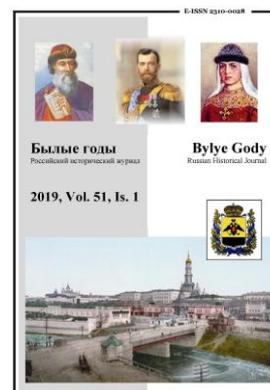


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## From the History of the Russian Soda Production in the 18th and 19th centuries (as illustrated by the Example of Siberia)

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### Abstract

The industrial growth between the late 18th and 19th century was largely facilitated by advancing science, which led to the technical and technological revolution. For example, evolving chemistry crystallized into new industrial sectors, one of which was the soda production. Soda was an essential element for the textile, leather, glass and soap industries in this period. Soda was produced in the potash process in Russia before the 1780s. It was not until the late 18th century that Academician Erich Laxmann was able to achieve a commercial process for soda. However, the first soda plant was opened in the Russian Empire in Altai in 1864 by Prang brothers. Since the second half of the 19th century, Western Siberia was a major center in the soda production in Russia. The new sector formed in the environment of protectionist policies for soda plant owners, carried out by the government. This paper will examine some aspects of the history of the soda production in Russia, using the example of Siberia, i.e. sources and specifications of raw materials, history and business operations of soda plants as well as description of their respective owners. The work made use of documents from a range of Russia's central and regional archives and published results of field studies conducted by mining engineers in the late 19th century.

**Keywords:** soda production, Leblanc process, “Prang i K<sup>o</sup>”, Siberia, Altai bitter lakes.

### 1. Introduction

The major milestones in the evolution of the global chemical industry in the period under review include: development of production methods for soda based on the Nicolas Leblanc's process (1791), for sulfuric acid based on the chamber process (1746), for superphosphate (1840), for soda based on the Ernest Solvay ammonia process (1863). An idea of obtaining sulfuric acid using the contact process was put forward (1831).

Before the 19th century, soda ash (sodium carbonate) was obtained primarily from the ashes of some algae and coastal plants. Key European importers of soda until the end of the 18th century were Spain and France, whose production capacities were concentrated on the Mediterranean coast.

In the late 18th century, Russia emerged as an active player in the industrial production of soda that replaced potash in the second half of the 19th century. The main contributors to the transition were both scientific and technological discoveries and rich deposits of Glauber's salt (sodium sulphate), which became the primary raw material for soda manufacturing. One of the centers of the soda production was the Altai (South of Western Siberia) that boasted many bitter lakes rich in Glauber's salt.

The soda industry today uses four methods – the ammonia process (from sodium chloride), natron process, nepheline processing, as well as the carbonization of sodium hydroxide. The leading position is still held by the first method of the soda production, although its share, which has more recently amounted to 100 %, is now gradually decreasing. Advantages of the ammonia-soda process include: A relatively cost-efficient method, widespread availability and extraction affordability of the required raw materials,

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insignificant temperatures (up to 100°C), under which main process reactions take place, a well-established method of the soda production and low production cost of soda ash.

## 2. Materials and methods

This paper will examine some aspects of the history of the Russian soda production. At the turn of the 19th century, Siberia was one of the major centers for the industrial production of soda. We will provide a description of the production.

The work employed documents from central and regional archives of Russia, such as acts of legislation, decisions of the Government and ministries, business letters, statistical data about industrial enterprises and published statistical materials.

The paper uses various historical methods. The chronological approach has given us the opportunity to study the problems which represented the essence of the research subject, by arranging them in the chronological sequence and identifying quantitative and qualitative changes that took place in them. Making use of the retrospective method has allowed us to turn to the past for a deeper understanding of historical processes and see them from a certain distance, when it became clear what historical results they produced. The genetic technique has enabled us to look from the historical perspective at how the research subject evolved in a specific area in a particular time period.

## 3. Discussion

The history of the soda production in Russia in the pre-Soviet period was largely unexplored. The distinctive feature of historiography is that it analyzes this problem in the context of the progression in the industry in general or in the chemical sector in particular.

First publications came out already in the late 18th century. It was Academician A.I. Gldenstdt who wrote in his reports to the Imperial Academy of Sciences in St. Petersburg, that it was crucial for Russia to develop the soda production and it had its own raw materials available for its production (Gldenstdt, 1780).

