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# **Formalisation of Agricultural Research: Activities of the Imperial Free Economic Society (Second Half of the 18th – First Half of the 19th Centuries)**

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**Abstract**---As an independent component of modern research in natural sciences, branch research developed as a result of the accumulation of knowledge from three spheres of public activity – agriculture, branch-specific education, and agricultural research – under the influence of a complex interaction of many external factors. The purpose of this study is to investigate the initial stage of formalization of agricultural research as a branch of natural sciences with the development of corresponding sign-symbolic systems and terminology. Based on the study of printed and archival research of the Imperial Free Economic Society (IFES), adjustments were made to the scientific periodization of the history of research as a branch of knowledge, considering the personalized contribution of its luminaries. Forgotten or little-known studies of pioneers of Ukrainian research – the IFES members: Swiss mathematician L. Euler; Russian scientist of Swedish origin, botanist and chemist E.G. Laxman; a native of Chernihiv Region, Professor of agriculture V. P. Prokopovich, and others were introduced into scientific discourse. The present paper analyses the areas of diverse research activities in agriculture, which were conducted by IFES figures at the early stages of the first scientific and economic association in the Russian Empire.

**Keywords**---agricultural research, branch research, economic society, formalisation research, works imperial.

## **Introduction**

In the history of Ukrainian branch research, the fact that since the end of the 18th century, 80 % of Ukrainian ethnic territories (Left-Bank, Right-Bank, and Southern Ukraine) were part of the Russian Empire was crucial, giving objective

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grounds to consider the genesis and evolution of the scientific and organizational foundations of agricultural research, considering the internal factors of development of this state. Analysing the history of natural sciences, academician V.I. Vernadsky (1863–1945) emphasized that in Russia, throughout the 18th and almost the entire 19th centuries, creative scientific work was directly or indirectly connected with the state organisation. The development of science was either caused by state needs, or science found itself, often contrary to the wishes of the government, in organisations established by the state for other purposes (Vernadsky, 1988). The initiators of scientific research were individuals whose activities were to a certain extent connected with the state – professors, doctors, teachers, individual officials in the civil service. Before the abolishment of serfdom, Russian pomeshchiks were completely indifferent to science, in contrast to the fact that in many Western European countries the nobility left a huge mark on the history of natural sciences. In particular, according to V.I. Vernadsky, the contribution of the Russian landed gentry to the development of agronomic culture – gardening, horticulture, animal husbandry, field husbandry – was miniscule; much more in these industries was “achieved by the nameless labor of raznochintsy” (Vernadsky, 1988).

The modern-day definition of agricultural research belongs to the Ukrainian scientist, academician of the National Academy of Agrarian Sciences of Ukraine V.A. Vergunov: “a deep and comprehensive study in specialized research institutions of agronomic, animal husbandry, and other agricultural phenomena that occur in natural and specially created conditions using appropriate methods and tools to find the most appropriate ways and approaches to improve the cultural level of agriculture, as well as the search for other means and ways to provide research-to-practice support to agricultural manufacture to yield the greatest quantity and the best quality of environmentally balanced agricultural products” (Vergunov, 2012).

Several periods of development can be distinguished in the history of Ukrainian branch research, the longest of which was the period when research was developing as an independent branch of natural sciences. This process, originating from simple empirical observations of the first farmers and pastoralists of the Neolithic era, was extremely slow in all countries, which, according to the outstanding organizer of the research, professor V.V. Viner (1872–1930), was the most amazing phenomenon in the history of agriculture (Viner, 1922). Due to the achievements of outstanding natural scientists, only at the turn of the 18th–19th centuries, the science of agriculture was included in the curricula of classical educational universities and special branch educational institutions and the first experimental fields were created as a basis for educational and practical training of students and industry experimentation.

The history of science connects the completion of the formalisation of agricultural research with the publication of the study “Russian chernozem” by V.V. Dokuchaev (1846–1903), which in fact was the report of the scientist to the IFES on the research results, and his defence of his doctoral dissertation on December 10, 1883 (Dokuchaev, 1883). As one of the main methods of theoretical research, formalisation constitutes a reflection of scientific knowledge in a sign-symbolic form, the so-called formalised language that ensures the systematisation of

