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Research Report

NUMBER 20

The Legacy of the Soviet Agricultural Research System for the Republics of Central Asia and the Caucasus

A. Morgounov
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About ISNAR

Mission

The International Service for National Agricultural Research (ISNAR) assists developing countries in improving the performance of their national agricultural research systems and organizations. It does this by promoting appropriate agricultural research policies, sustainable research institutions, and improved research management. ISNAR's services to national research are ultimately intended to benefit producers and consumers in developing countries and to safeguard the natural environment for future generations.

Impact

To maximize the impact of its work in developing countries, ISNAR focuses on three objectives:

- enhancing the capacity of agricultural research organizations to respond to their clients' needs and to emerging challenges
- expanding global knowledge on agricultural research policy, organization, and management
- improving developing countries' access to knowledge on agricultural research policy, organization, and management

Background

ISNAR was established in 1979 by the Consultative Group on International Agricultural Research (CGIAR), on the basis of recommendations from an international task force. It began operating at its headquarters in The Hague, the Netherlands, on September 1, 1980.

ISNAR is a nonprofit autonomous institution, international in character and apolitical in its management, staffing, and operations. It is financially supported by a number of the members of the CGIAR, an informal group of donors that includes countries, development banks, international organizations, and foundations. Of the 16 centers in the CGIAR system of international centers, ISNAR is the only one that focuses specifically on institutional development within national agricultural research systems.

ISNAR's Research Report series presents the findings of research conducted by the institute and its partners in the areas of agricultural research policy, organization, and management.

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Citation

Morgounov, A. and L. Zuidema. 2001. The Legacy of the Soviet Agricultural Research System for the Republics of Central Asia and the Caucasus. Research Report No. 20. The Hague: International Service for National Agricultural Research.

AGROVOC descriptors

Agriculture; economics; research; research institutions; management; Russian Federation; technology.

CABI descriptors

Agricultural research; change; economics; management; research institutes; Russia; technology.

ISSN: 1021-4429

ISBN: 92-9118-057-2

Contents

Foreword

ISNAR and several other CGIAR centers initiated activities in Central Asia and the Caucasus in 1997 following a decision by the CGIAR to include these regions of the former Soviet Union within its mandate. An early ISNAR activity was an expert consultation on *Agricultural Research Policy, Organization, and Management in Central Asia and the Caucasus* held in The Hague, June 3–5, 1998 and funded by the International Fund for Agricultural Development (IFAD) and ISNAR. This report was prepared as a key contribution to this expert consultation.

The agricultural research system of the Soviet Union was unlike any other system in the world. For the most part, it was a well funded, science-based, and centralized system which was closely linked to the political institutions it was designed to serve. Like other agricultural systems, it evolved in response to political, economic, and technological changes. At the time of independence, the eight countries in Central Asia and the Caucuses were left with substantial local assets of the former Soviet system from which to develop appropriate national systems for agricultural research. More importantly, national agricultural leaders have had, over the past 10 years, the daunting task of changing the mentalities, objectives, procedures, processes, and programs from those designed to serve the Soviet Union to those that serve their national needs and aspirations.

The purpose of this report is to help readers understand the structure, operations, nature, and evolution of the system of agricultural research that these newly independent countries inherited from their past association with the Soviet Union. The report also examines how these countries dealt with this legacy from 1991 to 1998 and makes some assertions as to prospects for agricultural research reforms. With this background knowledge and understanding, institutions and organizations that cooperate with the evolving agricultural research systems of these countries will be better prepared to assist and develop effective partnerships.

ISNAR continues to document institutional change in the region and to assist those countries endeavoring to reform their agricultural research systems to meet the challenges of their emerging market economies in the current context of globalization.

Stein Bie
ISNAR Director General

June 2001

Acknowledgments

The authors, Alexei Morgounov, CIMMYT Wheat Breeder, and Larry Zuidema, ISNAR Senior Fellow, extend their sincere thanks to the persons who provided assistance in the preparation of this report. Many are listed below.

Prof. M. Suleimenov, Academician of the Russian Academy of Agricultural Sciences and Kazak Academy of Sciences and ICARDA Liaison Officer for Central Asia, reviewed early versions of the report and provided useful information and insights. His experience as director general of one of the largest institutes in the VASKHNIL system, as well as his comprehensive knowledge of the whole system of agricultural research in the USSR, was invaluable in developing this manuscript.

Discussions with three persons on the Soviet agricultural research system before 1990 and current changes in the system were most enlightening and stimulating: Prof. A. Zhuchenko, Academician and Vice-President of the Russian Academy of Agricultural Sciences; Prof. E. Nettevich, Academician of the Russian Academy of Agricultural Sciences and Distinguished Scientist of the Agricultural Research Institute of the Central Non-Chernozem Zone; and Prof. V. Penchoukov, Academician of the Russian Academy of Agricultural Sciences and Head of the Breeding Department in Association "Russian Seeds." In addition, Dr. Stanley Johnson, Vice President for Extension at Iowa State University, identified and provided excellent sources of information. Dr. T. Payne, Wheat Breeder from CIMMYT-Ethiopia, made editorial suggestions and Mrs. E. Vostrikova commented on and prepared a Russian translation of the report.

The authors learned much from their colleagues in Central Asia and the Caucasus about the history and contemporary status of agricultural science there. They express their sincere gratitude to the many professionals who made their trips to these countries productive and informative. At the risk of omitting key persons, the following are specifically acknowledged:

Armenia—Dr. S. Avetissian, Head of the Department of Science and Education, Ministry of Agriculture; Dr. A. Khachatrian, Rector, Armenia Agricultural University; and Mr. R. Culver, Armenian Technology Group.

Azerbaijan—The late Dr. K. Moustafaev, Head of the Department of Science, Education and Extension, Ministry of Agriculture, and Dr. Nabiev, Head of the Department of Scientific Cooperation, Ministry of Agriculture.

Georgia—Dr. G. Agladze, Vice President, Georgian Academy of Agricultural Sciences, and Dr. D. Nakani, Deputy Minister of Agriculture.

Kazakhstan—Dr. A. Satybaldin, Director General, National Academic Center of Agricultural Research.

Kyrgyzstan—Dr. J. Akimaliev, President, Kyrgyz Agricultural Academy, and Mr. B. Talgarbekov, former Minister of Agriculture and Deputy Prime Minister.

Tajikistan—Dr. B. Sanginov, President, Tajik Academy of Agricultural Sciences.

Turkmenistan—Dr. O. Garakhanov, Deputy Director, Agricultural Research Institute.

Ukraine—Dr. P. Kovalenko, Vice President, Ukraine Academy of Agricultural Sciences.

Uzbekistan—Dr. B. Azimov, Head of the Department of Crop Production, Scientific Production Center of Agriculture.

The authors also thank their respective institutions, CIMMYT and ISNAR, for facilitating the preparation of this report. While acknowledging the considerable assistance provided by the above persons in preparing this manuscript, the authors take full responsibility for its content.

Abstract

The primary legacy of the Soviet agricultural research system for the former Soviet republics of Central Asia and the Caucasus was a highly organized, fully funded, and overcapitalized agricultural research establishment. The new republics inherited a large number of research institutions and a huge complement of scientific staff. Evolution of their economies and their agriculture, however, challenges these countries to reform their technology system to make it responsive and effective. Up to now, a preservationist strategy has been the dominant means for dealing with agricultural research structure, implying the maintenance of existing institutes as a system. This is true despite a strong desire by scientists and government to optimize agricultural research. Future development in these countries depends largely on the political will of agricultural research system leaders to take bold steps to reform agricultural research according to a sound strategy that takes into account changing demand for agricultural research as reflected in emerging local and international markets.

Executive Summary

Agricultural research in Russia, and later the Soviet Union, has a long and remarkable history, starting with the establishment of the Russian Academy of Sciences by Peter the Great in 1724. By the end of the 19th century, a complex network of agricultural research and educational institutes had emerged comprising laboratories, experiment stations, horticultural crop nurseries, and experiment farms and fields. In 1929, a number of elite agricultural research institutes were united in the Soviet Academy of Agricultural Sciences, also called VASKHNIL after V. I. Lenin.

In the Soviet era, development of agricultural science reflected societal development. Since society was highly politicized, science was politicized as well. There are many examples during this period of shifts in agricultural science being determined purely by political decisions. This affected the behavior of scientists and science administrators at all levels in the research hierarchy. In the first place, only those supporting the official ideology were eligible for promotion or rewards, including trips abroad. Also, during Stalin's rule scientists learned that disagreement with the official viewpoint could be a serious mistake, leading to imprisonment or worse. This pressure resulted in a dependence on politics which is still palpable in the older generation of researchers.

VASKHNIL had a dual role in the Soviet agricultural research system. It was both an association of institutes and an association of scientists. Its structure, and that of agricultural research itself, was marked by constant flux. Over time, however, two distinct organizational patterns emerged. The first pattern, which dominated in the 1960s, was VASKHNIL as a union of a few specialized institutes, with a significant amount of agricultural research being conducted by institutes under the Ministry of Agriculture, outside VASKHNIL's management. The second pattern shows VASKHNIL as a giant organization managing almost all the agricultural research in the USSR with a complex structure of departments and regional branches. This pattern dominated throughout the 1980s.

In evaluating the Soviet agricultural research establishment, some advantages and disadvantages are worthy of mention. Positive aspects of the system were its elaborate research network, VASKHNIL's role as a communication forum, its exemplary information and documentation system, the Soviet Academy's system for recognizing outstanding scientific achievement, and its attention to human resource development. Disadvantages, however, were the system's reliance on politics, the low rate of technology adoption, strict government control, inflated bureaucracy, absence of a consistent system of evaluation, disproportionate numbers of scientists to technicians, and separation between agricultural research and education. These undermined the effectiveness of agricultural research in the Soviet Union and continue to challenge the newly independent countries of Central Asia and the Caucasus as they build their own national systems for agricultural research.

The newly independent countries of Central Asia and the Caucasus each inherited parts of the former Soviet Union's agricultural research establishment. Most

were left with far more institutes and scientists than their economy could support. Nonetheless, rationalizing of institutes and programs has proven difficult.

Some common trends have emerged in these countries' efforts to develop their national systems for agricultural research. Strict state control, for instance, has remained in all of the countries, with conservatism continuing to be the rule in management structure. Further, in all the countries either VASKHNIL-type academies or more practical, production-oriented structures have been created. Funding constraints and resistance to downsizing continue to plague efforts to restructure these research systems. Furthermore, most countries have lagged in developing new research program priorities to respond to changes in the structure of their agricultural sectors and their emerging market economies. Perhaps the most negative development has been the disintegration of scientific contacts and projects established within the former Soviet Union. Communication with and technical assistance from the West, however, is gaining momentum.

The development of nation-states from the former Soviet republics has been difficult and, in some cases, traumatic and chaotic. Economic and agricultural sector changes in these countries will continue to have considerable influence on the agricultural research systems needed for the future: their size, scope, and level of support. Changes in the structure of agriculture, such as from large collective farms to small privately owed ones, mean that the entire agricultural technology system (including research, education, and extension) in these countries must be reorganized in order to be responsive and effective.

Up to now, a preservationist strategy has been the dominant means by which these countries have dealt with their inheritance of agricultural research institutions, implying the maintenance of existing institutes as a system. This appears to be true despite a very strong desire by both scientists and selected government agencies to optimize the research system. The importance of a scientific and systematic approach to this optimization is still underestimated.

Future development of the research systems in the Central Asian and Caucasus countries will depend largely on the political will of agricultural research leaders to take bold steps to reform their research systems and develop a sound strategy to carry through the reform process. The strategy must take into account future demand for agricultural research as reflected in emerging local and international markets and be conditioned by the optimal utilization of the human, financial, and physical resources available.

1. Introduction

Purpose

The first part of this research report documents the history and development of the Soviet agricultural research system up to the demise of the Soviet Union. It then explores how this system is influencing the development of national agricultural research systems in the former Soviet republics of Central Asia and the Caucasus. Purposely, and of necessity, the first chapters of the report are descriptive, enabling the reader to discover how the Soviet agricultural research system was established and how it evolved to support both agricultural production goals and the political system dictating them. A brief discussion (chapter 4) evaluates the advantages and disadvantages of the Soviet system. The report then reviews current developments in the newly independent countries of Central Asia and the Caucasus in order to form the basis for the final chapters, which explore future prospects for agricultural research reform in these countries and draw conclusions.

The authors hope that this report will help those involved in the process of change in these countries (nationals and expatriates) to better comprehend the institutional legacy that has influenced and will continue to influence both individuals and institutional development of national agricultural research systems there. Perhaps with an improved understanding of the past, the process, substance, and timing of reforms can be better calculated and applied.

General Observations

Some general comments and observations serve to highlight fundamental issues relating to this report. First, the development of agricultural science (as well as science as a whole) in the Soviet Union was a reflection of societal development. Since the latter was highly politicized, science was politicized as well. There are many examples of shifts in agricultural science strategy that were determined purely by political decisions. This affected the behavior of scientists and science administrators from the highest to lowest levels. In the first place, only members of the communist party and those supporting the official ideology were eligible for promotion or rewards, such as trips abroad. Also, during Stalin's rule scientists learned that disagreement with the official viewpoint could be a serious mistake, leading to imprisonment or worse. This pressure on scientists resulted in a dependence on politics that is still present in the older generation of researchers. Though the relationship between politics and science was one of the most important factors influencing many aspects of agricultural research, it is not the

focus of this report. Instead, the report concentrates more on technical details of the structure and management of agricultural science using an analytical approach.

Second, many entities were involved in agricultural research in the Soviet Union. This report focuses primarily on the institutions within the Academy of Agricultural Sciences, which was the major structure responsible for scientific support to agricultural production. Agricultural research was also conducted in the institutes and stations belonging directly to the Ministry of Agriculture. In addition, some research was done in the agricultural colleges and universities located throughout the country. This report briefly describes these institutions in relation to the Academy of Agricultural Sciences for the following reasons: (1) the institutes in the Ministry of Agriculture system had essentially the same organizational structure and management system as the institutes of the Academy; (2) eventually, many of the institutes were transferred from the Ministry to the Academy; and (3) educational institutes and universities played a very minor role in agricultural research and are mentioned only in the context of the broad issues of agricultural knowledge development and the country's educational system.

Third, the Soviet Union's agricultural research system was enormous and had a remarkable history. A lengthy book would be needed to adequately reflect the details of its development. Indeed, A. A. Nikonov explores such details in his Russian-language book "The Spiral of a Centuries-Long Drama: Agrarian Science and Politics in Russia from the 18th through the 20th Centuries."

2. Early History of Agricultural Research in Russia (pre-1917)

Historically Russia, and later the Soviet Union, was largely an agricultural country, at least up to the 1950s. The majority of the population lived in the countryside and was involved in crop cultivation and animal husbandry. Agriculture progressed as society progressed and, at a certain stage of development, science became an integral part of its evolution. The beginning of agricultural science in Russia is associated with the establishment of the Russian Academy of Sciences by Peter the Great in 1724. Shortly thereafter, a notable scientist of the time, Mikhail Lomonosov (1711–1765), established a separate structure within the Academy with responsibility for assistance to agriculture. The first scientist in Russia who conducted experiments and published a number of books on agriculture was Andrey Bolotov (1738–1833), a military officer and landowner (Nikonov 1995).