In 1893, the journal "Bulletin of gold mining and mining in general" (Vestnik zolotopromyshlennosti i gornogo dela voobshche) published an article by a Professor of Chemistry at the Tomsk State University, S.I. Zalessky. This was the first article that delivered a general description of the soda plant owned by M. Prang, the only business of its kind in Asian Russia (Zalessky, 1893: 3-4). The article was the summary of Professor Zalessky's trip to Siberia when he personally visited the soda plant and assessed its operation.

In the late 19th – early 20th century, a central scientific magazine, which published materials in mining, metallurgy, chemical and electrical engineering sectors in the Russian industry was "Gornyi Zhurnal" (Mining Journal) (published from 1825 up to the present). It published two articles which raised the issue of the soda production in Russia. Their authors were mining engineers who graduated from the St. Petersburg Mining Institute.

In 1894, mining engineer N. Zavadovsky published the article "Soda production in Siberia" in "Gornyi Zhurnal," which was dedicated to the 30th anniversary of the Prang soda plant in Barnaul, Tomsk province (Zavadovsky, 1894: 383-391). It focused on the early days and history of the company. It particularly pointed at Matvey Prang's interest to foreign practices in the soda production and his commitment to upgrading the production using the latest technology. To this end, the entrepreneur made three trips to England (Zavadovsky, 1894: 387-388). At the same time, it provided only fragmentary references to Matvey's older brothers, mining engineers, who initiated and financed the enterprise. Zavadovsky did not go into details of the production cycle deliberately, saying that it was "unlikely to be of interest to the layman reader" (Zavadovsky 1894: 390).

In 1897, mining engineer A. Bobyatinsky was commissioned by the Chief of the Altai district, V.K. Boldyrev, to explore bitter lakes in the South of Western Siberia. In 1898, his findings were published by Gornyi Zhurnal in the article "Description of bitter lakes of the Altai District." (Bobyatinsky, 1898: 372-397). It paid attention to the chemical characterization of Glauber's salt sources, which was supplied to soda plants in the region. Bobyatinsky revealed that the government created considerable impact on the development of the soda industry in Siberia, by linking the excise policy to the successful start and progression of the enterprises (Bobyatinsky, 1898: 375-376).

In 1897, a famous exiled revolutionary S.P. Shvetsov, who lived in the Altai (1888-1896) and was a local statistician, published an article in Moscow, entitled "The situation of workers at private plants in the Altai district." As he analyzes the working conditions and the situation of workers at private capitalist enterprises in the South of Western Siberia, the author concentrates on the Prang soda plant and noted paternalistic relations between hired workers and the entrepreneur (Shvetsov, 1897: 130-180).

A distinguishing feature of pre-Soviet publications was their reliance on local sources. Authors, professionally connected with Siberia for a long time, personally knew Siberian businessmen and had credible information on them.

The Soviet period featured a number of works that became classics in the history of the Russian industry in its imperial period. 1951 brought about the publication of the 3d volume of "History of chemical works and chemical industry in Russia until the end of 19th century" by Professor P.M. Lukyanov (Lukyanov, 1951). Volumes 1 and 2 were awarded the Stalin Prize. The first chapter of the monograph turned to the

problem of extraction and production of Glauber's salt, sodium sulphate and hydrochloric acid. Lukyanov delivered an in-depth analysis of the role, that Academician E.G. Laxmann played, not only in devising a glass melting process using Glauber's salt, but also named him the founder of the Russian industrial production of soda. Lukyanov gave a brief description of the Prang soda plant. One of the major drawbacks to Lukyanov's research was the fact that it only resorted to published works and did not take into account archival materials.

In the post-Soviet era, Russian historians addressed the problem of ethnic entrepreneurship. This interest resulted into individual studies that examined how German businessmen, the Prangs, facilitated the growth of the Russian soda production (Skubnevsky, 2010: 198-202; Shaidurov, 2016: 666-674). Contemporary authors merit praise because they make use of a wide array of archival documents that allow us to have a close look at various aspects of the industry.

The history of soda production in Europe is of interest to researchers. Archaeologists are studying the use of soda for the production of glass in the Ancient world. Historians of science study the problem of the invention and the production of soda ash in the industry (Kragh, 1995: 285-301).

Hence, the history of soda production in Siberia between the 18 and 19th century was not thoroughly covered by researchers. The key aspects that need further attention include the following: analysis of the laws that existed in the Russian Empire and served as the platform for the industry; the impact of government policies on the industry in different historical periods; the involvement of Russian soda manufacturers in the global soda production, etc.