research results, their reflection in the clear concepts and statements, and also excludes ambiguity of interpretation (Novikov & Novikov, 2007). Most often, scientists associate the beginning of the formalization of research as a branch of natural sciences with the publication of the “Invitation to rural homeowners to conduct certain experiments relating to agriculture” in the IFES’s “The Works...”: in 1769. This work is considered the first instruction for conducting scientific experiments in agriculture and is associated with the name of the first Russian academician M.V. Lomonosov, although the author’s last name is not indicated in the collection either at the beginning or at the end of the work. At the same time, modern historians of science make an important comment that similar instructions were published earlier – for instance, monasteries provided lay people with recommendations on soil cultivation, the time for sowing grain and fodder crops, etc (Vergunov, 2019). However, the instructions of the monasteries concerned only the territory of their economic interests, while the “Invitation to rural homeowners...” published in the IFES’s “The Works...” was supposed to help develop agriculture within the borders of the entire state. The purpose of this study is to investigate the historical prerequisites and initial period of formalisation of research as a branch of natural sciences based on the examination of printed and archival works of figures of the IFES, including the studies by pioneers of industry experimentation of the late 18th – early 19th centuries (Doroshenko et al., 2021; Saravanadurai & Manimehalai, 2016).

## Materials and Methods

Historiographic analysis of literature allows identifying three main periods, the chronology of which is determined by the dominant political, socio-economic, and cultural-national factors in society: 1) pre-revolutionary (19th century – before the revolution of 1917–1920); 2) Soviet (1921–1991); 3) post-Soviet (1991–present), which is represented by scientific studies of Ukrainian researchers and scientists of the post-Soviet space. Among the pre-revolutionary studies, the works of IFES’s secretaries, Professor Khodnev (1865), and Kulyabko-Koretskiy (1897), particularly stand out. Important information is contained in the historical reviews compiled by the secretaries of the Moscow Society of Agriculture (MSoA) Maslov (1846), and Gorbunov (1870), created on the initiative of the IFES in 1818. Despite the clear bias, the presented works of the of IFES and MSoA secretaries are important from the standpoint of the factual material presented by the authors, which allows including these works in the source base of this study. Methodological approaches are defined considering the provisions set out by academician V.I. Vernadsky in a study covering the history of natural sciences in Russia, the first section of which was published in 1914 (Vernadsky, 1988). The Soviet period of historiography is represented by the works of well-known founders of agricultural research and at the same time its chroniclers Viner (1922); Doyarenko (1921); Pshenichny (1964). On the territory of Ukraine, the works of Academician Vergunov (2012; 2019), constitute a considerable asset of modern Ukrainian historiography for the study of the scientific and organisational foundations of the agricultural research. The history of the formalisation of research is partially presented in the monograph of Ukrainian scientists T.H. Tikhonenko, V.A. Vergunov, M.O. Gorin, N.M. Novosad (Tikhonenko et al., 2016). In modern scientific discourse, the problem of scientific and organisational foundations of the establishment and development of agricultural research in the

system of higher branch training of Ukraine has become relevant (Holikova, 2020; 2021). In the post-Soviet space, methodological approaches to studying the origins of research as a branch of knowledge were developed by the authors of the collective monograph “Essays on the history of agronomy” (Ivanov et al., 2008). Most comprehensively, the history of branch research is covered in the monograph by Elina (1972). The synthesis of traditions and innovations in the activities of Russian agricultural scientists in 1820–1860 was considered by the historian Kozlov (2019). Important research on the history of the IFES from the beginning of its foundation belongs to Lukichev (2015; 2016). Interesting factual material on the history of the IFES is presented in the somewhat biased work of the first vice-president of the Free Economic Society (FES) of Russia Krasilnikov (2015).

Therewith, the author agrees with the periodisation of the IFES history introduced by Professor P.M. Lukichev from the standpoint of the transformations that the IFES underwent under the influence of changes in the economic and social life of the Russian Empire (Lukichev, 2015). Scientists have identified three stages:

- “Tsarist” (1765–1815), which is described by the determination of scientific research areas (so-called competitive tasks) by tsars or their closely associated dignitaries, who simultaneously provided for the financial needs of the IFES, which miraculously united the higher state nobility and academic scientists;
- “Noble” (1816–1865), when the development of the IFES was directed primarily by representatives of the gentry, which reflected the decrease in the elitism of the IFES in the conditions of its increasing financial independence; during the presidency of Count M.S. Mordvinov in 1823–1841, financial revenues increased almost fivefold;
- “public” (1865–1919), which is described by an increase in the democratic nature of the IFES, whose activities involved various segments of the population, as well as a considerable intensification of research-to-practice activities in the context of the modernisation of the Empire after the abolition of serfdom (Lukichev, 2015).