In 1765, Katherine II issued a decree establishing the Imperial Liberal Economic Society with its major objective to assist in the development of Russian agriculture. The Society conducted experiments and published books and journals on a number of agricultural subjects such as soil science, beekeeping, veterinary medicine, agronomy, animal husbandry, and others. The Society's work was dissolved in 1915, however, because some of its members were suspected of socialist activities. Agricultural science in the 19th century was mainly concentrated in universities in Moscow, St. Petersburg, and other large cities. The second part of the 19th century saw the establishment of specialized agricultural universities and colleges. The first two were Gorygoretsk Agricultural College, established in 1848 (now Belorussian Agricultural Academy), and Petrovskaya Agricultural Academy, established in 1865 (now Timiryazev Moscow Agricultural Academy). By the start of the 20th century Russian scientists had accumulated detailed knowledge of farming systems, crop rotations, mineral nutrition, soil fertility, cropping in dry environments, and many other subjects. According to the 1897 census, 85 percent of Russia's population lived in the countryside and 74 percent depended entirely on production from their farms for their living (Nikonov 1995: 74). At the same time, the country exported 33 percent of its wheat and 41 percent of its barley (*ibid.*: 72).

The end of the 19th century and the beginning of the 20th (period of 1890–1915) witnessed a large increase in the number of agricultural research and educational institutions. Factors that influenced this development included the favorable

economic situation before World War I, a rapid increase in agricultural production resulting from liberal reforms conducted by government in 1906–1911, and the high priority given by government to agricultural production. Reflecting this growth, the budget of the Department (Ministry) of Agriculture increased from 2.4 million rubles in 1895 to 29.4 million rubles in 1913. In 1910 there were 239 agricultural educational institutions (courses of all levels, schools, colleges, universities); by 1915 this number was 341. Government's share of funding for these institutions increased as well, from 42 to 60 percent.

By January 1, 1915, the country had a network of state agricultural experiment institutions totaling 287 (Nikonov 1995: 112). Five types of research institutions existed at that time:

- experiment stations (general and specialized), which were involved in research and conducted experiments on the application of fertilizers, soil tillage, forage crops, and breeding
- experiment fields to conduct trials adapted to a particular environment
- experiment farms to conduct field research on a larger scale
- laboratories for analysis
- nurseries for multiplication of horticultural crops

Experiment fields were more common in Russia than in Western countries, where experiment stations dominated. Russia's agricultural research institutions could belong to the Department of Agriculture, local authorities of the *gouberniya* (region) and *uezd* (county), agricultural societies, city departments, industrial or scientific societies, groups of landowners, or private persons. Most, however, belonged to government (*ibid.*: 118).

The following experiment stations, established during this period, illustrate how both government and progressive landowners were interested in the development of agricultural science. Shatilov Agricultural Experiment Station was established in 1896 on the property of the landowner Shatilov in Central Russia by *gouberniya* authorities. The Moscow Breeding Station was established by the Department of Agriculture. Rostov-Nakhichevan Experiment Station in Southern Russia was founded in 1908 using funds from the regional agricultural society. The Kamenno-Stepnaya Experiment Station was established in Central Russia in 1911 by the Department of Agriculture (Nikonov 1995: 120). Summarizing the development of agricultural science just before the revolution, Viner (*ibid.*: 120) came to the following conclusions: (1) the initiative and the funds of private people, societies, and government were used to establish agricultural research enterprises; (2) the network of research institutions expanded quickly after 1910 due to agrarian and market reforms; and (3) there were efforts to study different aspects of crop production using the newly established experiment stations and fields.

This brief description of the history and status of agricultural research prior to 1917 demonstrates the type of agricultural research system that existed before the revolution. In summary, scientists working mainly on basic problems related to agriculture were concentrated in universities and colleges. Applied research

was done in experiment stations and fields focusing on the adaptation of agricultural methods to local conditions.

The October Revolution of 1917 and the events that followed caused major upheavals in society as a whole and in agricultural science in particular. The following chapters address developments in agricultural science during the period of the Soviet Union and its post-Soviet evolution.

3. Research in the Soviet Academy of Agricultural Sciences (1918–1991)

The Soviet Union's Academy of Agricultural Sciences evolved from an association of a few elite institutes into a giant establishment uniting almost all the agricultural research institutions in the USSR. This chapter describes the evolution of the agricultural research system of the former Soviet Union, including some detailed information about its structure, management, and linkages up through the 1980s. Knowledge of the Soviet system during this period helps us to understand the agricultural research systems developing in republics of Central Asia and the Caucasus, as the USSR system was the basis on which agricultural research systems in the newly independent countries were established.

Historical Development

Establishment of the Academy

The civil war that followed the 1917 revolution prevented the Bolshevik government from rebuilding agricultural research infrastructure, although in 1918 the establishment of the Russian Institute of Agricultural Science was approved at the meeting of Sovnarkom (the council of the people's commissars, or deputies, that functioned as the government). Several new institutes were also founded at that time, including the Institute of Experimental Veterinary (1918), the Fertilizer Institute (1919), and the Institute of Applied Zoology and Phytopathology (1922). In 1922, the First Congress of Soviets of the USSR adopted a resolution to set up a central body that would unite agricultural research institutions and help increase agricultural production. The follow-up action by the government was a resolution adopted August 8, 1924 to establish an All-Union Academy of Agricultural Sciences and, as a first step, to establish the Institute of Applied Botany and New Crops, now called the Vavilov Institute of Crop Industry (Nikonov 1995: 200).

Revitalization of the network of experiment stations also continued. The economic situation in general, and the agricultural situation in particular, was very favorable due to the so-called New Economic Policy (NEP), which liberalized production and trade. From 1925, grain production exceeded 70 million tons compared with 50 million tons in 1922 and 45 million tons in 1920 (Nikonov 1995: 150).

On June 25, 1929, Sovnarkom issued its decree finally establishing the All-Union Academy of Agricultural Sciences named VASKHNIL after V. I. Lenin,

hereafter also called the Academy. The aforementioned institutes provided VASKHNIL's initial basis. However, the same decree ordered VASKHNIL to establish 10 new institutes for major subjects of agricultural science and a specialized library. The objective of the Academy at that time was to provide both a theoretical and practical basis for agricultural production increases and for the overall reconstruction of agriculture.

The history of VASKHNIL can be divided into several periods, which coincide with important stages of development of Soviet society. These time periods are normally marked by changes either in the country or in VASKHNIL leadership.

VASKHNIL from 1929 to 1937

A world famous scientist, Nikolai Vavilov, was the first president of the Academy, combining this position with the directorship of the Institute of Applied Botany and New Crops in Leningrad (1925–1940). The first action of the Academy was to implement the Sovnarkom decree. Thus, by January 1, 1930, 10 new institutes were established: the Institute of Agricultural Economics, the Institute of Organization of Large Farming, the Pest and Disease Protection Institute, the Drought Institute, the Amelioration Institute (for drainage and irrigation), the Cropping System Institute, the Institute of Animal Husbandry, the Institute of Fisheries, the Institute of Mechanization and Electrification, and the Maize Institute. In addition to these mandated institutes, a number of other new institutes were opened in 1930–1931 such as the Microbiology Institute, the Institute of Oil Crops, the Beekeeping Institute, and others (Nikonov 1995: 200–201).

For a short initial period, VASKHNIL reported directly to the government, Sovnarkom; but in January 1930 it was transferred to the Ministry of Agriculture. The president and vice presidents of the Academy, however, were still appointed by the government. There were no individual memberships in the Academy until 1935 when Sovnarkom approved 42 scientists as members or "academicians" of VASKHNIL. At that point, the Academy became not only an association of agricultural research institutes but also an association of individual scientists. Until 1956, academicians and corresponding members (similar to academicians, but nonvoting) were government appointed, rather than being elected by secret ballot, as they were thereafter. The rationale for the appointment of individual members to the Academy was twofold: (1) to single out eminent scientists supporting the regime and use them to promote government policy and (2) to raise the status of VASKHNIL making it similar to the Academy of Sciences. The first 42 members of the Academy included the best agriculturists and biologists of the time (14 of them were later to die in the Stalin camps). The first few years of the Academy were characterized by explosive growth of the network of agricultural research institutions in Russia and its republics.

On July 16, 1934, as part of a VASKHNIL internal review, the president of the Academy, Nikolai Vavilov, reported to Sovnarkom the results and impacts of research activities. The subsequent government assessment was largely negative. The Academy was blamed for inadequate linkages with producers, poor results in wheat and cotton breeding, and deficient research on fertilizer application. Its structure and management were furthermore criticized for (1) lack of coordination among research activities, (2) narrow specialization resulting in the

establishment of many institutes devoted to minor problems, and (3) inadequate documentation of the advanced methods utilized on the best farms. As a result of the review, Sovnarkom decided to reorganize VASKHNIL on the following basis: (1) the Academy would be the highest body in the USSR involved in agricultural research and consist of full members (academicians), honorary members, and corresponding members; (2) sessions of the Academy would be conducted regularly to discuss the most important issues of agricultural development, plan the research agenda, and review high-priority projects; (3) leadership of the Academy would consist of a president, two vice presidents, and a scientific secretary, all appointed by government; and (4) the outreach branches of the Academy in the republics would be closed (Nikonov 1995: 202).

The 1934 review had important consequences for agricultural science in the USSR. Only a few major institutes were left within VASKHNIL. The remaining institutes and stations were transferred either to the All-Union Ministry of Agriculture or to structures within the republics. Some were closed or redirected to conduct different activities. By the mid-1930s VASKHNIL consisted of just 12 institutes: the All-Union Institute of Crop Industry (VIR, Leningrad), the Plant Breeding and Genetics Institute (Odessa), the All-Union Institute of Fertilizers and Agro-Chemistry (Moscow), the Agro-Physical Institute (Leningrad), the Institute of Microbiology (Leningrad), the Central Genetics Horticultural Laboratory (Michurinsk), the Institute of Animal Husbandry, the Institute of Acclimatization and Animal Hybridization, the Institute of Hydraulic Engineering and Melioration, the Institute of Electrification of Agriculture, the Institute of Marsh Farming (Minsk), and the Central Scientific Agricultural Library (Moscow) (Nikonov 1995: 203). The government's decision to leave only a few elite institutes within VASKHNIL clearly indicated that the priority of the Academy was to be in basic rather than applied science.

It is difficult to judge to what extent the changes in the Academy were driven by logical reasoning and to what extent they were the result of political struggles. By 1935, a group opposed to President Vavilov had developed and become influential largely due to support from academician Trofim Lysenko, who promised to do wonders in agriculture using new methods and approaches. On June 21, 1935, Vavilov was replaced as president of VASKHNIL by Alexander Muralov, who was deputy minister of agriculture at the time. In June 1937, Muralov was arrested and executed under suspicion of treason. For a short time, the acting president was Georgiy Meister, Vice President of VASKHNIL and a noted wheat breeder. His fate was the same as his predecessor's, however, as he was arrested in late 1937 and later executed (Nikonov 1995: 213).

In summary, VASKHNIL experienced unprecedented growth in its first eight years. This was followed by a major reorganization which determined its structure, organization, and management for many ensuing years.

VASKHNIL from 1938 to 1953

From 1938 to 1953, the Academy's history is associated with the name of Trofim Lysenko, who was its president from 1938 to 1956 and again from 1961 to 1962. In the three to four years preceding World War II, agricultural science, as well as society as a whole, was particularly shaken by Stalin's repression, in which

millions of innocent people were killed. It was in this period that VASKHNIL's first president, Nikolai Vavilov, was imprisoned. He died in a Saratov jail in 1943.

On June 22, 1941, Germany invaded the USSR and the Great Patriotic War started, lasting until 1945. VASKHNIL had several objectives during this period. Institutes that had industrial experiment facilities, such as the Institute of Mechanization and Electrification, provided direct assistance to the military. Genetic resources collected by Nikolai Vavilov were conserved and maintained at his institute in Leningrad despite the famine. Occupation of the European part of the USSR resulted in the need for a substantial increase of agricultural production in the east. This was achieved using new methods developed by VASKHNIL scientists. Major research institutes were evacuated, and VASKHNIL itself and the Institute of Animal Husbandry moved to Omsk, Siberia. The Plant Breeding and Genetics Institute moved to Tashkent, Uzbekistan and Timiryazev Moscow Agricultural Academy moved to Samarkand, Uzbekistan. The war-related evacuation from the European areas thus prompted establishment of agricultural research centers in eastern Russia and Central Asia.

Scientific discussion about key agricultural issues calmed during the war, but appeared with new vigor in 1946–1948. VASKHNIL's president, Trofim Lysenko, and his followers were against genetics and the basics of biological science. They claimed that human beings could alter nature however they like and, in this way, dramatically increase agricultural production. Lysenko put forward the theory that plants and genotypes can be "educated" by the external environment to change and adapt to new conditions. He believed that the environment played a more important role in defining the attributes of a crop than its heredity and the combination of traits acquired from its parents. Stalin was attracted to this opinion, and gave unlimited support to Lysenko. Nonetheless, many scientists contested Lysenko's ideas and did not follow his methodology.

In August 1948, VASKHNIL conducted a session attended by some 700 participants; all were leading agriculturists and professors from agricultural universities. Lysenko made an opening speech entitled "About the status of biological science" which was against geneticists and all those who followed scientific methods. He concluded the speech by stating that the Central Committee of the Communist Party approved his approach. This session had extremely negative consequences for a generation of researchers. From that time on, the institutes were unable to openly conduct experiments based on scientific knowledge. At the same time, a huge amount of resources was wasted on experimentation in line with Lysenko's theories. Generations of students graduated from universities without any knowledge of genetics. No books were published that reflected biology as a scientific discipline. Only supporters of Lysenko were appointed as VASKHNIL academicians (Nikonov 1995: 289). The structure and management of VASKHNIL under Lysenko remained largely unchanged.

VASKHNIL from 1953 to 1965

Though Lysenko remained the president of VASKHNIL, its strategy and activities, to a large extent, depended on policy developed by Nikita Khrushev, who was the first secretary of the Communist Party. By the early 1950s, grain

production had reached its pre-war level, or 80–85 million tons. Yet it was still insufficient to feed the fast-growing population. In 1954 the government decided to bring into cultivation the virgin lands of eastern Siberia and northern Kazakhstan. Within three years, an additional 41 million hectares (25 million hectares in Kazakhstan and 16 million hectares in Siberia) were plowed and planted with cereals. Grain production increased by 30–40 million tons. The small institutes and experiment stations in these regions were soon transformed into major scientific centers. In 1956, a station in Shortandy (northern Kazakhstan) was transformed into the All-Union Research Institute for Cereal Production. The institute had tremendous impact on production in the region by developing a soil-conservation cropping system. In western Siberia, the Altai Agricultural Research Institute (Barnaul) and the Siberian Agricultural Research Institute (Omsk) were strengthened and became important regional scientific centers. Later the Siberian branch of VASKHNIL was established in Novosibirsk indicating the priority given to the region.

Under Nikita Khrushev, the government paid considerable attention to the development of agriculture. In 1956, the Council of Ministers issued a decree "about improvement of the work of the agricultural research institutions." Agricultural science was criticized for being uncoordinated and isolated from producers. Reports also faulted research for having poor impact on field production, lack of focus on regional production systems, and overconcentration of institutes in a few major cities (Moscow, Leningrad, Kiev, and Tashkent). The decree's practical outcome was increased funding for agricultural science. A significant change was that research institutes were given large production units for field trials and production.