#### 4. Results

The general scientific progress at the turn of the 19th century and foundation of higher technical institutes and schools with a primary focus on chemistry and chemical technology were predetermined by needs of the industry. The industrial revolution added powerful impetus to almost all sectors, especially to the textile industry and metallurgy, which played an enormous role in the development of chemical plants. There was rising demand for raw materials. With the growth of the mining industry, chemical products received the increasingly higher value in total volume of raw materials produced. The prerequisite for their production was the goal to substitute scarce types of traditional raw materials with cheaper and more available chemical materials. The industry started to use "surrogates" and production waste.

Core areas took clear shape in the evolution of chemical plants, related to finding new sources of raw materials to manufacture soda, sulfuric acid, more effective bleaching, mordant and dyeing chemicals required for textile, metal, glass, leather, fats and oils and other industries.

Soda was called "zoda" or "suds" in Russia. When in 1720 Emperor Peter I answered to the question asked by Prince Golitsyn, why we need "zoda," he wrote: "Zoda can be used to soften wool" (Güldenstädt, 1780: 152).

One of the first researchers who addressed the problem of the soda production in Russia was Academician A.I. Güldenstädt. He wrote in 1780 that "soda can be considered an important commodity in the Russian trade. Glass makers and dyers use it in large quantities, and now it will be spent even more when white glass production will increase" (Güldenstädt, 1780: 152). According to Güldenstädt, Russia needed to develop its own sources of soda. At the time, key soda suppliers were Spain and France which extracted it in seaweed burning. But the same seaweed was discovered during travel across southern Russia and the Caucasus. For example, according to Güldenstädt, Tatars, who lived in the North Caucasus, used it to produce soda and added it to the black soap.

This technology was developed in Siberia in the first half of the 19th century. Improvements in leather, soap and glass technology was impossible without the use of potash (potassium carbonate –  $K_2CO_3$ ). However, one of the main sources of the chemical in Russia was wood. In Siberia, the peasants, who were engaged in potash works, faced prohibitive laws that protected forests. As a result, they were forced to seek new ways to produce potash.

In the 1840s, peasants and townspeople in the Tobolsk province used primitive technology to extract potash and soda from ashes of wild herbs that grew in the place of dried bitter lakes. In 1843, 1844, 1846, a tradesman of the Tobolsk province, Klyukin, submitted to the Ministry of Finance and to the Emperor Nicholas I applications to grant him privileges (monopolies) on soda production in Siberia. However, the correspondence with Governor-General of Western Siberia Petr Gorchakov brought to light nuances of soda production. For example, Gorchakov wrote to St. Petersburg that already in 1841, Klyukin in partnership with townsman Kolmakov organized a plant manufacturing potash and soda and "bought from farmers ashes burnt from herbs" (RGIA. F. 40. Op. 1. D. 11. L. 301). However, they never invented the method which local peasants had long been aware of. An enterprise of this type was established by peasant Bukarin in Kurgan, Tobolsk province, in the mid-1840s (RGIA. F. 40. Op. 1. D. 11. L. 301). Although Gorchakov accepted the need for the potash and soda production, he opposed the common technology applied for the purpose. Herbs were to be picked to be further burnt for ashes near saline lakes. With the lack of control, this process could lead to thefts of salt from the lakes and cause losses to the Crown (RGIA. F. 40. Op. 1. D. 11. L. 301 ob.). (At that time, a state monopoly on salt production was in force in Russia). For this reason, the soda production remained at the handicraft form.

The first industrial process of producing soda was pioneered in Russia. In 1764, a Russian chemist, Academician Erik Gustav Laxmann<sup>1</sup>, a Swede by birth, reported that soda could be obtained by sintering natural sodium sulphate with charcoal. Laxmann obtained soda using his own process at a glass factory in Taltzinsk near Irkutsk (the factory was built on the money of merchant Alexander Baranov – the future head of the Russian-American Company and Governor of Russian America) in 1784 (Lukyanov, 1951: 14). Soda was received as a by-product following years of experiments in glass melting, which Laxmann started already in Barnaul in 1764–1766. Many years of chemical experiments enabled him to open a new era in the glass manufacture which at that time used only wood ash (potash). However, Academician Laxmann was not the founder of industrial production of soda based on Glauber's salt.

