliu nachalnika Glavtsellulozy P.N. Alekseevu, 1950 g. (Letter by the head of the Svetogorsky Pulp and Paper Plant A. Sil`chenko to the associate director of Glavtselluloza, 1950) // LOGAV. F. R-180. Op. 2. D. 20. L. 16.

[28] Stakhanovets (Svetogorsky rabochii) was a local newspaper, the main source of information in the plant.

[29] Otchet ob osvoenii i eksperimental`nykh ispytaniiakh opytnoi ustanovki dlia nepreryvnoi varki (Report on implementing and experiments on continuous pulp cooking)// LOGAV. F. R-180. Op. 4. D. 331. L. 10.

[30] Ibid.

[31]Barber et al. "The Structure," 9.

[32] In the reports on supplies of bleached pulp, there were several classified enterprises which received raw materials for military purposes. See Otchety po vepolneniu plana sbyta produktsii (Reports on supplies)// LOGAV. F.R-180. Op. 5. D. 293. L. 5, among others.

[33] Protokol soveshchania pri zamestitele ministra K.A. Veinove, 1953 g. (Protocol of the meeting held by deputy minister K.A. Veinov in 1953) // LOGAV. F. R-180. Op. 1. D. 25. L. 8.

[34] Pis`mo nachal`niku inspektsii pri Ministerstve lesnoi i bumazhnoi promyshlennosti SSSR Nikiforovu ot direktora Enso A. Sil`chenko ot 4 dekabria 1950 goda (Letter to the head of the

inspection of the Ministry of Forestry and Paper Industry of the USSR Nikiforov sent by the head of Enso A. Sil`chenko, 4th December, 1950)// LOGAV. F. R-180. Op. 2. D. 20. L. 33.
[35] Otchet o komandirovke L.A. Mazina (Report on the business trip by L.A. Mazin)// RGAE. F. 9480. Op. 7. D. 925. L. 103.
[36] There were more indications about these obstacles in communication between research and industry. The Kamsky paper plant had been initially constructed on the basis of plans proposed by Giprobum – the head institution to construct industrial objects in the Soviet Union. However, as the first head of the plant M. Eliashberg said, this plan included many significant mistakes. While the plant was under construction, the engineers decided to work out a new one, actually not referring to Giprobum. See *Kamskomu kombinatu 20 let*, 63.
[37]TsNIIB was established in 1930 (Zherebov was among its founders) as the first research organization in the pulp and paper industry. It consisted of several departments, each dealing with both applied and theoretical research in the field, being important in terms of conducting research on pulp-based products.
[38] Sekretnoe pis`mo A. Sil`chenko direktoru TSNIIB Minlesbumproma SSSR S.A. Puzyrevu, 1951 god (Secret letter by A. Sil`chenko to the head of the Central Institute of Paper of the Ministry of Forestry and Paper Industry S.A. Puzyrev)// LOGAV. F. R-180. Op. 2. D. 15. L. 1.
[39] Ibid.
[40] Pis`mo direktora TsNIIB Minlesbumproma SSSR S.A. Puzyreva direktoru Enso A. Sil`chenko (Letter by the head of the Central Institute of Paper and Pulp of the Ministry of Forestry and Paper Industry S. Puzyrev to the head of Enso A. Sil`chenko)// LOGAV. F. R-180. Op. 2. D. 15. L. 2.
[41] Otchet o rabote, provedennoi TsNIIbom po tvorcheskomu sodruzhestvu nauki i proizvodstva (Report on the activities of the Central Institute of Paper and Pulp in the cooperation of science and industry)// RGANT SPb. F. 303. Op. 13. D. 84. L. 17-18.
[42]Bailes, *Technology and Society*, 371.
[43] Pis`mo glavnogo inzhenera K. Malyshkina i.o. nachal`nika Glavtsellulozy Minlesbumproma SSSR E.A. Kuznetsovu, 1951 god (Letter by the engineer-in-chief K. Malyshkin to the vice-director of Glavtselluloza of the Ministry of Forestry and Paper Industry E.A. Kuznetsov)// LOGAV. F. R-180. Op. 2. D. 15. L. 7.
[44] Pis`mo nachal`nika Glavtsellulozy M. Serdiukova glavnomu inzheneru K. Malyshkinu (Letter by the head of Glavtselluloza M. Serdiukov to the engineer-in-chief K. Malyshkin)// LOGAV. F. R-180. Op. 2. D. 15. L. 8.
[45] Spravka o tekhnicheskom urovne tekhnologii proizvodstva na TSBP, 1957 (Summary of the technical level of production in pulp and paper enterprises)// RGAE. F. 9480. Op. 2. D. 40.
[46] Perechen` stroitel`stva ustanovok po nepreryvnoi varke i nepreryvnomu gidrolizu, 1953 – 1955 gg. (List of facilities for continuous pulp cooking and continuous hydrolysis) // LOGAV. F. R-180. Op. 1. D. 24.
[47] Pis`mo glavnogo inzhenera Malyshkina ministru bumazhnoi i derevoobrabatuvaiushchi promyshlennosti K.A. Veinovu, 1953 god (Letter by the engineer-in-chief Malyshkin to the Minister of Paper and Timber Industry K.A. Veinov, 1953)// LOGAV. F. R-180. Op. 1. D. 25. L. 1.
[48] Otchet ob osvoenii i eksperimental`nukh ispytaniakh opytnoi ustanovki dli nepreryvnoi varki (Report on implementing and experiments on continuous pulp cooking)// LOGAV. F. R-180. Op. 4. D. 331. L. 4, 8.
[49]The "thaw" allowed some criticism of many Soviet realities. In 1956, the Soviet writer Vladimir Dudintsev published his well known *Not by Bread Alone*, the story of engineer Lopatkin, who tried to launch the production of pipes for the chemical industry, an unprecedented invention, but one that faced hostility and an impenetrable bureaucracy. The book contained reflections on Soviet industry and implied that engineers were hostile towards new ideas. See Dudintsev, *Not by Bread Alone.*