During this period, the agricultural research network became a multi-level structure:

- State agricultural research stations reported to the *regional (*oblast*) departments of agriculture* within a republic and were mandated to support regional agriculture by consulting and providing high-generation seed.

- Zonal agricultural research institutes were established within large economic zones (each included several *oblasts*) with similar soil, ecology, and farming systems within Russia, Ukraine, and Kazakhstan. Reporting to the *Ministry of Agriculture of their respective republic*, they were mandated to develop scientific recommendations and to breed new varieties for the whole zone. In Russia, the institutes were in the central zone, northwest zone, northeast zone, central black soil zone, western Siberia, and others.

- The specialized or commodity institutes with an all-union mandate *remained within VASKHNIL*. Most of these were in Moscow and Leningrad, but a few were in Ukraine and one was in Kazakhstan.

- *Academies of agricultural sciences of the republics* were established in Ukraine, Belorussia, Uzbekistan, Kazakhstan, and Georgia. The agricultural research institutes in the republics were previously within academies of sciences, which had been established in all of the republics. During this period of reforms, these institutes were transferred either to the newly established acade-

mies of agricultural sciences or to their respective agricultural ministry. Later the academies of agricultural sciences in the republics were closed and all the institutes were transferred to the agricultural ministries.

Despite the positive changes in agriculture and science during 1953–1965, VASKHNIL was still headed by Lysenko and his follower, M. Olshanskiy (1962–1965), and they forbade experimentation and publication that was not in line with their theories.

VASKHNIL from 1965 to 1985

The period of Soviet society between 1965 and 1985 was one of stagnation. Leonid Brezhnev was the leader of the country for 18 of the 20 years. Cereals yields remained basically unchanged at 1.4–1.5 tons per hectare for 15 of the 20 years (1970–1985) (Nikonov 1995: 330). At that time, VASKHNIL was headed by presidents P. Lobanov and P. Vavilov.

The Great Soviet Encyclopedia published in 1970 reflected the official view on many subjects. It defined VASKHNIL's objectives as follows:

- develop theoretical research for major agricultural subjects
- identify new means for technical progress in agriculture
- improve research methods to increase the efficiency and level of science
- study and summarize global science
- assist in the practical application of research achievements

To implement the objectives, VASKHNIL was involved in planning and coordination of research, methodological leadership in major research issues, and human resource development through graduate study, training, and dissemination of scientific knowledge.

There were only about 30 leading specialized institutes within VASKHNIL at the end of the 1960s. Nonetheless, VASKHNIL had expanded over the decade and, in 1969, had three regional branches: Southern in Kiev, Central Asian in Tashkent, and Siberian in Novosibirsk. The branches played coordinating and organizational roles in their respective regions. For example, channeled through them were the financing and reporting for all the agricultural research institutes in their region (except the all-union institutes). Later, in 1991, the branch units were the basis on which academies of agricultural sciences were established in the newly independent states of Ukraine and Uzbekistan.

During 1965–1985, agricultural science readily responded to a number of mega-projects developed and pursued by the Central Committee of the Communist Party. Unfortunately, many of these projects were based on political considerations, and they frequently failed to deliver their intended product. For example, a project on concentration of agricultural production resulted in huge animal farms which, in the end, lacked sufficient locally produced feed. Enormous investments in the agriculture of Central Russia's non-black soil zone failed to achieve its aim of doubling production in 10–15 years, but merely sustained it. A food program proclaimed in 1980, aiming to provide enough food for the population by 1990, also failed. Agricultural science was called upon to support all

these projects and programs. It tried to do so, despite the highly politicized environment. One achievement of agricultural science during this period was development of farming systems for each region based on long-term experimentation and economic analysis. These were published and served as valuable guidelines for agricultural production in specific areas.

The 1970s witnessed the further expansion of VASKHNIL, once again following Communist Party directives. In 1974, the Non-Black Soil Zone branch of VASKHNIL was established in Leningrad. A number of research institutions and farms were essentially transferred from the Ministry of Agriculture to form the new branch. This decision united 34 research units including several large institutes and 53 farms (Nikonov 1995: 364). The farms were used for testing technologies generated by the institutes as well as for seed production and income generation to support research activities. The same thing happened in the establishment of the Siberian branch of VASKHNIL, which united a number of institutions and was responsible for research targeting the whole of Siberia and the Far East of the USSR. In the early 1980s, several other regional branches were established: All-Russian, Far-Eastern, Western, Trans-Caucasian, and Eastern. As a result, VASKHNIL rose from a relatively small organization to become a giant uniting almost all the agricultural research institutions of the country.

VASKHNIL from 1985 to 1991

Perestroika started with the appointment of M. Gorbachev as a party leader. Soviet society gradually became more open. In agriculture, highest priority was given to the introduction of new forms of property and work organization, more efficient economic mechanisms, and land reform. VASKHNIL actively participated in developing recommendations for new production methods. It also contributed to the drafting of new laws. Another high-priority issue for VASKHNIL during the period was development of farming in drought environments. Several institutes and production units were charged to find efficient production methods under moisture stress. VASKHNIL held sessions in 1985 and 1987 devoted to this problem. The detailed recommendations that resulted were successfully applied in several drought-prone regions.

In the late 1980s, the regional branches of VASKHNIL were transformed into the Republican Academies of Agricultural Sciences in Ukraine, Belorussia, Kazakhstan, Uzbekistan, Georgia, and Turkmenistan. This transition was relatively smooth due to growing nationalist tendencies. There were, however, some initial tensions relating to the ownership of assets and, in particular, genetic resources. In 1990, the Russian Academy of Agricultural Sciences was established based on the four VASKHNIL branches situated in Russia.

The general tendency was for the republics to establish their own agricultural research structures. In 1991, VASKHNIL decided to transfer to the republics 80 percent of the institutes and leave within its structure only specialized, more basic, science-oriented centers such as the Vavilov Institute. The State Council chaired by M. Gorbachev supported this initiative. In practice however, the republics were taking over the institutes that had been envisioned as remaining within VASKHNIL. By the end of 1991, VASKHNIL's existence was at risk and

urgent measures were needed. The scientific community viewed its roles as (1) coordinating and uniting the new sovereign countries, (2) providing a center of human resource development, and (3) ensuring continuance of a center for basic agriculture-oriented research. Accordingly, the heads of the academies of agricultural sciences from 10 republics (Azerbaijan, Belorussia, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Turkmenistan, Uzbekistan, and Ukraine) signed a letter to M. Gorbachev and the heads of the sovereign republics recommending that VASKHNIL be transformed into the Academy of Agricultural Sciences of the Sovereign States. This new Academy was expected to consist of major intergovernmental scientific centers with funding from participating countries (Nikonov 1995: 412). However, nobody responded to this letter, and the USSR broke apart in December 1991. On January 30, 1992, President Borus Yeltsin signed a decree establishing the Russian Academy of Agricultural Sciences on the basis of the All-Russian Academy of Agricultural Sciences and VASKHNIL.

VASKHNIL had its last session February 4, 1992. The last VASKHNIL president was the noted economist, A. A. Nikonov, author of the Russian-language book that provides much of the history described in this report.

Historical Summary

This brief history of the organization of agricultural research in the Soviet Union demonstrates the close links of science to the politics of the times and a continuous shifting of control of the system between scientists (VASKHNIL) and ministries of agriculture. Many changes that took place had significant influence on the structure of agriculture in the republics, and this legacy remains an important factor today. Table 1 summarizes the changes that took place in the structure of agricultural research in the republics from the 1950s to the late 1980s. These changes reflect, on one hand, the higher priority that central government gave to agriculture in the republics and, on the other hand, the tendency to decentralize research and make it more impact oriented at the republic level. Unfortunately, the reorganization that took place in the 1970s and 1980s to optimize research management subordinated many of the republics' agricultural research institutes to VASHKNIL as regional branches.

National Structure and Resources

Since 1935, the USSR's Academy of Agricultural Sciences had a dual character. It was both (1) an association of research institutions and (2) an association of individual scientists. This remains so in Russia and, to some extent, in the independent republics. This section explores this dual character since the idea, if not the reality, today remains in the minds of agricultural scientists and research leaders in Central Asia and the Caucasus.

An association of research institutions

VASKHNIL's structure, and that of agricultural research itself, was in constant flux. Over time, however, two distinct organizational patterns emerged. The first reflects the Academy as a union of a few specialized institutes, with the rest of

Table 1. Changes in the Structure of Agricultural Research Organizations in the Republics of the USSR, 1950–1990

Period	Ukraine, Belorussia, Uzbekistan, Kazakhstan, Georgia	Armenia, Azerbaijan, Kyrgyzstan, Tajikistan, Turkmenistan,
	Agricultural Research Structured Under:	
Early 1950s	Academy of Sciences of the republic	Academy of Sciences of the republic
Late 1950s	Academy of Agricultural Sciences of the republic	Ministry of Agriculture of the republic
Mid 1960s	Ministry of Agriculture of the republic	Ministry of Agriculture of the republic
1970s and 1980s	Regional branch of VASKHNIL and Ministry of Agriculture of the republic	Part of a regional branch of VASKHNIL and Ministry of Agriculture of the republic

research in the country conducted under the Ministry of Agriculture. This pattern dominated in the 1960s. The second pattern shows the Academy as a giant organization managing almost all the agricultural research in the USSR with a structure of departments and regional branches. This was the VASKHNIL of the 1980s.

P. Lobanov, who served as VASKHNIL president for several years from 1965, characterized the division of the Academy as both subject and region oriented. During this period, the Academy had three regional branches (Southern, Central Asian, and Siberian) and was divided into eight departments plus the library. The departments were in charge of the all-union institutes only and focused more on basic research. They defined research priorities based on government programs for the development of the agricultural sector and financed the institutes accordingly. The regional branches were in charge of institutes with a specific local mandate and, therefore, focused more on applied research. They defined their own research priorities and disbursed funding based on local needs. Regional branch institutes tended to use methodologies and technologies developed by the all-union institutes.

The eight departments were as follows:

- *Department of Cropping Systems and Chemicalization* (Agro-Physical Institute, Institute of Crop Protection, Institute of Crop Protection of the South-Western Region, Institute of Crop Protection in Tashkent, Institute of Cotton, Soil Institute, Microbiology Institute, Institute of Fertilizers and Soil Science, and Institute of Cereals Production)

- *Department of Crop Science and Breeding* (Institute of Maize, Institute of Oil Crops, Institute of Plant Industry, Plant Breeding and Genetics Institute, Institute of Legumes, Institute of Cotton Breeding, Institute of Vegetable Breeding, Genetic Laboratory of Horticultural Crops, and Nikitskiy Botanical Garden)

- *Department of Animal Husbandry* (Institute of Animal Husbandry, Institute of Animal Physiology and Biochemistry, Institute of Animal Breeding)

- *Department of Veterinary* (Institute of Helmintology, Institute of Experimental Veterinary)

- *Department of Mechanization and Electrification* (Institute of Mechanization, Institute of Electrification, Institute of Mechanization and Electrification of the Southern Regions, Institute of Equipment and Precision Measurements)
- *Department of Hydraulics and Melioration*
- *Department of Forestry and Agroforestry* (Institute of Agroforestry)
- *Department of Economics and Organization*
- *Central Scientific Agricultural Library*

Most of the regional agricultural research institutes and experiment stations belonged to and were funded through the Department of Science of the Ministry of Agriculture of their respective republic. The Council of Ministers of a republic was influential in setting the regional institutes' research agendas. The ministries of agriculture also played a strong role in VASKHNIL activities.

The ministry research network had a two-level structure. Research institutes were at one level and their network of research stations and farms, which were used for testing new technologies and for extension services, were at another level. The institutes were mostly regionally oriented, though some did work on a particular subject. The institutes under the Ministry of Agriculture tended to use the newest methodologies from the VASKHNIL institutes, where their scientists were sent for training.

The research conducted in agricultural colleges and universities was isolated both from VASKHNIL and from the ministries' research network. It aimed mainly to address local problems and teach students how research is done. Of course, the level of science was high in a few major academic institutions, like Timiryazev Moscow Agricultural Academy and Leningrad Agricultural College. Figure 1 shows the overall organizational structure of agricultural research in this period.

The essence of changes in the organization of agricultural research during the 1970s and 1980s was a gradual transfer of the institutions from the Ministry of Agriculture to VASKHNIL and mainly to its regional branches. By the mid 1980s, there were nine regional branches of VASKHNIL:

- All-Russian, Moscow
- Siberian, Novosibirsk
- Non-Black Soil Zone, Leningrad
- Far Eastern, Khabarovsk
- Western, Minsk
- Southern, Kiev
- Trans-Caucasian, Tbilisi
- Eastern, Almaty
- Central Asian, Tashkent

The all-union commodity institutes reported directly to their respective subject departments at VASKHNIL headquarters. The other institutes reported to

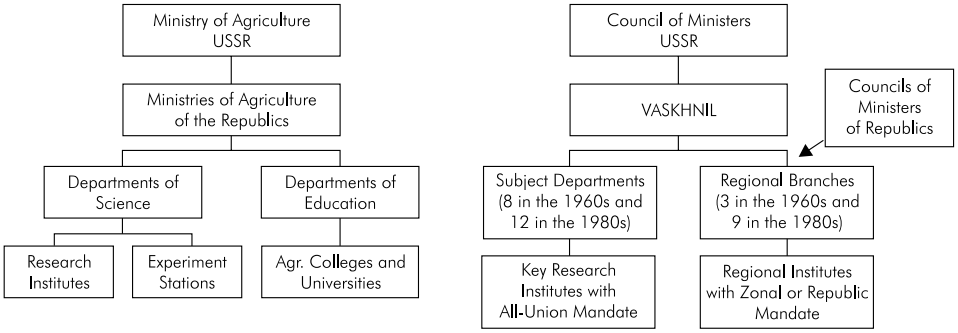


Figure 1. Agricultural research structure in the USSR

regional branches. During the 1970s and 1980s, most of the experiment stations were upgraded to institutes. They no longer reported to the VASKHNIL zonal research institute, but directly to a VASKHNIL regional branch. As an example of the structure of a regional VASKHNIL branch, the Non-Black Soil Zone branch headquartered in Leningrad had 42 research institutes with 1660 scientists (Nikonov 1995: 364). The other branches were of similar size.

Similar transformations took place in the republics. The research institutes that belonged to the ministries of agriculture were transferred to the regional VASKHNIL branches. In general, the consequences of VASHKNIL's expansion and changes in the regional structure were negative. Previously, the regional (*oblast*) experiment stations were directly responsible for scientific support to a region and reported to regional authorities and a zonal research institute which, in turn, reported to the Ministry of Agriculture. After restructuring, the regional experiment stations became the institutes and reported directly to VASKHNIL branches. Their activities also changed to some extent and sometimes local problems in their region were ignored. The regional departments of science of the ministries of agriculture could influence the research institutes' agendas only indirectly via VASKHNIL branches, not directly as in the past.