Russia's demand for soda was huge. This is illustrated by statistics of the Department of Mining and Salt Affairs under the Ministry of Finance (see Table 1).

**Table 1.** Imports of soda in Russia in 1852–1856 (RGIA. F. 18. Op. 2. D. 1711. L. 14)

Year	Import volume, poods <sup>2</sup>	Import amount, rubles	Unit cost, rubles
1852	176,502	388,362	2.20
1853	174,199	328,606	1.88
1854	100,425	215,558	2.15
1855	74,607	196,805	2.68
1856	251,016	564,378	2.25

For example, soda imports from Europe grew by 142 % only between 1852 and 1856. The decline in imports in 1854–1855 was brought about by the Crimean campaign when Russia was at war with France and Britain – major producers of soda at the time. In this situation, it was necessary to reduce reliance of the booming Russian industry on Europe.

Realization of the need for economic security took place in the reign of Alexander II (1855–1881). In the late 1850s, the government concluded that it was necessary to arrange industrial production of soda in Russia. A covering note by the Minister of Finance to the regulation issued by the Committee of Ministers, which granted a retired lieutenant Benardaki a 10 year right to extract bitter salt from the Astrakhan lakes for soda production (PSZ – II. Vol. 33. Sec. 1. No.33339), indicated that “Most soda used in Russia, one of the most important products in factory and plant business, especially in glass manufacturing, is imported from abroad at a very large price, whereas we have all basic materials to manufacture the above-mentioned soda in abundance and the localized production of soda, in addition to meeting the needs of our factories, could constitute a new item of trade, create a separate source of income, relieve manufacturers from foreign dependence, namely the purchase of the above-mentioned soda, and retain the capital designated to this end in the state” (PSZ – II. Vol. 33. Sec. 1. No.33339).

The Government shared the views of scientists and entrepreneurs. For example, a renowned chemist, Dmitri Mendeleev, when making a review of the Paris World Exhibition, pointed to the need to organize industrial production of soda in Russia (Shaidurov, 2016: 668). In 1867, the Department of Commerce and Manufactures at the Ministry of Finance received a petition from textile manufacturers of Voznesensky Posad and the Ivanovo village, Vladimir province, which were Russia's largest textile centers.

Another significant milestone in the development of soda production in Asian Russia was reached in 1856 by an Omsk merchant, Vladimir Kuznetsov, who requested for permission to build a plant in the Altai mining district or near Tomsk. Bitter salt and wood were supposed to be supplied by the Cabinet of His Majesty, which owned the right of the use of all natural resources in the Altai (RGIA. F. 468. Op. 23. D. 518. L.1-10b.).

Initially, the situation was extremely favorable for Kuznetsov. His initiative was supported by the Chief Director of the Altai factories, Major General Bekman. In his report to Chairman of the Cabinet of His Majesty Adlerberg, Beckman, in particular, pointed out that “Altai plants and factories have low need for bitter salt to melt metals..., <...>, the plant can be established by Kuznetsov as he himself wishes in the neighborhood of the city of Tomsk, and Altai plants will have no shortage” (RGIA. F. 468. Op. 23. D. 518. L.1).

St. Petersburg officials were well aware of the cardinal importance that the domestic soda ash production had. For example, one of the documents of the time cites the following: “It [the soda – V.Sh.] has applications at many factories and plants... It has been so far the case in Russia that it is most often replaced by potash, whose production involves large-scale destruction of forests, and those applications, which rely on soda in production, have to order it at a high price from abroad” (RGIA. F. 468. Op. 23. D. 518. L. 4-4 ob.). This allowed the Omsk merchant to obtain the prior consent of the Cabinet. But the decisive word was to be said by the Ministry of Finance which chose not to hinder local initiatives from being implemented.

<sup>1</sup> Laxmann Erik Gustav (1737-1796) – a Russian scientist and explorer of Swedish origin, a naturalist, academician at the Royal Swedish Academy of Sciences (1769) and the Imperial Academy of Sciences and Arts in St. Petersburg (1770); a chemist, botanist and geographer.

<sup>2</sup> Pood – a unit of weight in pre-Soviet Russia, 1 pood is equivalent to 16 kg.