[50] Barber et al. "The Structure," 24.
[51] Stenograficheskу otchet 28 sessii Uchenogo soveta instituta o rezultatakh eksperimental`nykh rabot, provedennykh v 1955-56 gg. na Svetogorskoi ustanovke dlia nepreryvnoi varki sulfitnoi tselliulozy (Minutes of the 28th session of the Scientific Council of the Institute on the results of the experimental scientific research, conducted in 1955-56 on the Svetogosrky` digester for continuous cooking of sulfite pulp// RGANTD SPb. F. 303. Op. 13. D. 281. L. 17.
[52] Ibid., 47.
[53]Control and measuring instruments were a constant problem at the plant. The local archive is full of complaints of engineers on that there were not instruments available and also that there was a lack of specialists in this field. As a result, the plant initiated special courses in a local technical school to train graduates with relevant expertise. Otchet o rabote Svetogorskogo vechernego tselliulozno-bumazhnogo tekhmikuma (Report on the activities of Svetogorsky pulp and paper technical school)// LOGAV. F. R-180. Op. 1. D. 18. L. 4.
[54] M. Serdiukov, M. Popov, A. Vasilenko. Dokladnaya zapiska po voprosu o nepreryvnoi varke tsellulozy na Svetogorskom ZBK Ministerstva bumazhnoi i derevoobrabatyvaiushchei promyshlennosti, 1956 god (Report on continuous pulp cooking in the Svetogorsk pulp and paper plant of the Ministry of Paper and Wood Processing Industry prepared by M. Serdiukov, M. Popov, A. Vasilenko)// RGAE. F. 9480. Op. 2. D. 146. L. 5-6.
[55] The reason why a foreign digester was set in the Marisky plant seems to be unclear. It is probable that the Ministry considered that expensive and valuable techniques should be delivered into inner parts of the country, so not installed in the border region.
[56] Ibid., 7.
[57] Pis`mo zampreda Gostekhniki Y. Maksareva v SM SSSR, 14.3.56 (Letter of the vice-director of Gostekhnika Y. Maksarev to the Council of Ministers of the USSR, 14th March 1956)// RGAE. F. 9480. Op. 2. D. 146. L. 9.
[58] Protokoly i reshchenia rasshirennogo zasedania Tekhnicheskogo soveta po nepreryvnoi varke, 31.05.1955 (Protocols and decisions of the extended meeting of the Technical council on continuous cooking, 31st May 1955)// LOGAV. F. R-180. Op. 4. D. 332. L. 38.
[59] This number of decrees is probable, although I found only five. The sum spent for the project might also be true, but the sources use in this article show it to be much lesser. This letter saying about the results of the meeting does not provide more detailed data, other than final figures.
[60] Pis`mo zampreda Gostekhniki U. Maksareva v SM SSSR, 14 marta 1956 goda (Letter of the vice-director of Gostekhnika Y. Maksarev to the Council of Ministers of the USSR, 14th March 1956)// RGAE. F. 9480. Op. 2. D. 146. L. 9.
[61] Stenograficheskу otchet 28 sessii Uchenogo soveta instituta o rezultatakh eksperimental`nykh rabot, provedennykh v 1955-56 gg. na Svetogorskoi ustanovke dlia nepreryvnoi varki sulfitnoi tselliulozy (Minutes of the 28th session of the Scientific Council of the Institute on the results of the experimental scientific research, conducted in 1955-56 on the Svetogosrky` digester for continuous cooking of sulfite pulp// RGANTD SPb. F. 303. Op. 13. D. 281. L. 44.
[62] Ibid., 87.
[63] Ibid., 99.
[64] Ibid., 101.
[65] Ibid., 121.
[66] This might be also explained by Zherebov's advanced age (in 1956 he was already 93 years old) and his devotion to highly theoretical work.
[67] Ibid., 127.
[68] Sekretariu Karasnogvardeiskogo raionnogo komiteta KPSS Kazakovu M.M. (A Letter to the secretary of the committee of Krasnogvardeisky region M.M. Kazakov)// RGANTD Samara. F. 613. Op.1-1. D. 171. L.102.
[69] Ibid., 196.
[70] Ibid., 171.