A. A. Nikonov (1995) notes that there were no common criteria to explain why some institutes belonged to VASKHNIL and others to the Ministry of Agriculture. Theoretically, the Ministry was supposed to keep very specialized institutes that were needed for its departments (like the Plant Quarantine Institute). In practice, this rule was not followed. It is difficult to explain why, for instance, the Institute of Maize belonged to VASKHNIL and the Institute of Rice belonged to the Ministry.

Agricultural research institutes belonging to VASKHNIL or to the Ministry of Agriculture enjoyed full funding for their activities in the 1970s and early 1980s. The central government invested in new facilities construction, new equipment and machinery, and salaries and operational costs for VASKHNIL all-union institutes and regional branches. The republics did the same for institutes under their governance. Physical resources were sufficient for effective research. New

institutes were easily established following political decisions by Communist Party leadership. Figure 2 presents the structure of a typical zonal agricultural research institute. Commodity research institutes would be similar in size or even bigger. They would have more research programs and fewer extension activities. By Western standards, it may be considered a luxury to have a regular breeding program supported by such departments as genetics, wide crosses, plant physiology, quality control, and greenhouses. But this was considered normal in the USSR. At that time, there were qualified scientists and resources sufficient to run the programs.

Table 2 presents the numbers of agricultural research institutes in the USSR by subject, including VASKHNIL institutes. The table demonstrates the relative importance of research in VASKHNIL versus that conducted under the Ministry of Agriculture. VASKHNIL had 228 institutes and 573 experiment farms with total area of 3.5 million hectares (Nikonov 1990).

An evaluation of the Soviet agricultural research system in the early 1990s and its comparison with Western countries (Pray and Anderson 1997) demonstrates an apparent overinvestment in agricultural research in the USSR. This was coupled with scientists' low efficiency due to their lack of motivation, poor working environment, lack of technical support staff, and other factors. The transformation of agricultural science from a privileged structure with unlimited resources into one with efficient impact-oriented programs is one of the major challenges currently facing the newly independent states of the former USSR.

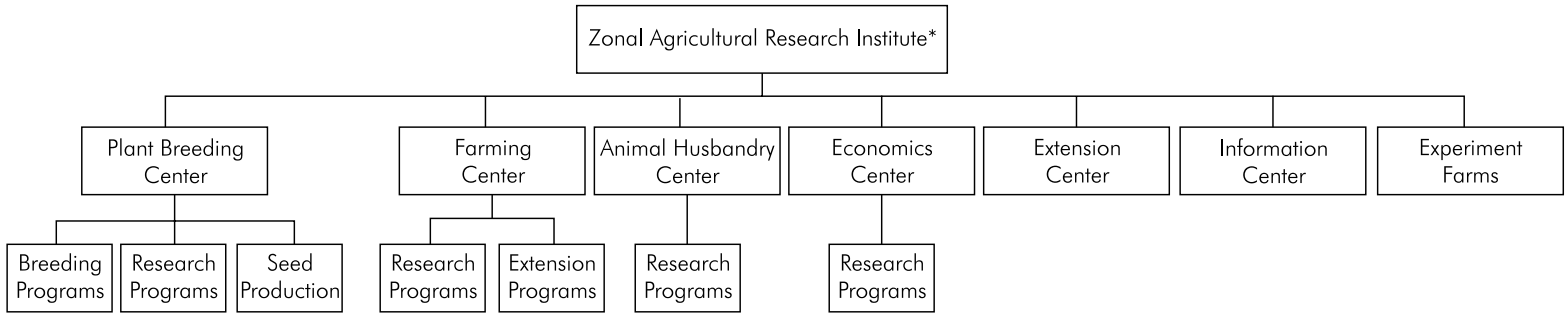
An association of individual scientists

The Academy of Agricultural Sciences had several levels of membership: full members or academicians, corresponding members, foreign members, and honorary members. *Full members or academicians* were scientists elected by secret vote of academicians at the annual general assembly of the Academy according to quotas for subject departments or regional branches. Research insti-

Table 2. Distribution of USSR Agricultural Research Institutes by Subject

Subject/Activity	Total Institutes		VASKHNIL Only	
	No.	Percent	No.	Percent
Economics and organization of production	31	6.8	17	7.4
Soil science and cropping systems	78	17.1	40	17.5
Crop science and breeding	94	20.7	73	32.0
Plant protection	19	4.2	7	3.1
Animal husbandry	49	10.7	30	13.1
Veterinary science	29	6.4	18	7.9
Mechanization and electrification	18	4.0	13	5.7
Processing	40	8.8	27	11.8
Land reclamation and water resources	27	5.9	–	–
Fishery	11	2.4	2	0.9
Forestry	17	3.7	1	0.4
Construction design	41	9.0	–	–
Total	454	100	228	100

Source: Nikonov 1990.



* Characteristics of a typical zonal agricultural research institute
- total personnel: 700 to 1000
- total scientists: 100 to 200
- experiment farms: 3 to 5

Figure 2. Typical structure of a zonal agricultural research institute in the USSR in the 1980s

tutes were entitled to nominate full members, and academicians served as members of the council of their respective subject department or regional branch. They earned an honorarium in addition to their regular salary. By the end of the 1980s there were some 120 academicians.

For *corresponding members*, the procedure for election and their responsibilities were similar to those of academicians. Corresponding members could not vote in elections for new academy members, however. Their numbers were more or less equal to the number of academicians.

For *foreign members*, the procedure for election was the same. For nomination, the support of at least three Academy members was needed. VASKHNIL had some 80 foreign members at the end of the 1980s. Nobel Prize winner N. Borlaug was among VASKHNIL's foreign members.

For *honorary members*, the election and nomination procedure was similar to that for corresponding and foreign members. This level of membership was designed to honor outstanding national personalities who contributed to agricultural development. A famous honorary member was T. Maltsev, who never graduated from school but made a major contribution as an agronomist to the development of a soil-conservation tillage system in the Ural region. VASKHNIL had just a few honorary members.

Regardless of type, membership was offered for the recipient's lifetime. Scientists from any institution (not only the VASKHNIL network) were eligible for membership. When VASKHNIL dissolved its activities in early 1992, all its members automatically became members of Russian Academy of Agricultural Sciences. Academy membership was considered recognition of achievements in science. It conferred additional responsibility and was financially rewarded. The system of secret voting prevented membership from being used for political purposes. In fact, many high-ranking officials wanted an academician title, but were not elected.

The two functions of the Academy—as an association of research institutions and an association of individual scientists—were interrelated. Once elected, members usually played an active role in Academy management and coordination of its activities.

Management of Agricultural Research

Governance of the Academy

The highest decision-making body of the Academy was its general assembly, which consisted of all members and invited guests (prime stakeholders). The general assembly elected the Presidium of the Academy to manage day-to-day affairs. The Presidium consisted of a president, vice presidents (3), a chief scientific secretary, heads of the regional branches, and several famous scientists. Though the procedure of appointment of Presidium members was democratic, its implementation resulted in a very low rotation. Since the same individuals were in charge for 10 to 20 years, there was obvious conservatism in Academy leadership.

Figure 3 presents the general structure of VASKHNIL headquarters. Each subject department and regional branch was headed by an academician-secretary who was appointed by the Presidium (see figure 4). Each department also had a bureau consisting of academicians and corresponding members (15–20 persons). This bureau was responsible for developing a strategy for research, planning the research program, and coordinating activities. Each subject department was further divided into "sections" or "councils," which addressed a particular narrow problem. A section normally consisted of a chair, deputy chair, and a secretary. The section was responsible for coordinating research efforts on a particular subject. Only the academician-secretary of the department was based at headquarters and had administrative responsibilities. The members of the bureaus and section chairpersons were all active scientists: the most advanced and recognized in their fields. A section chairperson automatically became a national coordinator for a particular research agenda. As an example, figure 4 shows the structure of the Academy's Department of Cropping Systems.

At the research institute level, the management structure included the director, deputy directors (science, administration, and production), and heads of research departments and administrative units.

Employment of research and administrative staff

At first the directors of the research institutes were elected by secret ballots cast by members of the Academy departments. In the late 1980s, the procedure was changed to one in which the directors were elected by secret vote of the institute staff on a competitive basis. The elected candidate, however, still had to be approved by the Presidium of the Academy. The director of the institute appointed deputies and other administrative staff, but candidates again had to be approved by the Presidium. Positions of head of research programs and senior scientist were advertised and a five-year appointment made by the director following the recommendation of selection committees. Every five years, the program heads and senior scientists prepared review reports, in part to determine whether their employment should be continued. Once again, the procedure sounds democratic and logical. However, reappointment was often a mere formality and positions were regularly given to a favorable candidate without being advertised.

University graduates were hired for junior positions according to requests from the Department of Education within the Ministry of Agriculture. The rotation of research staff was low. The typical pattern would be graduation from an agricultural college, post-graduate study at one of the research institutes, and employment in a junior position at the same or another institute. Then there would be a gradual advance to senior scientist and, possibly, head of a program. It was common for scientists to be associated with only one institution in their lifetime. One reason for the low rotation was difficulty in moving and obtaining new housing. In fact, the system encouraged employment at only one institution, as a person employed more than 10–15 years at one institute enjoyed significant advantages in obtaining social privileges that were distributed by the administration.

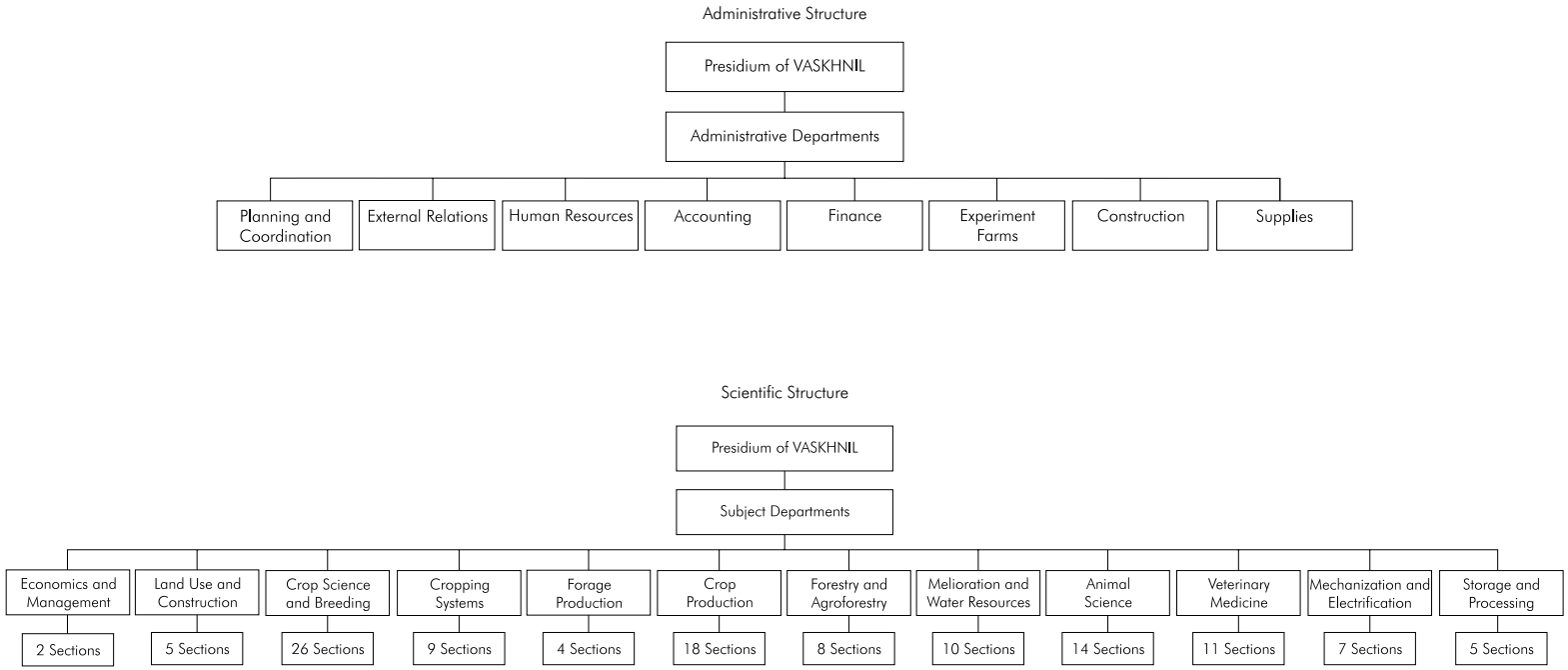


Figure 3. Structure of VASKHNIL headquarters

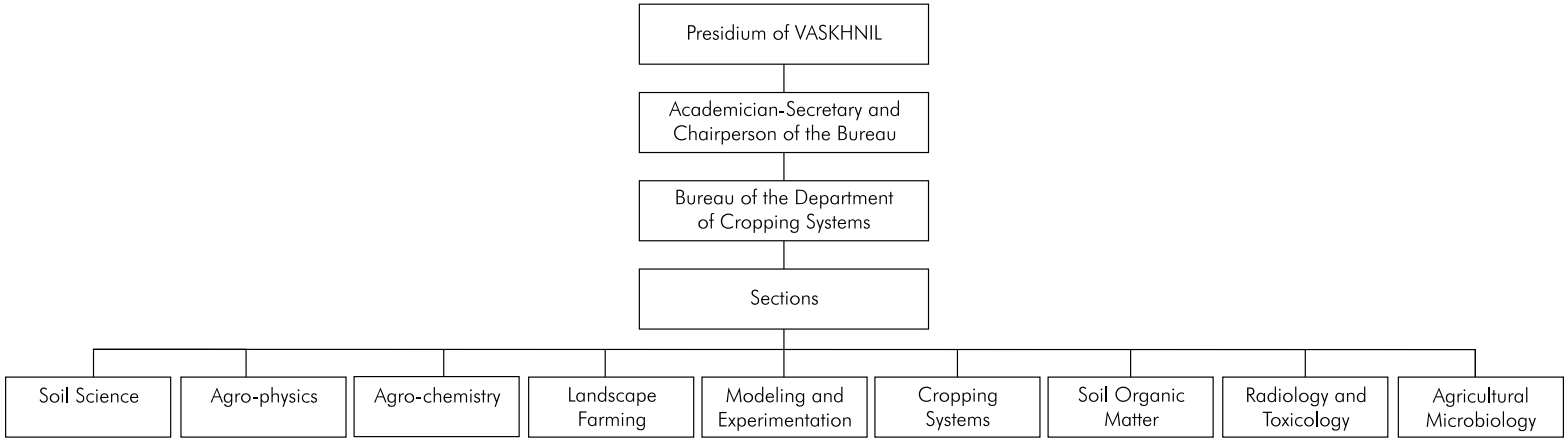


Figure 4. Structure of the Department of Cropping Systems of VASKHNIL in the 1980s

Priority setting and client identification

Procedures for priority setting as used in the West, such as consultation with stakeholders, were unknown in the agricultural scientific community of the USSR. Priority setting was highly politicized, as one would expect, and largely top-down (Cross 1995). The general directions for social development were given by the Communist Party. Whether they were based on scientific knowledge or the personal ambitions of the leadership is an open question. The scientific community was often consulted, but it was not always heard. The decrees of Communist Party congresses or plenums were interpreted by the government to shape policy and determine investments. The fact that VASHKNIL reported (in reality) to the Ministry of Agriculture and was not an independent structure clearly indicates that its objective was essentially to assist the government in increasing agricultural production.