One year later, on September 11, 1857, Kuznetsov received the Cabinet's approval to construct a soda plant near Tomsk (RGIA. F. 468. Op. 23. D. 518. L. 18-20). However, the production unit was never founded. The failure seems to have had objective reasons. Firstly, the plant owner was to face financial expenses associated with the organization of salt production and its delivery to Tomsk using animal transport over a distance of about 600 km. Secondly, he had to have an idea of the potential that soda consumption market could offer. There was no such market in Siberia, in the 1850s. Kuznetsov's followers would also face this problem. Additionally, he also needed chemical engineers that would be experienced in the practices of industrial soda production based on the Leblanc process (the only method at the time), and Russia did not have such subject matter specialists yet. This unhappy combination of geographic, economic and human factors did not allow this project essential for Russia to become reality (Plotkin, Khaikin, 2017: 139–140).

One of the first private factories in the Altai in the post-reform period was the soda plant of the Prang brothers. Ivan Bogdanovich (Johann Gottlieb) (1812–1886) and Yegor Bogdanovich (Georg) (1814 – before 1879) were trained at the St. Petersburg Mining Cadet Corps which they graduated from in 1835 and 1836 (CGIA SPb. F. 963. Op. 1. DD. 4245, 4559). Both brothers brilliantly knew chemistry which was demonstrated by their management of the Central Laboratory at the Altai Mining Plants in various years. In the 1860s, Yegor Prang taught analytical chemistry at the Barnaul School of Mines. In the second half of the 1850s, they already held high positions: Ivan Prang was the manager at the Pavlovsk Silver Foundry and Yegor Prang was the manager of the Altai plants Central Laboratory.

In the late 1850s – early 1860s, the chemical industry received little attention of potential business because there were other ways to earn additional income. For example, colossal profits at low costs were generated by distilling and gold mining business.

In 1861, a company of four mining engineers, including colonels Prang, submitted an application addressed to Emperor Alexander II for a permission to establish a distillery in the Altai mining district (RGIA. F. 468. Op. 23. D. 523. L. 10-19). Of course, the prime goal of an enterprise was to improve the financial prosperity. However, their project received no support.

A favorable combination of circumstances enabled them to actually establish their own monopolistic soda production in Siberia. Their position in the Altai plant management hierarchy suggests that they had some idea of Vladimir Kuznetsov's project mentioned above. Zavadovsky's article mentioned earlier indicated younger brother Matvey Bogdanovich (Matthias Johann Theodor) (1830–1890) as the initiator of the production plant, while limiting the role of Ivan and Yegor to only financial participation (Zavadovsky, 1894: 385). As an important reminder, unlike his brothers mining engineers, Matvey completed a course at the Academy of Arts (1852–1859) and received the qualification of the unclassed mosaic artist and, therefore, it is unlikely that he could understand all the nuances of chemical soda in the early 1860s (RGIA. F. 789. Op. 10. Lit. "P". D. 1. L. 3). He would accumulate the experience over the years.

Realizing the multidimensional challenge the enterprise was, the Prangs approached the matter with utmost thoroughness. Already at the project preparation stage, Matvey made a 6-month tour of Western Europe at the end of 1862, where he was to study the local expertise in soda production (Zavadovsky, 1894: 386).

Brothers Ivan and Yegor Prang obtained a right to the excise free extraction of Glauber's salt; a similar license was received by Benardaki mentioned above (Skubnevsky, 2010: 199). The foundations of the soda plant were laid near the city of Barnaul September 14, 1864, and at the end of 1864, the plant already finished its first products.

With the natural resources in the South of Western Siberia, the mining engineers were able to adjust the production of soda on the basis of the Leblanc process. For example, it was no longer needed to extract sodium sulfate from cooking salt. The central bitter salt production was concentrated around the Mormyshanskie lakes in the Kulunda steppe of the Altai mining district. According to Tomsk Professor Zalesky, it already contained 97 % of pure sodium sulfate (Zalesky, 1893: 3-4). Coal was supplied by the Kolchugino mines in Kuznetsk coal basin, and limestone was quarried in the Barnaul area. All raw materials for the production were delivered to the plant on horses.

Until 1878, Glauber's salt was delivered mainly from the Maloe Mormyshanskoe lake, and then the salt production center moved to the Bolshoe Mormyshanskoe lake. The average annual production amounted to 2.1 tonnes between 1878 and 1896 (Bobyatinsky, 1898: 375). Commercial reserves of Glauber's salt in the Bolshoe Mormyshanskoe lake were estimated by contemporaries to have from 360,000 to 800,000 tonnes (Bobyatinsky, 1898: 388-389), which was supposed to provide raw materials to the then Siberian production for at least 90-110 years.