The present study analyses the “Tsarist” and Noble stages of the IFES's activity, when the scientific and organisational foundations of the formalisation of research as a branch of knowledge were laid, which also determines the chronological boundaries of this study. The source base of this study includes both the articles by figures of the IFES published in the “The Works ...” of this very first scientific and economic association, and archival materials stored in the Russian State Historical Archive (RSHA). In particular, the research objectives were determined by the references to digitised materials of the RSHA on the history of the IFES, primarily works and messages sent to the IFES by various authors for publication in “The Works...” or for involvement in competitive tasks announced by the IFES (Fund 91). Important sources of this study are published works of outstanding scientists, whose research is the foundation of Ukrainian science in agriculture and branch research – Lomonosov (1952; 1954; 1955); Bolotov (1952); Afonin (1771); Pavlov (1837); Komov (1788), et al. To establish the state-legal aspects that influenced the evolution of the scientific and organisational foundations of research in particular historical circumstances, the

authors of the present paper used the documents presented in the official publication “Complete collection of laws of the Russian Empire”.

The methodological basis of this study is the system method, which includes the principles of historicism, objectivity, comprehensiveness, specificity, and complexity of the approach to the problem under study. The methodological specifics of the system approach enable a comprehensive study of the regularities and mechanisms of formalisation of research. In addition, the study employs general scientific and special methods of historical research. The study of printed and archival sources led to the use of methods of analysis, synthesis, generalization, classification, and systematisation (Potts & Kastle, 2017; Imamov & Semenikhina, 2021).

## Results

### **Prerequisites for the formalisation of agricultural research as an independent branch of natural sciences**

The Free Economic Society for the Encouragement of Agriculture and Husbandry in Russia has played an essential role in the formalization of agricultural research. Created on November 11 (October 31), 1765 during the reign and under the patronage of Catherine II of Russia, it existed until 1919. According to the Charter, approved on June 26 (15), 1765, the purpose of the IFES was to increase agriculture and economy in Russia by summarising the available agricultural practices — both domestic and foreign, and the members of the Society undertook to spread “knowledge useful for agriculture and husbandry” in Russia (Lvov et al., 1999). According to the Charter (Chapter IV; Paragraph 2), in their works, active members of the IFES had to conduct experiments on husbandry, agriculture, forest reproduction, animal husbandry, fishery and animal hunting, mining and manufacturing, as well as investigate various problems of private and state economy (Lvov et al., 1999). A manifestation of the IFES's openness was the regular proclamation of competitive tasks with public consideration of the answers received (Khodnev, 1865). During the first century of activity, 243 competitive tasks were announced (Lomonosov, 1954). Printed works of the IFES – “The Works ...” – was published almost every year since 1765. In some places, the IFES members followed the instructions set out by the Empress in her “Order to the Commission for Drafting a New Code” of August 10 (July 30), 1767, in the development of which they were directly involved.

Historians note that the IFES, as the first scientific association in Russia, was created according to M.V. Lomonosov's plan on the foundation of the State Board of zemstvo husbandry in 1763 (Lomonosov, 1952). World-class naturalist and first Russian academician of the St. Petersburg Academy of Sciences M.V. Lomonosov (1711–1765) studied at the Kyiv Mohyla Academy for several months in 1734 (according to another version – until the end of the 1734/35 academic year). In his works, the scientist drew conclusions that were ahead of their time. For example, in the work “First fundamentals of metallurgy or ore mining. Addendum Two, “On the layers of the Earth”, first published in 1763, M.V. Lomonosov considered soil development as a biological process and linked the

origin of chernozem with the accumulation of humus in it – the remains of plant and animal organisms (Lomonosov, 1954).

Scientific activity of M.V. Lomonosov started at the time when the demand for agricultural knowledge began to develop in society, but there was almost no special literature in Russian. The only printed work on husbandry was the so-called “Florinus's economy” in nine books. This work of a German economist Francisk F. Florinus (?–1699) was first published in Russian language by the St. Petersburg Academy of Sciences in 1738 (during the 18th century it was published five times). It became the first popular science publication to contain recommendations on agriculture and husbandry borrowed from German practice. In 1747, M.V. Lomonosov translated into Russian the work of Solomon Hubertus (?–1653) “Economic stratagem, or to those who study agriculture...” (first published in German in 1645). Adapted to the Russian style and translated by M.V. Lomonosov, this work was titled “Livonia economy” and was published by the Academy of Sciences in 1747. The book served as a guide for conducting various branches of husbandry – agriculture, field production, cattle breeding, poultry farming, fishing, forestry, beekeeping, etc., with the definition of meteorological conditions and the most favourable calendar time by month of the year for performing work (Lomonosov, 1955). Translated by M.V. Lomonosov, “Livonia economy” was a work which gave one of the founders of agronomy in Russia A.T. Bolotov (1738–1833) his first theoretical knowledge of agriculture – he came across a book while sorting through his father's business papers. According to some researchers, M.V. Lomonosov did not limit himself to a simple translation of the work of Solomon Hubertus and outlined his personal opinions on agricultural economics in the translation process (Lvov et al., 1999). Therewith, the compilers of Volume 11 of “The Complete Works” of M.V. Lomonosov insist that his translation does not contain any deviations from the text of Solomon Hubertus, with the exception of information about sunrise and sunset in the Livonia province as unimportant for Russian landowners (Lomonosov, 1955).