The mechanism by which overall priorities set by the government were translated into the priorities of a particular research program is difficult to describe. Partly it was done through research planning (described below). In many cases, however, program leaders set priorities themselves based on what they saw as necessary. Sometimes government regulations determined priorities. In the case of plant breeding, for example, if the Ministry of Agriculture decided not to accept varieties susceptible to a certain disease, breeders had to emphasize breeding for resistance to that pathogen. But the major factor that changed priorities was funding levels for the various institutes and programs. The introduction into cultivation of virgin lands in Siberia and Kazakhstan, for example, was accompanied by a tremendous increase in the funding of agricultural research in and for these regions.

The scientific interests of the Academy's president also influenced priorities. An economist would expand the economics department and establish a few new institutes. An agronomist would shift priorities to that area of research. In fact, producers' opinions hardly counted in establishing priorities. The Academy did not, in fact, have a formal, structured way of setting priorities.

Client identification and participation was not pursued in the USSR. The uniformity of agricultural enterprises in the country did not allow for a differentiated approach. The *kolkhozes* (collective or cooperative farms) and *sovkhozes* (state farms) were very similar in their farming methods and level of agriculture. Their needs were made known to VASKHNIL through the Ministry of Agriculture. Unlike the present situation, there were no private farmers or strong farmers' associations requesting science to address a particular issue.

Research planning, funding, and reporting

A five-year period was the basis for planning nearly all activities in the USSR, including agricultural science. One year prior to the implementation period, the respective subject departments of VASKHNIL or its regional branches would ask the institutes to identify proposed activities for the next five years. Each research program compiled a detailed plan describing what would be done, what output was expected, what the impact would be on producers' output, and what funding was needed. The institutes' plans would then be compiled and reviewed, first in the respective section and then in the bureau of the respective subject

department. Where the problem addressed had local importance, it would be reviewed and included in the research plan of the regional VASKHNIL branch. The Presidium of VASKHNIL would then take a complete plan to the Ministry of Agriculture and eventually to the government for approval and subsequent funding. The whole procedure of planning, coordination, and reporting was monitored and supervised by the Department of Agricultural Sciences of the Central Committee of the Communist Party. This committee, consisting of scientists-administrators, was the final authority.

The planning procedure described was, to some degree, a formality for several reasons. First, personal relations between institute directors and their superiors in the Academy outweighed the plan of work in determining funding. Second, many research programs were highly conservative in planning their research agenda and would focus on the same problems for many years. For the Academy, it was sometimes easier to establish a new institute to address new problems rather than to reorient existing programs. Third, nobody questioned the cost of research or its impact. The bigger the institution, the more additional funding could be requested for research expansion and social needs. Fourth, there were no uniform criteria by which to judge the research programs' results, and often there were no criteria at all. For example, a crop breeding program that did not release any variety for a number of years would still receive as much funding as another, more successful program.

The government rarely gave 100 percent of the funds requested. The institutes had their experiment farms with land that was used for production. The "profit" from these farms was invested partly in science. Most research programs were obliged to seek contract research, in which producers would pay a research unit, for example, to develop high-productivity seeds, to adapt a new technology to their environment, or to provide recommendations for soil improvement. Money earned through contract research varied from program to program, but in the mid 1980s it accounted for some five to ten percent of total research funding. As the economic situation deteriorated in the late 1980s, the share of contract research in overall funding increased. Normally such money was pooled and used by the administration, in part to support programs that were unable to earn funds through contract work. This practice dissuaded scientists from pursuing research contracts.

Funding of agricultural science was also characterized by strict rules on how to spend money allotted. Funds allocated to one budget item could by no means be used for another purpose. Program leaders thus lacked flexibility to effectively manage their budgets.

The word "grant" was unknown to agricultural researchers in the USSR before the late 1980s, when the State Committee for Science and Technology announced competitive projects including some related to agriculture. Those grants were small, however, and without significant impact on agricultural research.

Research reporting was done both annually and at the end of the five-year planning periods. Each research institute had a scientific-technical council. In December each year, the research programs would publicly report to the council

what was accomplished during the year. The council critically reviewed the work and gave suggestions as necessary. A brief written version of the report was compiled into an overall institute report. Depending on the institute, the director would then present the annual report either to the bureau of the subject department or to a meeting of the regional branch of the Academy. The bureaus and the regional Academy branches compiled the institute reports and presented an overall report to the general assembly of VASKHNIL. The Presidium of the Academy provided a final report to government. Normally, the reports focused on scientific achievements and, to a lesser degree, on the impact of programs or institutes on agricultural production. Few reports were accompanied by solid impact studies.

The subject coordinators did additional reporting as well. Though research coordination was a prime objective of the Academy, it nonetheless functioned in a confusing manner. The chairperson of a subject section in a subject department of the Academy was also the country coordinator in their field. The institute at which the chairperson worked became the coordinating institute. The coordinator was responsible for compiling an overall plan of work, producing an annual report from all participating programs, and conducting an annual coordination meeting. This was all done in a for-better-or-worse fashion depending on the coordinator. At the same time, however, funding was channeled through the Academy's subject department or regional branch, depending on the institute. Only in the late 1980s were some small amounts of money given to coordinating institutes to support the research activities of the participating programs. Most operating funds reached the research institutes directly from the Academy.

Since coordinators had no financial mechanisms by which to influence the research agenda, their planning activities were, once again, mainly formality. There were, however, a few examples of successful coordinated efforts to address a particular problem. The program "North" united several institutes to breed early-maturing maize. The program "DIAS" made concerted efforts in Siberia to study the genetics of spring wheat and breed new varieties. Still, these successes can be attributed more to the individual efforts of interested scientists than to the coordinating system of the Academy. Very little, if any, cooperation and coordination existed between the institutes belonging to the Academy, the Ministry of Agriculture, and the agricultural colleges. The rare examples of cooperation were based on personal contacts between scientists.

Review processes and evaluation of research programs

The research institutes were reviewed on a regular basis by a commission consisting of a representative from VASKHNIL headquarters, scientists from other institutes, and professional auditors. Directors of the institutes were dismissed if financial irregularities were found. The commissions had little influence on research structure and agenda.

As mentioned, there were no uniform criteria by which to evaluate research programs. Some authorities (mainly the Communist Party) used regional production figures to evaluate the impact of an institute or research program. Academy administration was satisfied with proper reporting and implementation of the five-year plans. Numbers of publications were taken into account when

promotion of a scientist was considered. No formal system of research program evaluation was applied in the VASKHNIL institutes.

National and International Linkages

Figure 5 schematically presents the linkages between the Academy and other organizations. Reviewed here are VASKHNIL's linkages with the Academy of Sciences, agricultural colleges and universities, the State Committee for Science and Technology, the All-Union Ministry of Agriculture, the ministries of agriculture of the republics, scientific societies, agricultural science institutions of other socialist countries (e.g., "COMECON," the Council for Economic Assistance of the Soviet Union), and the scientific community of the West.

Certain research conducted within the *Academy of Sciences* had application in agriculture. Accordingly, the government encouraged closer collaboration between that Academy and VASKHNIL. Joint sessions of the two academies were conducted from time to time. In order to build a bridge, several VASKHNIL academicians were elected as members of the Academy of Sciences and vice versa. Despite these efforts, however, cooperation and coordination between the academies remained stalled or, as Holderbaum (1993) describes, practically nonexistent. There were few joint projects despite the high potential of collaboration. For example, some very attractive joint programs could have been developed with the Department of Biology, particularly with the institutes that worked on plant biotechnology. Although biotechnology research was accorded high priority in the 1980s, investments and expertise in the agricultural research community lagged behind development needs for the technology. Successful cooperation did take place between the Institute of Physical Chemistry of the Academy of Sciences and VASKHNIL breeding programs that were involved in mutation research. The Institute of Genetics and Cytology in Minsk (Belarus) and Novosibirsk (Russia) enjoyed close and fruitful collaboration with several breeding programs. Unfortunately, these positive examples were primarily the result of communication and collaboration at the level of individual scientists rather than structured coordination efforts.

Agricultural colleges and universities prepared students for employment in the Academy of Agricultural Sciences. Unfortunately, the relationship between agricultural science and education was weak. The two were separate structures with few linkages, even though their objectives did overlap. Most educational institutions prepared first-degree level specialists. Typically, after graduation bright students were kept on as assistant professors at the college or university where they had studied. However, a candidate of science degree was required to advance to higher levels. Research institutes belonging to VASKHNIL prepared specialists as candidates of science and awarded their degrees. Candidates could choose either to enter the VASKHNIL three-year doctoral study program or to continue teaching and complete the degree by distance learning. As a result, while some professors were exposed to the institutes' research environment, others were not.

Most of the teaching positions allowed only 10 percent of working time for research. Since the facilities for research in educational institutions were inferior

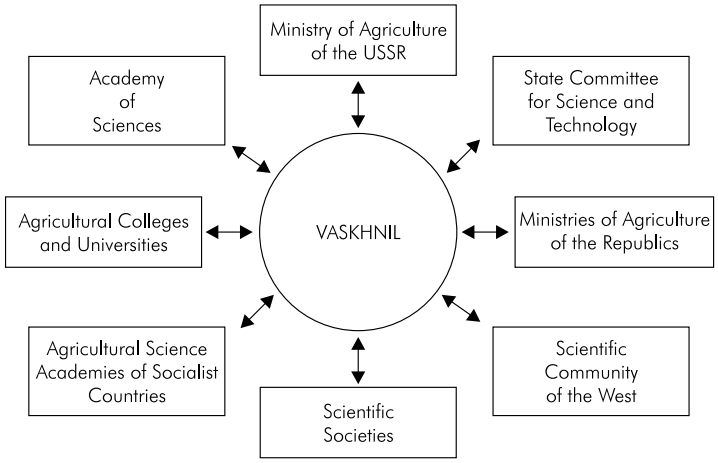


Figure 5. The linkages of VASKHNIL

to those in the VASKHNIL system, the level of science practiced by the professors was far lower than that of scientists at the research institutes. Only elite universities (like those in Moscow and Leningrad) maintained a high level of research for the benefit of students. VASKHNIL scientists were rarely invited to give lectures or offered part-time teaching positions. There was little rotation of staff within educational institutions and exchange of staff between the Academy's institutes and the colleges. Again, a key reason was that people were attached to their housing.

The *State Committee for Science and Technology* was responsible for securing a coherent national science and technology policy in accordance with party and government directives (Cooper 1994: 291). Its main counterpart was the Academy of Sciences. As mentioned, VASKHNIL was involved in some biology-related grants in the late 1980s, yet the areas of interest of the two academies were quite different.

The relationship between VASKHNIL and the *Ministry of Agriculture of the USSR* has been mentioned already. The All-Union Ministry was essentially the client of the Academy. With the evolution of VASKHNIL, as more and more institutes were transferred from the Ministry to the Academy, the importance of this linkage increased dramatically. However, because of the Academy's conservatism, it did not readily respond to new priorities and directions put forward by the Ministry.

The *ministries of agriculture of the republics* had their own research institutes, which were gradually transferred to the regional branches of the Academy. By the end of the 1980s, the republics' agricultural ministries had become heavily dependent on the Academy and its regional branches. Due to the Academy's complex structure, the various agricultural research institutes situated in a republic might report to different organizations. One might report directly to Moscow if it belonged to a VASKHNIL subject department. Another might report to a VASKHNIL regional branch situated in another republic. Still another might

report to the local Ministry of Agriculture. This structure sometimes resulted in important local problems being ignored. The contribution of an institute to the republic in which it was situated often depended on the strength of the lobbying efforts of the local agricultural ministry or the closeness of the relations between the ministry's leadership and the respective institutes. A republic that hosted a regional VASKHNIL branch often had definite advantages, since these institutes would concentrate efforts on their host republic first.

Contrary to the situation in Western countries, *scientific societies* played a minor role in the USSR. The activity of the All-Union Society of Geneticists and Breeders was limited to the organization of meetings every four to five years and the publication of their proceedings. There was no regular publication or communication between the members. While the leadership of the society consisted of academicians of VASKHNIL and the Academy of Sciences, there were no formal linkages between the academies and these societies.

In the international arena, the Academy's highest priority was cooperation with the *academies of agricultural sciences of COMECON and other socialist countries*. Most of these copied VASKHNIL in their structure. There were several mechanisms for cooperation. First was the establishment of joint research programs addressing common problems. For example, a successful program that focused on winter wheat breeding united plant breeders from Russia, Ukraine, Hungary, Romania, Bulgaria, and other countries. This program was coordinated by the Soviet Plant Breeding and Genetics Institute and resulted in a number of advanced varieties. Second, cooperation at the institute level was encouraged, involving both joint research and exchange of scientists. It seems that agricultural research cooperation and coordination at this international level (COMECON) was much better than at the national level. Third, reciprocal membership in the Academy helped to maintain communication. Here, leaders of an academy of agricultural sciences in a friendly country were elected as foreign members of VASKHNIL and vice versa.

The relationship with the *scientific community of the Western countries* could be characterized as one of isolation due to two main factors: lack of language skills and very limited exchange of people. As a rule, trips abroad were undertaken by Academy bureaucrats and rarely by scientists. Researchers invited to attend scientific conferences abroad were, for political reasons, often not allowed to go. Very few scientists were trained abroad. Even those who learned languages and details of the research system in place elsewhere were hardly able to apply their knowledge due to the institutes' conservative environment. This was ironic since the system of agricultural education encouraged and required knowledge of foreign languages. In graduate study, in fact, everybody had to pass a language exam. While many scientists were able to read and understand a foreign language, there was no motivation to learn to speak it. Most importantly, there were few joint research programs with institutions from the West.

The Academy, nonetheless, felt that physical isolation from the West should not undermine information exchange. Accordingly, all important scientific journals published globally were received by the Central Agricultural Library and made available to scientists. Abstracts in Russian were also published on a monthly

basis. The libraries of research institutes as well as individual scientists could easily subscribe to these monthly compilations of abstracts. There was even some overlapping of efforts by VASKHNIL and the Academy of Sciences. Finally, a journal entitled *Agriculture Abroad* published monthly consisted of literature reviews and trip reports.

VASKHNIL's relationships with institutions in developing countries had political overtones. In friendly countries (e.g., Yemen, Angola, Afghanistan), the Academy supported agricultural research through joint projects and assistance of outposted experts. VASKHNIL outreach locations were established in some countries. For example, the Vavilov Institute had an office in Vietnam to regenerate its collection of tropical crops and another in Mexico to tap into local biodiversity. The All-Union Institute of Phytopathology had a station in Ethiopia to study cereal diseases.

Several research centers in the Consultative Group on International Agricultural Research (CGIAR) had working relations with VASKHNIL. The Mexico-based International Center for Maize and Wheat Improvement (CIMMYT) trained several wheat researchers as far back as 1972, and there were many short-term visits to Mexico after this. Similar relations were developed with the International Center for Agricultural Research in the Dry Areas (ICARDA) and the International Potato Center (CIP). Although VASKHNIL scientists had technical information about research conducted in the CGIAR and while a germplasm exchange was active, the way in which the international centers were funded, their objectives, and operational mechanisms remained unknown to them.

Like national linkages, the Academy went about its international relations according to a set hierarchy. While the institutes had their own level of interactions, they were not allowed to independently develop a cooperative international research project. As with everything in society, such international contacts were strictly regulated.