The period from 1865 to 1875 was the most difficult time to the Barnaul soda plant. The Prangs had to deal with a thin Siberian soda market. Local soap-making business used ash liquor and as result the soap quality was very poor. At the same time, soap makers were unprepared to switch to the new raw material. In these circumstances, the Prangs took an unconventional decision – to continue the production chain, launch their own glassworks and soap production based on the own soda and promote soda on the Siberian market of soap making and leather industry.

So, in January 1863, Matvey Prang applied for a license to open their own glass and soap factories to meet local needs (high quality soap was transported from European Russia at that time and sold at very high prices) (RGIA. F. 468. Op. 23. D. 529. L. 1-2). He was supported by the Mining Board of the Altai mining district, represented by the Chief of the Altai plants, Colonel Ozersky (a mining engineer and a graduate of

the Mining Cadet Corps in 1831). According to him, for this purpose the district had the required raw material that was used inefficiently or was not used at all. Opening the new plant would provide the population with “cheap glassware and good soap” (RGIA. F. 468. Op. 23. D. 529. L. 3). But they only managed to establish an upgraded soap factory.

Meanwhile, Matvey Prang also initiated promotional activities among local soap-makers, trying to convince them of the benefits offered by the transition from ash liquor to soda (potash). To this end, he distributed printed brochures and leaflets. However, illiterate peasants, who were mainly engaged in this business, were unwilling to retrofit their production process.

The bet on other regions, in the first place, on the Urals was also lost. The absence of a developed transport infrastructure led to a dramatic rise in the cost of the Altai soda on the Urals market.

In 1870, the brothers sold their enterprise to Matvey. This step resulted in further difficulties. In 1870–1872, he had to struggle with the excise department which obliged the new owner to pay the excise tax, motivating the decision by the fact that the excise free right was possessed by the former owners (Ivan and Yegor Prang), who were granted the privilege, rather than the enterprise. For this reason, Yegor Prang had to take the lead in the production facility over again.

It was until January 21, 1875 that Matvey Prang gained a right to excise free salt extraction over the next 10 years (RGIA. F. 1263. Op. 1. D. 3767. L. 186). Later, he personally managed the plant until his death in 1890, after which the plant was taken over by his widow Yulia Prang.

Initially, the plant was technically fitted with primitive equipment. Mechanisms were actuated by the force of water. It was the reason why the Prangs built it on the bank of the Pivovarka river. The plant used hand-worked furnaces until the end of 1870.

In 1874, Matvey Prang made a second trip to Europe where he visited soda plants. The outcome of this trip was the partial modernization of the plant, which included the reconstruction and extension of production facilities and introduction of better production technology. We should note that the industry at that time already knew a new soda production method patented by a Belgian chemist, Ernest Solvay in 1861 (the so-called industrial ammonia soda process). The technological innovations enabled Prang to receive caustic soda which came into common use in soap making instead of soda ash. Following it, the company was able to improve its finances. This allowed Prang to pay off his debts, in the first place, to his brothers.

In 1879, Matvey Prang made a third and longest trip to Europe. He visited soda plants in France and England which were opened by the time. In England, he bought a steam engine and latest equipment for his plant. The purchased equipment was to be delivered using the newly discovered Northern Sea Route. However, the attempt was unsuccessful. The English ship was unable to come through the ice of the Arctic Ocean and brought the equipment to St. Petersburg from where only part of it was sent to Siberia (Zavadovsky, 1894: 388). The latter fact was explained by new financial difficulties.

The English equipment allowed Matvey Prang to once again enhance his technology processes and production cycle in the early 1880s. However, despite the ongoing ban (steam engines were not used as their installation was prohibited at private plants located in the Cabinet lands), the director of the Altai mining district, A. Freze, permitted the installation of steam engines at the Prang plant. This gave Matvey Prang an opportunity to boost production levels. By 1888, the plant installed a new 4 hp steam engine used in parallel with outdated 3 hp horse-drawn machines (GATO. F. 234. Op. 1. D. 116. L. 160).