The scale of M.V. Lomonosov's strategic planning fully manifested itself in his project on the foundation of the State Board of zemstvo husbandry (Lomonosov, 1952). Drawn up in 1763, this project was, as it were, a “counter” proposal of the scientist regarding the Order of Catherine II to create the “agriculture class” as a structural division of the Imperial Academy of Sciences. Contrary to the Empress's orders, M.V. Lomonosov developed a plan for the organisation of a new state institution, administratively independent from the Academy of Sciences, called “State Board of agricultural husbandry” with broad powers to provide scientific support for the needs of agriculture. Factually, the board was to become an Academy of Agricultural Sciences headed by the president and vice-president, which would include scientists who are “very knowledgeable in the Natural Sciences” – a physicist, chemist, botanist, forstmeister (forester – O. H.), gardener, historian of natural sciences, medic. The board was supposed to conduct its work in Russian, while most of the figures of the Academy of Sciences were adherents of German culture. Being organisationally independent from the Academy of Sciences, the State Board of Agricultural Husbandry, according to the scientist's plan, should have been in close contact with it. Lomonosov's project reflected the urgent social need for the existence of a scientific society that would encourage the development of agriculture. A separate item of the project (Item 17) made

provision for conducting agricultural research in the nearest villages, “where there would be different places, mountainous and dry, swampy and clay and meadow” (Lomonosov, 1952). During Lomonosov's lifetime, the plan for the establishment of the State Board of zemstvo husbandry was not implemented, but became a starting point in the history of branch research. At the same time, this project was implemented after the death of a brilliant scientist in the IFES established in 1765 to encourage agriculture and husbandry in Russia. Lomonosov's idea was implemented by dignitaries close to Catherine II, although in a stripped-down form (Martinho, 2018; Martinho, 2019; Patel & Trivedi, 2016).

The IFES's printed works – “The Works of the Free Economic Society for the Encouragement of Agriculture and Husbandry”, were published almost annually, starting from 1765. The second part of “The Works...” for 1767 (by general numbering – Part VI) published an article by the outstanding scientist of the 18th century, Swiss mathematician, mechanic, physicist, astrologer Leonard Euler (1707–1783). Academician of the St. Petersburg Academy of Sciences, L. Euler spent almost half his life in Russia. In the published article, the scientist who was just elected to the IFES raised a topic removed from mathematics: he contemplated on experiments to increase the yield of grain crops, which he personally conducted in Germany at his estate in Charlottenburg in the suburbs of Berlin (Euler, 1767). The essence of the experiment was that the scientist sowed winter rye earlier than usual; the seeds were bedded at a depth of half an inch (1.27 cm), at a distance of about four inches from each other. Before winter, he cut the shoots three times, and before frosts, he dug out the roots and divided them into 12–15 parts, each of which he planted at a distance of three inches from each other. The following summer, he cut the green mass again. The experiment has shown that with this technique the seeds require 100 times less than usual. However, L. Euler noted: “but many rural home builders considered planting seeds and planting roots to be an insurmountable task, and therefore no one wanted to conduct the experiment...” (Euler, 1767). “On the other hand,” the scientist argued, “mowing winter rye helped strengthen the root system and yield a large mass of green feed for livestock”. Despite the positive results obtained, this experiment of the world-famous mathematician was not widely recognised due to its extreme labour intensity, which does not prevent the recognition of Euler's work as one of the very first detailed instructions for setting up a field experiment, published in the collection of works of the first scientific and economic society in Russia (Jarrett, 1985; Just, 2003; Arnawa et al., 2019).