4. Evaluation of the USSR Academy of Agricultural Sciences (1929–1991)

Two questions are paramount in evaluating the agricultural research system of the USSR: (1) was it productive in delivering technologies that increased agricultural output and (2) was it competitive compared to the level of global science development. In analyzing the Soviet Academy of Sciences, Cross (1995) points out that the research level in priority areas such as physics was comparable to or higher than that in the West. As regards agricultural science, Pray and Anderson (1997) give a few examples of excellent achievements in research which were well recognized outside of the USSR. In general, however, the level of agricultural science in the USSR was good, but somewhat lower in comparison to other developed countries due to scientists' relative isolation and lack of advanced scientific equipment and computers.

Undoubtedly, agricultural science in the USSR had impact on production and contributed to the steady growth of agricultural output from 1950 to 1980. Crop production was almost entirely based on local varieties using local technologies. A similar situation was observed in animal husbandry. In the processing industry, Soviet technologies were mostly inferior to foreign ones. In stating that agricultural science in the USSR was basically capable of delivering a useful product, two important issues remain. First, was the cost (financial and ecological) of the achievements justified by the benefits received? Second, could the target have been reached in a more efficient manner?

This chapter weighs some of the advantages and disadvantages of the USSR's agricultural research system with particular reference to the Academy of Agricultural Sciences (VASKHNIL).

Advantages

Several features contributed to VASKHNIL's ability to serve the agricultural sector. These aspects may provide relevant considerations for the further development of the agricultural research systems of the new republics in Central Asia and the Caucasus.

Research network

The Academy and its institutes had the most elaborate research network in the country. The all-union mandated commodity institutes had regional branches and experiment stations in all targeted environments. This network enabled the

conduct of comprehensive experiments. For example, the All-Union Institute of Fertilizers and Agro-Chemistry was able to evaluate the response of different crops to major compounds at 100 sites across the country within three to five years. The Vavilov Institute had a network that allowed it to evaluate genetic resources across the country at its numerous stations.

Communication forum

The Academy scheduled two general assemblies each year: a mid-term meeting normally outside of Moscow and an annual meeting at headquarters. These meetings attracted leading scientists, policymakers, and producers' representatives. Both meetings provided an excellent opportunity for communication and exchange of ideas. In addition to these two formal meetings, a number of other meetings and conferences were conducted for scientists at all levels.

Information system

The Central Scientific Agricultural Library and the Institute of Information provided superior services to its corporate and individual clients in literature searches, reviews, etc. The library had basically all the world's most important journals related to agriculture. The Institute of Information routinely published abstracts of foreign research papers in Russian. Between 50 and 60 all-union journals related to agriculture were published by either VASKHNIL or the Ministry of Agriculture.

Recognition of achievements

Membership in the Academy was the most valuable recognition of an individual scientist's achievements. At a time when financial rewards were very limited, this type of recognition motivated research staff. VASKHNIL also conferred a number of its own awards for outstanding research in particular subjects.

Human resource development

Human resources was always a high priority for the Academy. Attention was paid both to graduate students and to post-graduate experiences. Researchers under 35 years of age had their own association of young scientists at each institute. They conducted conferences and produced separate publications. Limits on travel abroad were compensated by regional or national meetings and conferences which targeted this specific group of agricultural researchers.

Disadvantages

Some aspects of the Academy had negative consequences. These too warrant consideration for the development of agricultural research systems in the newly independent republics.

Dependence of research on politics

The politicized society had politicized science. Examples cited in this report have demonstrated the overriding importance of the will of the party or an influential individual in the development of agricultural science with respect to its priorities and its structure. Nikonov (1990) points out, "The management system

tried to make science knuckle down, to make it an extension of itself. This is the main reason for our failures and our backwardness."

Low rate of technology adoption

Though each institute had an extension department, there was no functioning bridge between product development and its adoption for commercial use. Science was turning to industry, but often found no reciprocal interest (Nikonov 1990). As a result, many of the technologies developed had low adoption rates. In such circumstances, the scientists themselves had to sacrifice research and act as extensionists to attempt to bring their products to producers. As Romanenko (1997) mentions, this is still one of Russia's major problems and concerns for agricultural research.

Strict government control

All functions of the research institutes were strictly regulated by government. This left little flexibility for modifications in research financing, priorities, and structure.

Inflated bureaucracy

"The Academies, Ministry of Agriculture and State Committees that directed and administered the overall research agendas and budgeting were often viewed as being inflated bureaucracies that were more an obstacle to scientific endeavors than a support mechanism." Little can be added to this statement made by Holderbaum (1993).

Absence of a fair system of evaluation

Depending on the institute, various criteria were used to evaluate research programs. Yet the appointment of independent review teams consisting of prominent scientists was an approach rarely utilized.

Weak economic justification of research programs

In many cases, the size of a research program or institute was determined by pressure to work on an objective without taking into account how economically justifiable that objective was. When research funding was unlimited, this resulted in overinvestment in some programs.

Disproportional numbers of scientists

Overinvestment in research coupled with poor work efficiency resulted in a huge number of scientist positions. Yet it was difficult to attract personnel for the poorly paid position of research technician. As a result, the ratio between scientists and research technicians approached 1:1. In more efficient research programs, this ratio would be about 1:2. Many Soviet scientists were doing the duties of technicians, thus decreasing the level of their professional output.

Separation between agricultural research and education

The system lacked close relations between agricultural research and education. As a result, both suffered from isolation.

5. Development of National Agricultural Research Systems in the Republics (1991–1998)

With the absorption of VASKHNIL into the Russian Academy of Agricultural Sciences in 1992, the other republics were required to define and develop their own national agricultural research systems. As pointed out earlier, each had inherited a particular set of research institutions with various origins and alliances. Not all were or would be useful in their Soviet form for national purposes. Yet most remained with their staffs, physical assets, and histories waiting for their fates to be determined by national policymakers.

Table 3 summarizes changes that have taken place in the agricultural research systems of the 10 republics of Central Asia, the Caucasus, Russia, and the Ukraine from 1991 to 1997. Among the countries in Central Asia and the Caucasus only Georgia retains the academy system that characterized the research system of the former Soviet Union. Russia and the Ukraine also retain the academy system. Two countries, Kazakhstan and Uzbekistan, have now formed hybrid systems as "centers of agricultural research." Reforms at various levels

Table 3. Summary of Changes in the Structure of Agricultural Research in the Independent States of Central Asia, the Caucasus, Russia, and Ukraine

Country	NARS Structure in 1991 when Established	Reforms	NARS Structure in 1997	NARS Superior Body
Armenia	Ministry	1998	Ministry	MOA
Azerbaijan	Ministry	–	Ministry	MOA
Georgia	Academy	–	Academy	COM
Kazakhstan	Academy	1996	Center of Agricultural Research	MOS-AS
Kyrgyzstan	Ministry	1995	Education and Research	COM
Tadjikistan	Ministry	–	Ministry	MOA
Turkmenistan	Academy	1996	Institute	MOA
Uzbekistan	Academy	1996	Center of Agricultural Research	COM
Russia	Academy	–	Academy	MOA
Ukraine	Academy	–	Academy	COM

Abbreviations: NARS = national agricultural research system; MOA = Ministry of Agriculture; MOS-AS = Ministry of Science–Academy of Sciences; COM = Cabinet of Ministers.

have taken place in five of the eight Central Asian and Caucasus countries, with another two being involved in efforts to reform.

Table 4 shows the 1997 status of these same 10 agricultural research systems with respect to institutes and scientists. Note that all countries in Central Asia and the Caucasus still have far too many institutes and scientists in terms of what their agricultural resource base can support in the future. Georgia and Armenia have the highest numbers of scientists per thousand hectares of arable land, far exceeding the numbers for the richest countries in the world.

Tables 5*a* to 5*d* provide data on key human, economic, physical, and agricultural production indicators that will likely influence the future size and scope of the research systems. These tables show that while the countries have achieved economic improvements in the last year or two, they are still experiencing serious economic problems affecting the pace and scope of research system development. All eight countries have human development indices in the mid range (from 76 to 108). But their rankings of real gross domestic product (GDP) per capita (15 to 46 points higher) demonstrate the seriousness of their economic plight. In most, a relatively high percentage of population is still involved in the agricultural sector, even though the amounts of arable land per person are relatively low (except for Kazakhstan). Dependency on irrigation in most of the countries is high and water delivery systems have deteriorated to the point where heavy reinvestments are needed. This, plus the slow recovery of their economies, has caused agricultural production indices to remain low (relative to 1989–1991) in five of the eight countries, with the livestock sector showing the poorest performance.

Not obvious from these statistics is the fact that the collapse of traditional markets and the move toward more open market economies is changing the mix and quantities of agricultural commodities being produced. This will significantly affect future development of the agricultural research systems. Only now are these changes being perceived and factored into planning for the future.

The following is a brief summary of the agricultural research systems in the three new republics of the Caucasus region and the five new republics of Central Asia.

Table 4. Status of the Agricultural Research Systems of the Independent States of Central Asia, the Caucasus, Russia, and Ukraine, 1997

Country	Number of Institutes	Number of Scientists	Arable Land (million ha.)	Scientists (per 1000 ha. arable land)
Armenia	13	517	0.5	1.03
Azerbaijan	15	825	1.6	0.52
Georgia	16	876	0.8	1.13
Kazakhstan	29	1,902	35.0	0.05
Kyrgyzstan	5	203	1.4	0.15
Tadjikistan	8	–	0.8	–
Turkmenistan	7	540	1.4	0.38
Uzbekistan	19	2,850	4.1	0.69
Russia	203	17,000	132.0	0.13
Ukraine	51	7,000	31.0	0.22

Tables 5a to 5d. Central Asia and Caucasus Country Data

Table 5a. Human Indicators, 1997

Countries	Population (millions)	Population Growth (percent per yr.) 1975–1997	Population Density (# per ha.)	Agr. Population (percent of total)	Human Development Index (HDI)	HDI Rank
Caucasus						
Armenia	3.6	1.0	1.21	13.9	0.728	87
Azerbaijan	7.6	1.4	0.88	28.1	0.695	103
Georgia	5.1	0.2	0.73	21.7	0.729	85
Central Asia						
Kazakhstan	16.4	0.7	0.06	21.1	0.740	76
Kyrgyzstan	4.6	1.5	0.23	27.6	0.702	97
Tajikistan	5.9	2.5	0.41	35.9	0.665	108
Turkmenistan	4.2	2.4	0.09	34.8	0.712	96
Uzbekistan	23.2	2.3	0.52	29.8	0.720	92

Sources: UNDP, Human Development Report, 1999 for population (total and growth) and HDI data. Population density computed. FAO, FAOSTAT Statistics Database, August 2000 for agricultural population (percent computed).

Table 5b. Economic Indicators

Countries	GNP, PPP (billions)	GNP Per Capita, PPP	GNP Growth Rate (percent/year)	Agriculture in GDP (percent)	Inflation Rate (percent per year)
Caucasus					
Armenia	9.6	2,540	8.6	40.6	17.3
Azerbaijan	11.6	1,520	3.1	21.9	14.1
Georgia	10.7	1,980	13.2	31.6	7.0
Central Asia					
Kazakhstan	55.7	3,500	1.7	12.0	16.1
Kyrgyzstan	10.1	2,180	8.6	44.6	19.3
Tajikistan	6.6	1,100	2.2	—	—
Turkmenistan	6.5	1,410	-24.0	—	—
Uzbekistan	—	—	—	30.6	67.6

Abbreviations: PPP = current international dollars; GNP = gross national product; GDP = gross domestic product.
Source: World Bank, World Development Indicators CD-ROM, June 1999.

Russia and the Ukraine are added for comparison. Profiles produced by the International Service for National Agricultural Research (ISNAR) provide more complete information about some of these republics' agriculture and their agricultural research systems.

Table 5c. Physical Indicators, 1997

Countries	Total Area (000 ha.)	Arable Land (000 ha.)	Arable Land (percent of total)	Arable Land Per Capita (ha.)	Irrigated Land (percent of arable)
Caucasus					
Armenia	2,980	494	17.5	0.14	61
Azerbaijan	8,660	1,672	19.3	0.22	87
Georgia	6,970	781	11.2	0.15	60
Central Asia					
Kazakhstan	271,730	30,000	11.0	1.83	7
Kyrgyzstan	19,850	1,350	6.8	0.29	80
Tajikistan	14,310	760	5.3	0.13	95
Turkmenistan	48,810	1,630	3.3	0.39	–
Uzbekistan	44,740	4,475	10.0	0.19	96

Source: FAO, FAOSTAT Statistical Database, August 2000 (percent computed).

Table 5d. Agricultural Production Indicators, 1999 (1989–91 = 100)

Countries	Food Production Index	Agricultural Production Index	Crop Production Index	Cereal Production Index	Livestock Production Index
Caucasus					
Armenia	79.7	78.9	101.0	119.6	65.6
Azerbaijan	62.7	56.2	42.4	83.8	73.9
Georgia	80.7	74.4	65.8	136.4	82.6
Central Asia					
Kazakhstan	63.2	61.5	80.4	78.0	43.5
Kyrgyzstan	109.8	100.3	121.9	112.2	77.8
Tajikistan	61.0	54.0	61.0	173.1	38.2
Turkmenistan	128.4	112.3	105.6	378.8	130.6
Uzbekistan	120.0	101.5	91.4	247.1	115.4

Source: FAO, FAOSTAT Statistical Database, August 2000.

Armenia

Armenia did not host a branch of the Soviet Academy of Agricultural Sciences and therefore had some freedom after independence to establish a national agricultural research system to meet its needs. Nonetheless, scientists did create an Armenian Academy of Agricultural Sciences in 1991. This unit receives no regular budget, serving mainly as a professional society and provider of advisory services to government.

In 1998, the country still had 13 separately managed agricultural research institutes coordinated by the Armenian Ministry of Agriculture. These institutes employed 517 scientists, of whom 44 were doctors and 263 candidates of

science. Before 1991, most of these institutes and centers operated in association with institutions in the Soviet Union (many through the Trans-Caucasian regional branch of VASKHNIL located in the Republic of Georgia). Their programs were then determined in large part by these institutions. After 1991, the Armenian government funded the institutes within its borders, in 1994 introducing a competitive grant scheme to support research themes proposed by the institutes to the Prime Minister's Office. The Armenian Ministry of Agriculture further established a Department of Science and Education to develop and support the national agricultural research and education components of the agricultural technology system.

In March 1998, Armenia signed a World Bank loan agreement to develop an integrated system of agricultural research, education, extension, and information. The Ministry further established an agricultural research council to coordinate a research system that eventually is to be integrated with the Armenian Agricultural Academy (a university). Five research centers are to replace the current 13 institutes, and the university is to be the sixth research center. Experiment stations formerly belonging to the 13 institutes are to be rationalized to serve the entire system, with agricultural service centers in each *marz* (province) for adaptive research, testing, and demonstration of new technologies directly to farmers.