[71] Berliner, Soviet Industry, 212-13.
[72] Ibid., 216.
[73] This project never materialized, however.
[74] Dokladnaya zapiska ministru po voprosu osvoenoia opytnoi ustanovki dlia skoroi nepreryvnoi varki na Svetogorskom TsBK (Note to the Minister on the question of experimental digester for quick continuous cooking in Svetogorsk)// RGANTD SPb. F. 303. Op. 12. D. 267. L. 5, 14.
[75] Ibid., 30.
[76] Gregory and Stuart., *Soviet and Post-Soviet*, 379.
[77]More on modernization and Khrushchev see for example in *Modernization in Russia*.
[78] Parrott, *Politics and Technology*.
[79] See more on the history of the Committee in Temirbulatova, Gosudarstvennyi komitet.
[80]See more in Autio-Sarasmo, "Knowledge".
[81] Tarasiuk, *Osvoenie varochnogo apparata Pandia*, 3.
[82] Ibid., 22.
[83] In the USSR, the production of pulp was (in thousands tons per year) 592 in 1940, 2282 in 1960, 5110 in 1970. The USSR was among the five largest producers of pulp in the world. See Gal`braih et al., "Tselliulozno-bumazhnaya promyshellnost`".
[84] Alekseev, "Sozdatel` metoda nepreryvnoi varki," 78.
[85] Maliutin, "Sovremennoe konstruktivnoe reshchenie," 82.
[86] Hanson, *The Comparative Economics*, 1.
[87]The authors of a recent monumental book on the history of pulp and paper industry issued in Russian, essentially the only one in existence,, argues that Zherebov's ideawas not implemented because of insufficiently organized machinery industry and a lack of required construction materials. The problems, however, seem to be more general, covering resource supply and knowledge circulation. See *Istoria tselluilozno-bumazhnoi promyshlennosti*.

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