In the third part of “The Works...” for 1769 (according to the general numbering – Part XIII), two studies were published back-to-back: “Invitation to rural homeowners to conduct certain experiments relating to agriculture” (Laxmann, 1769), and “Economic answers relating to agriculture in places near the Svir River and the southern part of Olonets” (Laxmann, 1769). According to the usual practice of that time, the author's last name was given after the last (second) article, which allows identifying the author of the first unsigned publication. It was a Russian scientist of Swedish origin, court adviser, Professor of economics and chemistry, academician of St. Petersburg Academy of Sciences (since 1770) Erik Gustavovich Laxmann (1737–1796). During 1764–1769, E.G. Laxmann conducted extensive research in botany, agriculture, horticulture, animal husbandry, meteorology, mineralogy, and chemistry in the Altai and eastern

Siberia, as well as on Lake Baikal; corresponded with the Swedish naturalist Karl Linnaeus (Bobrov, 1970). A very informative work covering the activities of Academician E.G. Laxmann, was written by Professor, rector of the University of Alexander in 1845–1848 (now the University of Helsinki in Finland) Lagus (1890). According to his observations, in Irkutsk, along with many other studies, E.G. Laxmann was engaged in growing potatoes and garden trees in the greenhouse – cherries, peaches, apples, although the result did not particularly satisfy him (Lagus, 1890). The RSHA (Fund 91) contains the works of the scientist in German language, prepared for publication in the “The Works...” and for involvement in competitive tasks: “On new means to stop quicksand” (Laxmann, 1771), and “On growing a special type of almond and bean” (Laxmann, 1771); this work was published in 1771 in “The Works...” under the title “On Russian bean and oil made from it” (Laxmann, 1771). There is a high probability that the scientist is the author of the two unsigned works in German language, which were sent to the competition announced by the IFES: “Description of natural conditions, opportunities for agriculture, occupation of the population in the Sviri River Basin and Lake Ladoga” (Laxmann, 1771), and “Description of Lake Ladoga and its coast” (Laksman, 1771). The IFES Secretary Professor O.I. Khodnev also informed on the areas of certain scientific research of Academician E.G. Laxmann (Khodnev, 1865).

### **Development of a sign-symbolic system and terminology in agricultural research**

In 1769, E.G. Laxmann was elected a foreign member of the Royal Swedish Academy of Sciences and a member of the IFES. In 1770, the St. Petersburg Academy of Sciences published his work on entomology – the first work in the history of the Academy on this discipline. In the following years, the Academy and the IFES published several Laxmann's works with a description of some medicinal plants, the experience of afforestation of steppes in the Barnaul area, etc.

According to the instructions developed by Academician E.G. Laxmann to conduct four field experiments simultaneously, it was necessary to allocate a tenth of the field and divide it into eight equal sections. The first experiment involved simultaneous ploughing of the first site in a conventional way, and the second – somewhat deeper, using the same amount of manure and seeds on each site. The second experiment consisted of simultaneous ploughing of the third and fourth plots, using a third or a quarter more organic fertiliser on one of the plots, and seeds – a third or a quarter less, respectively. The third experiment involved ploughing the fifth and sixth plots at different times and in different ways (for one – “ordinary third ploughing”; for the other – “soil the land five times”), using the same number of organic fertilisers and seeds. The fourth experiment made provision for ploughing the land as for the third experiment, using a quarter less manure for the site that was “soiled five times”. The results of all experiments were subject to strict recording, with a clear calculation of the straw and grain obtained from each site (Bobrov, 1970). In conclusion, Academician E.G. Laxmann noted that: “...the more such accurate and reliable experiments are conducted in different provinces of the state over several years by persistent patriots... the more praise they will receive from grateful descendants” (Bobrov, 1970). In summary, more than two and a half centuries ago, the scientist was

almost the first to pay attention to agricultural experiments in the context of their benefits for the state and assessed their implementation as a patriotic activity.

According to M.I. Pshenichny, in the work “Invitation to rural houseowners to conduct certain experiments...” provides detailed instructions on a particular subject and the corresponding scheme and methodology for conducting a field experiment. This allowed the scientist to attribute the beginning of the Russian agricultural research to 1769, although he mistakenly connects this publication with the name of Academician M.V. Lomonosov (Pshenichny, 1964). To date, the conclusion regarding the authorship of this paper belonging to M.V. Lomonosov has been firmly rooted in scientific studies (Vergunov, 2019), which necessitates the adjustments to the scientific periodisation of the process of formalising research as a field of knowledge. At the same time, this error did not occur by chance, because the Lomonosov's contribution to the beginning of a scientific research is an indisputable fact. It was for a reason that Empress Catherine II instructed him in 1764 to inquire into the experimental sowing of cereals conducted in the summer garden by the court gardener G.Ya. Ekleben (who was soon-to-become one of the founders of the IFES and the author of its “The Works...”). Lomonosov examined the bushes of rye and wheat and testified that the German gardener factually managed to get whole groups of spikelets from one grain, about which the scientist expressed his authoritative opinion in the newspaper “St. Petersburg's Vedomosti” (1764, No. September 72, 7) (Vergunov, 2012). G.Ya. Ekleben himself reported that he yielded 2.375 grains from one sown grain. Modern scientists believe that he found a way to enhance the tillering of cereals as the ability of the plant to expel a great number of side stems. However, not a single instruction on the method of conducting this experiment was preserved by the German gardener (Masters et al., 2013; Alston et al., 1998).