Azerbaijan

There were 15 agricultural research institutes in Azerbaijan prior to the breakup of the USSR. Some belonged to the republic's Ministry of Agriculture and others to the Trans-Caucasian regional branch of VASKHNIL based in the Republic of Georgia. One station belonged to the All-Union Irrigation Association under the umbrella of the All-Union Ministry of Agriculture. Shortly after independence, Azerbaijan united most of its agricultural research institutions under its Ministry of Agriculture. These institutes have some 825 scientific staff of which 38 are doctors and 362 candidates of science. An additional institute belongs to the State Committee on Melioration and Water Resources and another four institutes related to agriculture belong to the Azerbaijan Academy of Sciences. No academy following the VASKHNIL model was established in Azerbaijan, probably because there was no VASKHNIL branch in the republic to build upon.

The current system of agricultural research in the country is described by Aliev and Mustafayev (1997) as follows: The Central Board of Science, Education and Extension supervises the scientific council in the Ministry of Agriculture. This latter is responsible for setting priorities; development of strategic research policy; coordination of research, education, and extension; and international collaboration. All institutes work under state contracts and are financed by government. Four institutes were transformed into scientific-industrial associations as a measure for self-financing of agricultural research and greater independence. The Agricultural Research Institute (crops) in Baku with all its stations was united with 20 farms to form an association. Similar associations were organized around the Vegetable Institute, the Horticulture Institute, and the Forage Institute. In 1997, ISNAR conducted a review of Azerbaijan's agricultural research system at the request of the country's Ministry of Agriculture (ISNAR 1997a).

Georgia

Before independence in 1991, Georgia was host to VASKHNIL's Trans-Caucasian regional branch. This branch managed a number of institutes in Armenia, Azerbaijan, and Georgia. The Georgian Ministry of Agriculture also had several research institutions. Some years after independence, nearly all these institutes were united in the Georgian Academy of Agricultural Sciences (GAAS) under the leadership of the Trans-Caucasian branch. Hence, the Georgian system of agricultural science is currently modeled almost entirely after VASKHNIL.

Aleksidze et al. (1997) describe briefly the objectives and structure of the Georgian Academy. There are currently 11 institutes and 5 centers in a system employing 876 scientists of which 56 are doctors and 435 candidates. GAAS is an independent scientific organization managed on democratic principles. Its main goal is to establish priorities for scientific and technological progress and conduct research to develop Georgia's agro-industrial sector. One main function of GAAS is providing finance on a competitive basis to basic and applied priority research through agreements with research institutions. Agricultural education is concentrated in the Georgian Agrarian University (GAU), which is one of the oldest in the USSR (founded in 1918). Other educational institutions involved in research are the Zootechnic Training and Research Institute and the Institute of Subtropical Farming. These educational institutions are independent from GAAS with few functioning linkages between them.

Kazakhstan

In 1941 VASKHNIL established in Almaty its Kazak regional branch. That branch was transformed into the Kazakhstan Academy of Agricultural Sciences in 1957. That Academy was closed, however, in 1962 and all its research institutes were put under the Ministry of Agriculture. VASKHNIL's Eastern regional branch was established in 1971 (NACAR 1997). Most of the agricultural research institutes in the republic became part of this branch, with the exception of the Institute of Cereals Production in Akmola, which had an all-union mandate and reported directly to Moscow.

In 1990, all Kazakhstan's research institutions were united to again form the Kazakhstan Academy of Agricultural Sciences (KAAS), which emulated the VASKHNIL structure. KAAS had six subject departments with 32 research institutes, 28 experiment stations, and 45 experiment farms (Kaliev and Suleimenov 1995). Research management and coordination was done through the subject departments and coordinating institutes. Like VASKHNIL, KAAS was an association of both institutes and scientists.

In 1996 Kazakhstan reorganized its agricultural science system. KAAS was transformed into the National Academic Center of Agricultural Research (NACAR) and became a part of the recently established and combined Ministry of Science/Academy of Sciences. NACAR currently comprises 29 institutes, 13 experiment stations, and 36 experiment farms. The farms had a total planted area

of 345,000 hectares in 1997. Academicians and corresponding members of KAAS became members of the country's Academy of Sciences.

Though the structure of NACAR remained essentially that of its predecessor KAAS, management and coordination procedures did change. Headquarters is now mandated only to define strategic plans for the major national research programs and participating institutions, which also include agricultural universities and research institutes outside of NACAR. Technical coordination and implementation of programs is delegated to regional research institutes. NACAR encourages research institutions to establish private or semi-private consulting, extension, and training companies so as to earn money to support scientists and their research. Agricultural research funding is currently channeled through 12 national programs. Table 6 presents the distribution of funds and personnel among different subjects.

Kyrgyzstan

Table 6. The Distribution of Research Funds and Scientists by Subject within NACAR, Kazakhstan, 1997

Subject	Funds (percent)	Scientists (percent)
Grain production	27.6	25.3
Water resources	2.3	2.3
Animal husbandry	21.3	26.4
Agroecology	1.9	2.2
Forage and pastures	15.2	13.2
Medicinal crops	0.5	2.2
Vegetables and potato	12.9	8.3
Veterinary	8.7	6.9
Economics	4.8	4.8
Forestry	2.7	2.6
Industrial crops	2.6	3.0
Food industry	1.2	1.4
Total	100	100

Source: Satybaldin 1997b.

In 1995 the agricultural research system of Kyrgyzstan comprised five research institutes in the network of the republic's Ministry of Agriculture and Water Resources (MAWR): the Institute of Cropping Systems, the Institute of Forage and Pastures, the Institute of Soil Science, the Institute Experimental Veterinary, and the Institute of Animal Husbandry. The combined staff numbered 442 of whom 203 were scientists. Another agriculture-related institute, the Institute of Biochemistry and Plant Physiology, is under the national Academy of Sciences.

The government reorganized the agricultural research system in 1996, aiming to reap advantages from combining education with research. Accordingly, all five MAWR institutes were subordinated to a newly established Kyrgyz Agrarian

Academy, which is now the major agricultural research and education institution in the country. The Academy is a management entity reporting directly to the cabinet of ministers. It is not currently an association of scientists and is not modeled after VASKHNIL. Research funding, management, and program coordination is concentrated in the Academy administration. As in other countries, research funding has diminished, but the number of research programs has remained steady. Plans are now being made for further reforms in agricultural research and education.

Tadjikistan

Before 1991, Tadjikistan housed seven agricultural research institutes. These were either part of the Central Asian branch of VASKHNIL or belonged to the republic's own Ministry of Agriculture. All the institutes continued operations up to 1997, forming the country's agricultural research network. Their exact structure is unclear, however, as the Tadjikistan Academy of Agricultural Sciences claims that the agricultural research institutes belong to it. Yet Ministry of Agriculture structural charts show the institutes as part of its departments. The Ministry's claims put the Academy in a consultative role rather than that of an executing agency. The Academy has few personnel and is currently involved in the preparation of laws, evaluation of major agricultural projects, and conducting meetings between researchers and producers.

The Ministry sets the institutes' research priorities, and a deputy minister is responsible for day-to-day management. All institutes have suffered drastic downsizing, mainly because many experienced scientists of non-Tadjik nationality left the country. The institutes conduct only the most essential operations, using manual labor even for planting and harvesting because much of the farm machinery was destroyed during a civil war. The most important tasks at present are revitalization of research infrastructure, incorporation of the institutes into the regional and global scientific communities, and training scientists. For the medium and long term, the concept of agricultural research and education needs to be developed further.

Turkmenistan

There were 12 agricultural research institutes in Turkmenistan prior to 1991. Upon independence, those were united by executive order to establish the Turkmenistan Academy of Agricultural Sciences. Some institutes were subsequently merged and by 1995 six institutes remained. During 1995–1997, the institutional structure remained the same, with the exception of changes in the apex body.

Designed to be self-financed, the Turkmenistan Academy initially used its 25,000 hectares of land to produce cotton. Processing the harvested cotton at its own plants, it then invested its profits in agricultural research, paying salaries and operating costs. At that time, the Academy and its institutes were said to be financially sound. In early 1996, however, the president of the country dissolved the Academy, which was then transformed into the Turkmenistan Agricultural

Research Institute. The new institute was obliged to divest some of its land and all its cotton processing plants. Despite the transformation of the Academy into the institute, very little changed in terms of research management. Former institutes (now departments) are physically separated and maintain a high degree of independence from each other. The reorganization was also accompanied by frequent changes in leadership. The financial status of the institutes has also deteriorated.

Uzbekistan

Uzbekistan hosted the Central Asian regional branch of VASKHNIL. Due to the traditional importance of agriculture in this republic, Uzbekistan had a well developed agricultural research network. Shortly after the USSR broke apart, the research institutions were united in a newly established Uzbek Academy of Agricultural Sciences. The Uzbek Academy was an autonomous structure responsible for agricultural research. Both institutes and individual scientists were members. Further, the Uzbek Ministry of Agriculture and Water Resources had under it one research institute working on water resources and four institutions for agricultural education.

In 1996, a reorganization transformed the Academy into the Scientific Production Center of Agriculture (SPCA) subordinated to the country's cabinet of ministers. The SPCA comprises 19 research institutes with 26 branches and experiment stations and 23 experiment farms (Usmanov and Azimov 1997). The SPCA employs 2850 scientists and possesses 109,000 hectares of arable land including 43,000 irrigated hectares. Government funds the institutes while the experiment farms are self-financed.

The SPCA institutes are involved in 10 research programs. The top three priority programs relate to development of effective, resource-saving technologies for grain, cotton, and vegetable production. Researchers from the Uzbek Academy of Sciences and educational institutions are also involved in implementation of these programs. A significant change in the structure of the SPCA, as compared to the Uzbek Academy of Agricultural Sciences, was the establishment of some 10 regional departments in each administrative unit (*oblast*) of the country. These departments are responsible for extension and transfer of new technologies and products developed by the SPCA (Usmanov and Azimov 1997).

Russia

As already mentioned, immediately after the breakup of the Soviet Union the Russian Academy of Agricultural Sciences (RAAS) was established, uniting the All-Russian Academy of Agricultural Sciences and VASKHNIL. The share of agriculture (including agricultural research) in state expenditures decreased from twelve percent in 1991 to six percent in 1994, and to three percent in 1996 (NIITEI Agroprom 1996). This reduction was reflected in both RAAS and the Russian Ministry of Agriculture. In 1996, for instance, the state provided only 44 percent of the budget of the plant breeding centers within RAAS (RAAS 1997a).

Despite severe budget reductions, the structure of RAAS and the number of research institutes within in remained essentially unchanged.

Initially RAAS was established as an independent organization (Romanenko 1993). Later it was brought under the umbrella of the Ministry of Agriculture, although it still maintained a high degree of independence. The president of RAAS is the deputy minister of agriculture.

Agricultural research resources in the Russian Federation in 1994 are presented in table 7. As of April 1997, RAAS employed 17,000 researchers including more than 1000 doctors of science and 6500 candidates of science (RAAS 1997b). The 405 experiment farms had a total area exceeding seven million hectares, with 1.7 million hectares of arable land. Annual gross production of agricultural products within RAAS totaled about one billion US dollars (Romanenko 1997).

The management of research within RAAS remains largely as it was during the time of VASKHNIL. Financing and coordination of agricultural research is currently executed through federal or regional targeted programs. RAAS is involved in 31 agricultural research programs, two federal programs financed by the Ministry of Science, and 26 international projects. Depending on their mandate, state funding of institutes varies from 80 percent (for national mandate commodity or subject institutes) to 20 percent (regional or local mandate institutes covering all aspects of agriculture). Other funding comes from production and research contracts with producers. Diminished funding led to a 60 to 70 percent reduction in staff in some institutes over 1990–1997. Official figures put the number of scientists in Russia in 1994 at 67.7 percent of the 1990 figure (RCS 1994). Unfortunately, it is the younger and brighter staff who are leaving. In 1993–1994, the country's agricultural education institutions attracted 14 percent fewer students than they had in the 1980s (*ibid.*). The separation between agricultural research and education remains, as in the former USSR.

In summarizing the results of the first five years of Academy activities, President Romanenko (1997) of RAAS, pointed out its weakest aspect as the practical application of research results. The Academy's extension services lack the resources for introducing new products. On the other hand, producers are weak economically and unable to pay for new technology development.

The five objectives of RAAS were stated in 1998 (RAAS 1998) as follows:

Table 7. Agricultural Research Resources in the Russian Federation, 1994

Resources	Academy of Agricultural Sciences	Agricultural Colleges and Universities	Ministry of Agriculture, Dept. of Science	Total
Number of research institutions	235	91	91	417
Number of scientists	22,000	1,200	4,200	27,400
Doctors of science	950	58	167	1,175
Candidates of science	7,400	452	1,413	9,265
Land (million hectares)	7.4	–	0.4	–

Source: Nikonov 1995: 488.

- develop basic and priority applied research for Russia's agro-industrial sector
- study trends in the development and future of the agro-industrial sector
- provide scientific support for the agro-industrial sector, agrarian reforms, and rural development
- study, summarize, and disseminate advances in national and global science
- develop human resources and training

RAAS and the Ministry of Agriculture recently drafted a joint report on improvement of the system of research support for the development of agro-industry in Russia (Romanenko 1997). The report defines RAAS research priorities as well as mechanisms of research planning, funding, management, and application of results. The need to restructure and optimize the research network is also mentioned. The obvious trend at present is a decreased share of funds coming to the research institutes through RAAS.

Ukraine

The national agricultural research system of the Ukraine was established in December 1990, one year before the breakup of the USSR. At that time, Ukraine hosted VASKHNIL's Southern regional branch with its developed network of research institutes. A few all-union mandated institutes under direct management of Moscow were also situated in the Ukraine (the Plant Breeding and Genetics Institute in Odessa was one such institute). In 1991, all these institutes were transferred to the newly established Ukraine Academy of Agricultural Sciences (UAAS). UAAS is an independent self-governing organization reporting to the cabinet of ministers. However, until 1998 the UAAS president was, at the same time, deputy minister of agriculture.

UAAS changed very little in the 1990s in response to the changing agricultural situation. Its structure and management remain similar to that of VASKHNIL. UAAS is an association of both institutions and scientists. It comprises 45 academicians, 59 corresponding members, and 21 foreign members (UAAS 1993). Its research network consists of 177 institutions, including 51 research institutes, 17 regional experiment stations and 7 commodity experiment stations. Its production base encompasses of 228 experiment farms with a total of 800,000 hectares. UAAS employs a staff of 127,000 including 7000 scientists.

Agricultural research in the Ukraine is funded by government, contracts with producers, and other sources. Government funds are distributed on a project and competitive basis. The research agendas of the institutes and stations are included in 15 national and a number of regional programs. For each program, a coordinating institute is designated, and this institute forms the coordination council that manages the program. At present, the Ukraine's research institutes suffer from low funding. By 1996, government funding of agriculture (including research) had plummeted (UAAS 1996). Lack of funds for scientific information, scholarships, and the purchase of foreign equipment has diminished research output. ISNAR reviewed the Ukraine agricultural research system in 1997 (ISNAR 1997b).

6. Future Prospects for Agricultural Research Reforms in the Republics

Considering the legacy of the Academy structure inherited from the Soviet Union, what future can be expected for the agricultural research systems of the new republics? This question is foremost in the minds of many of the republics' scientists and of increasing concern to agricultural sector leaders and government policymakers. While the future remains uncertain, some observable trends and experiences with strategies may serve as indicators of the near-term destinies of these fledgling agricultural research systems.