The statistics show that from the very beginning the enterprise continuously increased volumes of output. Already in 1866, the plant produced 3 thousand poods of soda, and in the 1870s the annual production capacity already was approx. 6.2 thousand poods (Skubnevsky, 2010: 199). Without any doubt, the installation of the steam engine made it possible to significantly raise the volume of production. For example, according to information given by M. Prang himself, in 1887 the plant made almost 17 thousand poods of soda products for almost 25 thousand rubles (GATO. F. 234. Op. 1. D. 116. L. 160).

According to Orlov, as of the end of the 1890s, the “Prang i K<sup>o</sup>” soda plant produced 14.2 thousand poods of caustic soda and 4 thousand poods of refined soda (Orlov 1900: 185). By the end of the 19th century, the enterprise was a major soda supplier for tanneries, glassworks and soap factories in Siberia and the Far East. The Prangs had only one rival in the region at that time – the plant owned by K. Zanevsky in the Trans-Baikal oblast, which produced only 450 poods of caustic soda at that time (Orlov, 1900: 185).

The growth of the Prang soda plant was also contributed by the fiscal policy carried out in the late 19th century. For example, until the mid 1880s, the plant received the bitter salt without paying the mandatory excise duty in the amount of 10 kopecks per pood. This was achieved through the privileges given to him in 1865 and 1875. In 1895, the production of various salts in the South of Western Siberia was financed by the Treasury Chamber. In this case, the Prang plant was in a better position than other bitter salt customers – to him, the excise was 3 kopecks per pood, while other manufacturers had to pay 5 kopecks (Bobyatinsky, 1898: 376).

As the soda market gradually developed, it encouraged Prang to expand his workforce. For example, his plant employed 55 people, mostly men (50 pers.) in 1888. The company was strongly dependent on customers, and as a result was seasonal: the capacity utilization rate rose to its peak in the period from December to May, hit the lowest level from July to September (GATO. F. 234. Op. 1. D. 116. L. 160).

The seasonal operations affected salaries and other aspects of the social situation of the workers. For example, the plant had shift schedule in place with each shift (day and night) lasting 11 hours – it was

commonplace for the time. Compensations were calculated on a per shift basis and amounted to the sum from 25 kopecks to 1 ruble 20 kopecks, depending on qualifications. The level of training remained extremely low – none of the workers had special education. As the business owner pointed out, “the works in the shops are done under the supervision of the six foreman’s assistants selected from workers and belonging to lower middle class and peasants... directly supervised by the owner of the plant” (GATO. F. 234. Op. 1. D. 116. L. 160).

Early 20th century studies into the work organization at private plants in the Altai mining district preserved information on the organization of production and workers’ life at the “Prang i K<sup>o</sup>” plant. For example, S.P. Shvetsov noted that the plant buildings were in a terrible condition: “The first section of the plant, which has a number of so-called sulfate furnaces, is nothing but an shabby log barn with no windows and ceiling; gates instead of the door, earthen floor” (Shvetsov, 1897: 160). That fact there were no basic safety measures in place at the plant is suggested by the quotation saying that “it was impossible to take a single step without assistance, risking to fall down in a boiler or furnace” (Shvetsov, 1897: 161).

Despite the significant personnel (there were over 60 workers at the end of the 1890s (Orlov, 1900: 185)), the soda plant had no medical doctor or feldsher on the staff (feldsher – a medical doctor's assistant). The lack of medical personnel at such a dangerous facility was compensated with free first aid medications available for workers. If they needed more serious treatment, they were sent to Red Cross Hospital in Barnaul. In this case, expenses were covered by the owner of the enterprise (Shvetsov, 1897: 170).

The soda plant was one of the few enterprises in the Altai, which maintained its own school. Shvetsov pointed out that children were taught for a long time by Julia Prang, Matvey Prang’s wife. In 1890, after her husband's death, she assumed control over the company and had to take a graduate from the Barnaul pre-gymnasium for the vacant position of teacher (Shvetsov, 1897: 172). Since the plant was located near Barnaul, children of workers and clerks at the plant office were also students at the school.

According to the production organization, production volumes, and number of employees, Prang’s soda plant can be characterized as a factory type enterprise. In addition, the value of the plant is that it was Russia’s first enterprise in the industrial production of soda.