In the second half of the 18th – early 19th centuries, an entire pleiad of talented agronomists united around the Free Economic Society, including A.T. Bolotov (1738–1833), M.I. Afonin (1739–1810), I.M. Komov (1750–1792), M.G. Livanov (1751–1800) and others. In Soviet times, their activities did not receive proper coverage in historiography, primarily for ideological reasons. Socio-political transformations of the second half of the 1980s paved the way for an unbiased investigation of the contribution of these pioneers of research to Russian agricultural science. Being original scientists, they have enriched this branch of scientific knowledge with essential discoveries and inventions. For example, A.T. Bolotov formulated the doctrine of mineral and “air” nutrition of plants; established a close correlation between the constituent elements of nature (soil, plants, animals); laid down scientific ideas about agricultural systems; developed basic methods of fertilising fields and weed control, etc. (Bolotov, 1952). Bolotov is known as the author of several thousand articles and notes, many of which were published in “The Works...”, and as the founder of the first agricultural journals: “The Villager” (1778–1779) and “Economic Shop” (1780–1789; with the support of the educator and publisher M.I. Novikov). Among the works and messages sent to the IFES by various authors for publication in “The Works...” and involvement in competitive tasks, the largest number of works belongs to A.T. Bolotov.

Unlike the brilliant amateur A.T. Bolotov, M. Afonin had a university education. In 1758–1761, he studied at the Prussian University of Königsberg, and during

1761–1766 – at Uppsala University in Sweden. In 1866, M.I. Afonin defended his dissertation on the topic “On the benefits of the history natural sciences in everyday life” under the supervision of the famous Swedish botanist Karl Linnaeus (in 2 parts, 30 pages; in Sweden, the work was published three times; the last time was in 1789) (Laxmann, 1771). Having received the degree of Doctor of Philosophy and Medicine, in 1769 Afonin returned to his homeland, and in 1770 began teaching a course on rural home economics at Moscow University (15 years after opening of the educational institution on M.V. Lomonosov's initiative). In 1774, he was approved as the first Russian professor of the history of natural sciences (zoology, biology, mineralogy) and agriculture. According to the biologist Professor V. S. Egorov, the most interesting in the theoretical legacy of M.I. Afonin is a conclusion about the origin of humus from organic bodies under the influence of living organisms of soil and atmospheric agents (water, air) (Egorov, 2009). Afonin proved that chernozem is the greatest asset in agriculture. He expressed his opinions on this matter in the historical speech “A word on the benefits, knowledge, collection, and location of chernozem, especially in agriculture” at the celebrations on the occasion of Catherine II's visit to the University in 1771. For the first time, the work was published in the same year, and for the second time – in 1820, in the collection “Speeches delivered at a solemn meeting at Moscow University”. In this report, M.I. Afonin introduced one of the very first classifications of chernozem, identifying eight types of different soils: 1) clay chernozem; 2) stony and sandy chernozem; 3) forest, resin-like, oily-looking chernozem; 4) boggy chernozem – sour and cold; 5) birch chernozem – dry and cold; 6) juniper and pine chernozem – not just warm, but hot; 7) spruce chernozem – rich, but colder than pine; 8) walnut chernozem – rich and warm, useful for rye and spring sowing (Afonin, 1771). Therewith, Professor M.I. Afonin emphasised the necessity of studying the fertility and properties of each particular plot of cultivated land, and also suggested drawing up a kind of “passports” of fields with a record of the natural qualities of soils in them. Due to his health condition (probably tuberculosis), M.I. Afonin left the University in 1777.

In 1784–1788, with the rank of collegiate adviser, he held the position of “the director of economy” in the Chamber of State Affairs of the Ekaterinoslav viceroyalty and the Crimea (Makidonov, 2011). Professors of agriculture M.G. Livanov and V.P. Prokovich worked as assistants to the director of economy (they obtained their professorial knowledge by decree of the Senate after an internship in England) (Yavornitskiy, 1989). The northern Black Sea region, which was described by a favourable climate and the absence of conventional agriculture was an ideal place for agricultural research. Together with the German scientist-encyclopaedist P.S. Palas, M. Afonin conducted agronomic experiments and reported on their results in “The Works...”.