Current Trends in Reforming Agricultural Research

Several common trends have emerged in the evolution of the agricultural research systems of the republics of Central Asia and the Caucasus.

Strict state control

Strict government control over the agricultural research system has remained in all of the countries, although it is reduced somewhat compared to USSR times. Since less and less funds come to the institutes from the state through academies or other structures, they are less dependent on these structures in terms of priority setting and research implementation. On the other hand, the bodies that manage science (academies or centers) do want to continue exercising significant control over the research programs.

Necessity to optimize the system

Post-independence evolution of the agricultural research systems in the republics clearly indicates a preoccupation by the governments and research establishments with the status and efficiency of the systems. In many countries, the research systems have been reorganized using a pragmatic approach. Seldom, however, have these reorganizations taken advantage of knowledge and experience accumulated elsewhere in order to avoid common mistakes.

Two approaches in organization

Agricultural research systems of the former Soviet republics have developed along two distinct patterns of organization: (1) VASKHNIL-type academies and (2) more practical production-oriented structures which are either independent or subordinated to the Ministry of Agriculture. Balazs (1997) draws some conclusions about the future of the VASKHNIL-type academies in the countries of the

former Soviet Union. She states that since some of these institutes have gained political power, they are likely to persevere. On the other hand, if the organization and management of research in these academies remains inefficient and unresponsive to changes in the agricultural sector, their futures will be dim.

Conservatism in management structure

The last president of VASKHNIL, A. Nikonov, optimistically stated in 1990, "We are departing from the rigid structure of research groups to give them creative freedom. These changes will also lead to the improvement of the quality of studies, the reduction of research time and the increased responsibility of scientists." This has not happened. Balazs (1997) sees conservatism as a major obstacle in the development of science. Procedures for planning, funding, coordination, and evaluation have undergone some changes, but these are not yet significant enough to impact research efficiency.

Funding constraints and downsizing

All the countries' agricultural research systems have experienced severe budget cuts, resulting in reduced operations and low salaries. Drastic downsizing of staff often occurred when funding shrank and programs closed. But numbers of institutes basically have remained as they were before 1990. Few countries have reorganized their whole system or been able to close entire research institutions.

Changing research priorities

Holderbaum (1993) listed "reformed research objectives to address new needs" as one of the conditions for a research institute to survive the restructuring period. A major priority at present is to assist in developing the concept of agricultural reform, along with the accompanying laws and regulations. Furthermore, increased emphasis is being given to commodities that provide self-sufficiency in basic food requirements, such as wheat in Central Asia. All the research systems are preoccupied with genetic resources in terms of their collection, documentation, conservation, and utilization. And long-ignored ecological problems of agricultural production are now attracting much more attention, with technologies and genotypes for low-input agriculture being developed.

Disintegration of scientific contacts and projects

One of the most negative developments has been the disintegration of scientific contacts and projects established within the former Soviet Union. Researchers communicate very little between countries at present, resulting in duplication of research efforts. For example, it would be surprising if the viticulture institutes of Georgia and Azerbaijan had different research agendas. In light of the similarity of their environments and the scarce resources available, regional and sub-regional cooperation, especially in Central Asia, would be advantageous to all.

Improved communication with global communities

Improving communication and collaboration with global scientific and donor communities is undoubtedly a positive development. Exchanges of scientists build a basis for communication and cooperation. However, the process is by no means easy due to very different mentalities and approaches. The first contacts are typically followed by disappointment on both sides. Scientists have high

expectations of the foreign research community and from donors. On the other hand, scientists in the republics understand cooperation in terms of big projects with major investments in infrastructure, machinery, and possibly, improvement of salaries. Foreigners with financial resources are unwilling to be involved in such projects, preferring instead small, targeted projects where results can be obtained in two to three years. Also, foreigners' lack of information about the countries sometimes results in proposals that seem ridiculous to local scientists because the problems suggested were already studied long ago. Gradually, as the process of learning about each other continues, cooperation should gain momentum.

Technical assistance from the West

Increased technical assistance in agricultural science is more a reality in some countries than in others. Some common mistakes are described by Bo Libert (1995):

> Too often, projects reflect the interests of the funding organization or country rather than real needs. The number and size of projects are often not correlated with the magnitude of the problems in different regions. Too little effort is devoted to understanding the people and culture. Important stakeholders are often not properly involved in the projects. As the different bilateral donors have relatively small resources, the projects have rarely gone to the core of the problems. Seminars and feasibility studies are organized, but there is no strategic approach. Frequently, when the specialists from the West (often duplicating each other's work) have identified the problems already known to local specialists, no resources are left to solve these problems.

There is growing understanding among agricultural research leaders that no one will come and make their sector (or country) prosper; everybody must contribute to this goal.

Strategies for Reforming Agricultural Research

Stanley R. Johnson (1993), in his fundamental paper on the legacy of the Soviet agricultural research establishment, outlined several alternative strategies for the development of the agricultural research base of the newly independent republics. Several years have passed since his paper was published. The following is an assessment of the extent to which Johnson's five alternative strategies have been applied in the newly established republics and their implications for the future.

Strategy 1: Preservationist

The preservationist strategy refers to the tendency of forces within existing scientific communities to maintain the current agricultural research and technology development system. Due to lack of finances, the likely outcome of this strategy would be the downsizing of existing research institutions. The changes in the research systems described in this paper over the past three to five years

indicate that this strategy was dominant in agricultural research development in the republics.

Strategy 2: Facilitating adaptation

In the facilitating adaptation strategy, available resources would be allocated so as to offer significant incentives for adapting to new economic and structural realities of the agricultural sector. Adoption of this strategy would imply a reorganization of institutes with emphasis on technology adoption, increased merging of research with education, and increased dissemination of research results. Some elements of this strategy were implemented in the republics. Kyrgyzstan, for example, merged its education and research systems, but retained its unsustainable production units. In general, research institutes are slowly turning to the new needs of farmers and traditional production units. However, this strategy was not dominant over the past seven years.

Strategy 3: Differential support for applied and basic science

A strategy by which differential support is provided to basic and applied science would enable the state to preserve fundamental scientific potential in the hope that the emerging private sector would fund applied research. To some degree, the Russian Academy of Agricultural Sciences has adopted this concept of funding. In Russia, major institutes with national mandates have 70–80 percent of their budgets paid by government compared with 40–50 percent government funding for the regional agricultural research institutes. However, the budgets of the basic research institutes and departments are still too low to be productive. Basic and applied research were also separated in Kazakhstan with the opposite approach. Here, basic science receives just enough to keep it alive during this difficult period.

Strategy 4: A cottage industry

The cottage industry strategy would aim to protect key (highly qualified) scientists and research programs by fully funding their activities at the expense of other programs. There are no indications that this strategy was applied in any of the countries considered in this report. As predicted by Johnson (1993), many internationally recognized scientists left for employment abroad. Also, movements of scientists within the former Soviet Union cannot be ignored, as a number of key researchers emigrated from Central Asian countries to Russia and the Ukraine.

Strategy 5: Import technology

The final strategy, to import technology, would imply importation of research products from abroad. Certain elements of this strategy have indeed taken place, especially in the processing industry. At the level of agricultural research systems, this strategy was applied by default in Tadjikistan, where civil war devastated research infrastructure and there was an erosion of qualified scientists. Now and in the future there will almost certainly be an increasing element of technology spillover in all of the republics.

7. Conclusions

The primary legacy of the Soviet agricultural research system for the republics of Central Asia and the Caucasus was a highly organized, fully funded, and over-capitalized system. Accordingly, the new republics inherited a large number of agricultural research institutions and a huge complement of scientific staff, all of which had previously served a single large country with a command economy. They also inherited a complicated and overstructured planning and operations system that tended to serve scientists more than research program goals and objectives. These eight countries are now left with the daunting task of creating from these resources and procedures effective and sustainable national agricultural research systems to serve national needs that are now only partly correlated with those of the former Soviet Union.

The development of nation-states from the former Soviet republics has been difficult and, in some cases, traumatic and chaotic. The resulting economic and agricultural sector changes in these countries will continue to have considerable influence on the agricultural research systems needed for the future: their size, scope, programs, and level of support. Changes in the structure of agriculture (e.g., large numbers of smaller, private farms) mean that the entire agricultural technology system (research, education, and extension) in these countries must be reorganized to be responsive and effective. In addition, research programs must now consider agendas not previously addressed or otherwise underemphasized, such as small-scale tillage, mixed cropping systems, farm management, and environmental management.

Up to now, the preservationist strategy has been the dominant means of dealing with agricultural research institutions, among the five strategies mentioned by Johnson (1993), implying the maintenance of existing institutes as a system. This appears to be true despite a very strong desire by both scientists and selected government agencies to optimize the research system. The importance of a scientific and systematic approach to this optimization is still underestimated.

Future development of the research systems will depend largely on the political will of agricultural research system leaders to take bold steps to reform their research systems and develop a sound strategy to carry through the reform process. The strategy must take into account future demand for agricultural research as reflected in emerging local and international markets and be conditioned by the optimal utilization of the human, financial, and physical resources available.

References

Aleksidze, G., A. Berlinski, and Sh. Chelidze. 1997. The Academy of Agricultural Sciences of Georgia. Tbilisi, Georgia: Academy of Agricultural Sciences.

Aliev, J. and H. Mustafayev. 1997. Scientific Research Institutes. Baku, Azerbaijan: Ministry of Agriculture.

Avetisian S., A. Voskanian, and O. Kloyan. 1997. Agrarian reform in the Republic of Armenia. *Agrarian Science* 4: 7–8.

Arutyunyan, R. 1995. The main soil types of the Republic of Armenia and their fertility. Presentation at the Workshop *Estimation of the Research Needs and Seed Production Status in Dry Areas of the Central Asian and Caucasian States*. Tashkent, December 5–9, 1995. Unpublished.

Balazs, K. 1997. Is there any future for the academies of sciences? In *The Technology of Transition* edited by D. Dyker, pages 162–183. Budapest: Central European University Press.

Cooper, J. 1994. Science policy. In *The Cambridge Encyclopedia of Russia and the Former Soviet Union* edited by A. Brown, M. Kaser, and G. Smith, page 291. Cambridge: Cambridge University Press.

Cross, J. 1995. A Guide to the Russian Academy of Sciences. Ames, Iowa: Cross Associates.

Gribanovkiy, A. 1997. The main results of NACAR activities in 1996. *Vestnik of Kazak Agricultural Science* 4: 19–31.

GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit). 1997. Advancement of Seed and Plant Production in Tajikistan. Report of a Consultancy Mission. Unpublished.

Holderbaum, J. 1993. Agricultural institutions and their relevance for the future. In *Science, Agriculture and Environment in the Former Soviet Union* edited by M. Strauss and S. Thomson. AAAS Proceedings of an Annual Symposium, February 12–13, 1993, pages 55–62.

ISNAR (International Service for National Agricultural Research). 1997a. The Agricultural Research System of the Azerbaijan Republic. Unpublished.

ISNAR. 1997b. The Agricultural Research System of the Ukraine. Unpublished.

Johnson, S. R. 1993. Rebuilding the research base. In *Science, Agriculture and Environment in the Former Soviet Union* edited by M. Strauss and S. Thomson. AAAS Proceedings of an Annual Symposium, February 12–13, 1993, pages 81–94.

Kaliev, G. and M. Suleimenov. 1995. The agricultural research system in Kazakhstan. Presentation at Workshop *Estimation of the Research Needs and Seed Production Status in Dry Areas of the Central Asian and Caucasian States*. Tashkent, December 5–9, 1995. Unpublished.

Lezina, M. 1997. Structural changes in Russian agriculture (1990–1995). *Agrarian Science* 6: 9–12.

Libert, B. 1995. The Environmental Heritage of Soviet Agriculture. Sustainable Rural Development Series, No. 2. Wallingford: CAB International.

NACAR. 1997. National Academic Center of Agricultural Research. Kazakhstan: NACAR.

NIITEI Agroprom. 1996. Agriculture of Russia and Foreign Countries. Moscow: NIITEI Agroprom.

Nikonov, A. 1990. Agrarian reform in the USSR and its scientific support. Presentation at Symposium *Insights into Perestroika: Implications for Agricultural and Scientific Cooperation*, May 21–22 at Iowa State University.

Nikonov, A. 1992. Agricultural transition in Russia and the other former states of the USSR. *American Journal of Agricultural Economics* 12: 1158–1162.

Nikonov, A. 1995. The Spiral of a Centuries-Long Drama: Agrarian Sciences and Politics in Russia from the 18th through the 20th Centuries. Moscow: Encyclopedia of Russian Villages Publishing House (In Russian).

Pray, C. E. and J. R. Anderson. 1997. The agricultural research system of the former Soviet Union: Past and future. *Journal of International Development* 4: 517–527.

RAAS (Russian Academy of Agricultural Sciences). 1997a. In the Presidium of RAAS. *Vestnik of RAAS* 3: 3–5.

RAAS. 1997b. The List of Agricultural Research Institutions of the Russian Academy of Agricultural Sciences. Moscow: RAAS.

RAAS. 1998. Russian Academy of Agricultural Sciences. Poster in RAAS headquarters. Unpublished.

RCS. 1994. Russia's Annual Statistics. Moscow: Russian Committee of Statistics. pages 132–143.

Redjepov, O. and O. Khodjakov. 1995. Brief description of the agricultural environment in Turkmenistan. Presentation at Workshop *Estimation of the Research Needs and Seed Production Status in Dry Areas of the Central Asian and Caucasian States*. Tashkent, December 5–9, 1995. Unpublished.

Romanenko, G. 1993. Russia's agriculture and its scientific support. In *Science, Agriculture and Environment in the Former Soviet Union* edited by M. Strauss and S. Thomson. AAAS Proceedings of an Annual Symposium, February 12–13, 1993. pages 125–134.

Romanenko, G. 1997. Difficult years of establishment. *Agrarian Science* 4: 2–5.

Satybaldin, A. 1997a. Economic policy of grain production in Kazakhstan. Presentation at *Kazakhstan-CIMMYT Workshop on Spring Wheat Production, Shortandy*. September 22–24, 1997. Unpublished.

Satybaldin, A. 1997b. Measures to improve the scientific support of agro-industrial sector in Kazakhstan. *Vestnik of Kazak Agricultural Science* 4: 3–18.

Srivastava, J. and C. Reinhard. 1996. Agriculture Knowledge Systems in the Transition Economies: A Survey of World Bank Experiences. Washington, D.C.: Consultative Group on International Agricultural Research.

UAAS. 1993. Ukraine Academy of Agricultural Sciences. Kiev, Ukraine: UAAS.

UAAS. 1996. Agricultural Research in Ukraine. Presentation at the International Workshop *Agricultural Research in Countries of Central and Eastern Europe*, Prague, May 6–7, 1996. Unpublished.

Usmanov, S. and Azimov B. 1997. Agricultural Research in Uzbekistan. Unpublished.

Covers: Chlorine-free paper
Inside pages: Recycled paper

Produced by ISNAR Publications Services

Text editor: Michelle Luijben
Printer: Rapporten Service Drukkerij B.V., Rijswijk, The Netherlands

ISSN 1021-4429
ISBN 92-9118-057-2

The Legacy of the Soviet Agricultural Research System for the Republics of Central Asia and the Caucasus

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International Service for National Agricultural Research

Part of the CGIAR Research Network

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