The plant won renown in the Russian industrial community. In 1870, it was awarded a silver medal at the All-Russian Manufacturing Exhibition. At the All-Russia Industrial and Art Exhibition 1882, M.B. Prang was awarded a gold medal with the inscription: “For the foundation of the first and the only existing soda plant in Russia so far, as well as for the assistance provided by the exhibitor in the development of the Siberian soap and other industries” (Zavadovsky, 1894: 389), and at the 1896 All-Russia Industrial and Art Exhibition in Nizhny Novgorod, he was given an entire stand.

By the end of the 19th century, the enterprise successfully operated an even managed to slightly increase its production output but then with the construction of the Trans-Siberian Railway, the situation changed dramatically. The isolation of the Siberian market, which closed it for companies from European Russia, was removed. Moreover, by the end of the 19th century, the European part of our country developed a strong soda industry. For example, the Berezniki Soda Plant in the Perm province, which still exists, produced 24 thousand tonnes of soda in 1900, and in total, the country produced 82 thousand tonnes.

The Berezniki Soda Plant was owned by Lyubimov, Solvay i K<sup>o</sup> and the company was quite likely to have decided to remove the only competitor in Siberia. Although the exact date when it bought the Barnaul soda plant was not identified, it is known only that in 1904 the plant already belonged to new owners. The exact date on which the enterprise was shut down also remains unknown. In any case, overviews of the Tomsk Province published the information on the Barnaul soda plant up to and including 1905. According to V.A. Skubnevsky, the soda plant was acquired in 1907 by Lyubimov, Solvay i K<sup>o</sup> which ran a larger similar facility in the Urals. In 1912, the Barnaul soda plant was closed down (Skubnevsky, 2010: 199).

This case makes it clear that the method of “hostile takeover” employed to eliminate a competitor was a widespread practice in the early 20th century. It was that period that witnessed an extensive system of monopolies forming in Russia, such as Prodamet and Prodvagon. They controlled sales and distribution and influenced prices. Actually, it is completely natural for a large company to strive to monopolize the market.

## 5. Conclusion

The turn of the 19th century brought about a new upsurge in the development of textile, glass, leather, soap and other sectors of the Russian industry. Further economic growth was possible only with the increased production of raw materials. Handicraft production of soda ash could no longer address constantly growing needs of industrial enterprises. Imports of soda from Europe made the Russian industry dependent on the world market and international environment. This was clearly demonstrated by the Crimean War of 1853-1856. Moreover, imports resulted in the more costly production. In this situation, it was essential to find a solution for the “soda question.”

The crucial role of the national soda ash production was realized by the government, business and academia by mid-19th century. The new branch needed support from the state and the state provided it in the form of protectionist policies.

The survey of mineral resources in the late 18th and early 19th century, improving chemical technologies in Russia and Europe and continuously growing demand provided a solid foundation for a Russian soda industry with Western Siberia as one of its first centers. But its development was slowed

because the region had no appropriate transport infrastructure. This problem will be resolved only at the turn of the 20th century. As result, Russia was not only able to completely supply the domestic soda market but also start its exports.

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### Из истории содового производства в России в XVIII–XIX вв. (на примере Сибири)

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**Аннотация.** Научно-техническая революция второй половины XVIII – начала XIX вв. спровоцировала резкий скачок в развитии промышленности. Развитие химии породило новые направления в промышленности, одним из которых стало содовое производство. Сода в этот период была важным элементом для текстильной, кожевенной, стекольной, мыловаренной отраслей. Процесс ее производства в первой половине XIX в. совершенствовался, что привело к открытию аммиачного способа (метод Сольве). Первый промышленный содовый завод в Российской империи был открыт в 1864 г. братьями Прангами на Алтае. Со второй половины XIX в. Западная Сибирь, где имелись богатые месторождения глауберовой соли, стала одним из центров содового производства в

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России. Становление новой отрасли проходило в условиях протекционистской политики правительства, что свидетельствовало о его заинтересованности в преодолении зависимости отечественной промышленности от иностранных поставщиков. В статье проанализированы особенности развития содовой промышленности в России на примере Сибири в досоветский период на примере завода «Пранг и К<sup>о</sup>». Впервые представлены проекты по организации содовых заводов в Западной Сибири и выявлены причины, по которым они не были реализованы. В работе были использованы документы из центральных и региональных архивов России, опубликованные результаты полевых исследований горных инженеров конца XIX в.

**Ключевые слова:** содовое производство в России, содовый завод «Пранг и К<sup>о</sup>», Матвей Пранг, Западная Сибирь, алтайские горько-соленые озера.