After M.I. Afonin left the University, the course on agriculture at Moscow University was resumed only 27 years later, when, according to the Charter of Moscow University of November 17 (5), 1804, agriculture as a science received recognition from the state and was included in the circle of academic subjects of the Faculty of Physics and Mathematics. To ensure the presentation of the course, the Department of Mineralogy and Rural Husbandry was created, headed by a native of Chernihiv Pryluky A.A. Prokopovich-Antonskiy (1762–1848). A

graduate of the Kyiv-Mohyla Academy in 1773, he studied at Moscow University since 1784, and since 1788 he worked at the Department of Encyclopaedia and History of Natural Sciences. During 1804–1818, he headed the Department of Mineralogy and Rural Husbandry of the Faculty of Physics and Mathematics, of which he was twice elected Dean (1808–1809, 1813–1818). In 1819, Professor A.A. Prokopovich was appointed as the rector of Moscow University; in the same year, he became one of the founders of the Moscow Society of Agriculture (MSoA). At the end of his life, he managed the MSoA Agricultural School, the first head of which was the Professor of Agriculture at Moscow University M.G. Pavlov (Gorbunov, 1870).

Mikhail Pavlov started teaching a course on agriculture at Moscow University in 1820, during the rectorship of Professor A.A. Prokopovich-Antonskiy. He read it intermittently until 1839. Being a student and follower of A.D. Thayer, M.G. Pavlov went down in the history of science as the founder of the theory of agriculture in Russia and the ideologist of agricultural science. In 1837, the scientist published the first Russian manual “Course of Agriculture” (two parts out of five planned were printed), where he presented the main problems of the industry at the level of contemporary science. Moreover, the first part highlighted the importance of natural sciences for the development of the science of agriculture: “science is the beginning of agriculture”, and he understood the science of agriculture itself as “adding natural sciences to the breeding of plants and animals that are useful in the social life” (Pavlov, 1837). Thus, the training course on rural husbandry started in 1770 by Professor M.I. Afonin at Moscow University, for the first time received a holistic presentation in the educational literature due to Professor M.G. Pavlov's activities.

By Order of Catherine II, for eight years – from 1776 to 1784 – I.M. Komov, M.G. Livanov and V.P. Prokopovich, under the leadership of archpriest A.A. Samborsky, studied agricultural science in England, at the University of Oxford, and on British farms (Komov, 1788). At that time, various fruit crops were being actively introduced in England, cultivated meadows were replacing ordinary pastures, new technical devices were being developed, etc. Therewith, in the second half of the 18th century, the views of the founder of the so-called new agronomy Arthur Young became widely known (1741–1820), who argued that agriculture should be the main object of state care. Being an English agronomist and economist, he was an original exponent of the economic thought that defended the interests of large landowners and related large farmers. On A. Young's personal farm in Suffolk County, together with an English scientist, I.M. Komov conducted experiments to improve agricultural technology (Hall et al., 2003; Evenson, 2001). The obtained innovative results allowed A. Young to recommend himself for election as a member of the Society for the Encouragement of Agriculture and Internal Improvement, established in 1793. Professor I.M. Komov wrote the country's first work on machine science – “On Agricultural Tools” (1785). He is also the author of the work “On Agriculture” (1788). This book immediately became a practical guide for rural homeowners. The demand for it was so great that a second edition was needed the following year. The work describes the importance of agriculture as a branch of the national economy; shows the connection of agriculture with natural sciences – the history of natural science, medicine, chemistry, mechanics, physics, and summarises that “agriculture is ... part of experimental physics, ...

each experiment will show something, ... that is useful for the entire human race” (Komov, 1788). At the same time, I.M. Komov argued that “the main way to improve agriculture is cattle breeding, ... cattle feed and clothe a person, and help fertilise the land” (Komov, 1788). According to scientists, this work is the most meaningful original domestic work on agriculture in the 18th century. Therewith, according to the conclusions of the historian O.I. Prymak, most of the practical tips given by I.M. Komov in this work were incorporated by him from the agricultural instructions of the 18th century. After I.M. Komov's return from England, by Decree of Catherine II, he was appointed assistant director of the Moscow State Chamber with the rank of titular counsellor (1785) (Primak, 2013). While studying in England, a student of Professor M.I. Afonin, agronomist, geologist, livestock breeder, Professor M.G. Livanov completed an internship on Robert Bakewell's (1725-1795) farm, whose work on breeding of domestic animals is widely known in the world. Livanov (1786), defined agriculture as “a science that indicates the means to multiply necessary and useful plants”. In his essays “The History of the City of Yekaterinoslav”, historian D.I. Yavornitsky (1855–1940) noted that in 1786 M.G. Livanov and V.P. Prokopovich were appointed teachers of Yekaterinoslav University, the project of which, at the request of Prince G.O. Potemkin, was approved by the Empress (it was not implemented due to the war with Turkey that began in 1787 and the death of Prince Potemkin in 1791) (Yavornitskiy, 1989). In 1786, M.G. Livanov's book “Instructions for practical and clerical agriculture” was published by Order of G.O. Potemkin, which substantiated the fundamental principles of agriculture from philosophical (theoretical) and agronomic (practical) standpoints (St. Petersburg, in 2 parts). M.G. Livanov has special merits an agricultural education: in 1790, he created the first Agricultural School in the Empire in the village of Bohoiavlenske, near the city of Mykolaiv. Professor M.G. Livanov is also the author of the “Guide to breeding and healing livestock” – the first Ukrainian work on animal husbandry (St. Petersburg, 1794). In 1799, the Printing House of the Black Sea Navigator School in Mykolaiv published another book of the scientist “On Agriculture, Animal Husbandry, and Poultry Farming” was published, which also included two previously published treatises. On the occasion of the 200th anniversary of the publication of this work, by the Decision of the Academic Council of the Mykolaiv State Agricultural Institute, in 1999, the work was published as a monument of domestic agricultural science in the same form it was published in 1799 (Livanov, 1999).

The sources do not have sufficient information about the activities of associate M.G. Livanov, a native of Chernihiv Region, titular consellor, Professor of agriculture Vasily Prokopovich (circa 1756–1792). He served as assistant economy director of the Yekaterinoslav viceroyalty until 1791 (Yavornitskiy, 1989). In 1785, he was accepted as a member of the IFES and the same year the “The Works...” published his studies on the research results in animal husbandry and crop production: “On the Best Feed and Care of Cows”, “On Hop Cultivation” and “Malt Cultivation” (Prokopovich, 1785).

Many talented individuals paved the way for improved agriculture. Quite frequently, their research activities were spontaneous, just as the process of developing science and research on the part of the state was little controlled. In their studies, historians of science O.Yu. Elina, V.A. Vergunov, S.O. Kozlov cite

the names of an entire cohort of talented representatives of the nobility – ideologists of wide application of field grass sowing and fruit growing or, according to O.Yu. Elina, “rational or exemplary houseowners”. This also includes the author of numerous works on agronomy, veterinary medicine, and economics, a member of the IFES and the MSoA V.O. Levshin (1746–1826); co-founder of the MSoA and the Agricultural School on Butyrsky Khutir under the IFES, known for introducing the principles of exemplary agriculture in his own estates landowner D.M. Poltoratsky (1760–1818); I.I. Samarin (1774–1847), who introduced the quadrupole and clover culture into the field crop rotation in the family estate and farms of peasants; author of many agricultural works D.P. Shelekhov (1792–1854) and others (Vergunov, 2019). Notably, according to the conclusion of the well-known economist Academician Nikonov (1955), the founders of agronomic science in the first half of the 19th century were primarily economists who sought to increase profits not at any cost, but at the lowest cost. Therewith, most of them were humanists, opponents of serfdom. However, in general, the Russian landed gentry expressed next to no interest in branch science experimentation on their estates (Sumberg et al., 2003; Jancowicz-Pitel, 2019).

## Conclusions

The historical reconstruction allowed studying the beginning of the formalisation of agricultural research as an independent branch of natural sciences with its inherent sign-symbolic system and terminology. Due to the use of general scientific and special methods of historical research, it is proved that the publication entitled “Invitation to rural houseowners to conduct certain experiments relating to agriculture”, which was published in the “The Works...” of 1769, which was conventionally credited to Academician M.V. Lomonosov, belongs to the Russian chemist of Swedish origin E.G. Laxmann. In turn, this conclusion enabled adjustments to the periodisation of the development of research as an independent branch of scientific knowledge, introduced by M.I. Pshenichny. Therewith, the author introduced the forgotten or little-known works of other figures of the IFES on rural husbandry into scientific discourse, including the studies of Swiss mathematician L. Euler and a native of Chernihiv Region, Professor of agriculture V. P. Prokopovich. The paper also analyses some areas of versatile research activities in the area of combining theory with practice, which was conducted by the figures of this first scientific and economic society in the Russian Empire. The scientific, educational, and practical activities of the IFES members contributed to the dissemination of the idea of rational agriculture among officials, the foundation of which was branch research.

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