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## Organization of Research

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### Russian Scientists in Global Scientific Migration Processes

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**Abstract**—A review of studies on the question of the mobility of Russian scientists in the recent period of Russian history is provided. The main stages and trends in the development of academic mobility over the past three decades are shown. The geography of migration flows, which involve employees of Russian research organizations and universities, is generalized. The unique position of Russia in terms of attractiveness for migrants from neighboring countries, which makes it possible to compensate to a certain extent for the outflow of domestic specialists, is emphasized. In addition, the authors draw attention to the methodological aspects of studying academic mobility and assessing its effectiveness, including the problem of data reliability and the development of a system of indicators.

**Keywords:** academic mobility, scientific migration, scientific collaboration, Russian diaspora, bibliometrics.

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In recent decades, scientific migration has become an integral part of scientific activity around the world. The mobility of scientists, especially at the international level, accelerates scientific research through the exchange of knowledge [1], contributes to more intensive scientific and technological development, and, in the context of globalization, becomes an important factor in economic growth [2]. Academic mobility contributes to scientific diplomacy, reducing political tension in relations between countries; its analysis makes it possible to predict the development of science [3, 4]. Considering the importance of the consequences of the migration of scientific personnel from the point of view of the successful development of modern Russia, domestic researchers actively study this phenomenon [5, 6], especially since scientists from our country participate in global migration processes on a full-fledged basis.

In preparing the review part of this article, the Informatics database of the VINITI abstract journal for 1990–2020 and the Scopus database were used, from which publications were selected on the topic of the mobility of Russian scientists over the past

30 years. The choice of the 30-year period was determined both by the transition of Russia to a new stage of historical development and by the almost complete absence of intercountry academic mobility during the Soviet era.

#### STAGES OF ACADEMIC MOBILITY DEVELOPMENT IN MODERN RUSSIA

In the history of migration of Russian scientists of the post-Soviet era, three significant stages are distinguished, regarding all types of mobility [7].

The first stage dates to the 1990s, when the number of scientific personnel in our country decreased significantly: according to various estimates, by 54–58% [8, 9] against the 1990 level. The flows of scientific emigration of Russian researchers during that period are described as brain drain, but this type of geographical mobility, according to later estimates, only affected tens of thousands of people. Most of those who left science remained in the country but had to change their profession and field of activity, and this time we are talking about hundreds of thousands of people [10, 11]. The outflow of scientific personnel especially affected basic areas of knowledge such as mathematics, physics, genetics, neuroscience, and biochemistry [11–13]. This was largely due to the fact that in the last decade of the 20th century, the funds for scientific research were rapidly decreasing, the drop reaching 18 times lower [14].

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In the 1990s, along with an increase in the rate of international outbound and internal mobility (often associated with a change of profession), an increase in the interest of foreign researchers in Russian science was observed, which was reflected in the opening of many international foundations in Russia to support science with little participation of government agencies [2]. One of the goals of state grant funding for science at that time was to prevent the departure of specialists associated with the military industry and nuclear technologies to countries that sought to gain access to this knowledge [15]. In addition, the grant funding was aimed at reorienting military scientific research to the civilian sector. The role of international foundations in the mobility of Russian scientists was significant, and participation in programs supported by the foundations had a significant positive effect on the professional and career growth of Russian researchers [16].

The main driving forces of mobility in the first decade of post-Soviet history were the understated remunerations of highly skilled labor, its ineffective use and lack of demand for scientific results, an overabundance of scientific personnel in the new conditions of a market economy, and the declining prestige of science [10, 11]. This was due to the contradiction between the high level of scientific personnel and the inability to meet researchers' scientific and human needs [14]. An important factor in deciding to leave Russia is a better technical base for conducting research and experiments in leading foreign countries. Since the mid-1990s, an additional incentive to leave for abroad has been the overproduction of graduates, which exceeded the demand for personnel in science and the higher education system [1]. According to some estimates, since 1992, Russia's annual economic losses from brain drain could amount to one annual budget every 5–7 years [5, 17].

The second stage—the systemic international mobility of Russian scientists—dates to the signing of two documents by Russia: the Lisbon Convention on the Recognition of Qualifications in 1999 and the Bologna Declaration in 2003 [18]. From that time, the flow of outbound mobility slowed down in comparison with the previous decade [10, 11], and the minimum number of researchers working in Russia was reached in 2010, amounting to 368 900 people [8]. The decrease in the rate of the brain drain was facilitated by the spread of new types of academic mobility, including circulation mobility—lecturing courses outside Russia or scientific internships [16, 19, 20].

Along with the slowdown in the rate of outbound mobility, there was a noticeable decrease in the age at which researchers are involved in the processes of mobility [16]. There was a gradual departure from the brain drain model, although some researchers believe that this process continued in the past decade and

point to its negative consequences from the standpoint of the country's intellectual security [12, 21, 22].

Of particular importance during that period was network mobility, which is directly related to the intensive development of information, communication, and network technologies in Russia. The concept of network mobility is based on the understanding that modern means of communication greatly facilitate the exchange of knowledge, which now, in most cases, no longer requires the physical movement of scientists. This type of mobility turns out to be convenient both for foreign employers, who reduce the costs of organizing the relocation and employment of a researcher of interest, and for Russian researchers, who in this case do not have problems with cultural and social adaptation, which are inevitable when moving to a different place [20]. Note that the network mobility of Russian scientists has been poorly studied until now and requires additional study.

In general, in all specialties, the emigration flow from Russia outside the post-Soviet space decreased from 100 000 people in 1995 to 11 500 in 2009 [23]. Russia began to develop mutually beneficial scientific and educational contacts with other countries, taking part in the formation of a single scientific and educational space within the framework of the Bologna process. The state became increasingly involved in the management of science and increased funding for research organizations and institutions in the system of higher education.

However, despite the increase in funding, its inadequacy for the successful functioning of the scientific sector remained obvious [24], demand for the results of scientific developments by the commercial sector of the economy was still low [10, 25], and the contribution of entrepreneurs to the funding of science was insignificant [8]. The level of intersectoral mobility, that is, the transition of researchers from the academic environment to the research units of business structures and vice versa, remained relatively low [25]. This is partly why the stable outflow of Russian specialists abroad continued, mainly to the countries of the European Union and the United States, which affected the economic development of our country [17].

The third stage covers the last decade and is characterized by multidirectional trends. The fullest scientometric analysis of the international and interregional mobility of Russian scientists was carried out in [26]. Its results indicate that the flow of researchers from the regions to the capital continues (the intra-Russian migration of researchers is 76% associated with Moscow) and from Russia abroad. The total number of researchers in comparison with the previous period again shows negative dynamics: 347 900 people in 2018 [27]. Just like in the previous period, the scale of scientific emigration is decreasing: from 0.9–1.2% of researchers who left Russia annually in the early 2000s

to 0.4–0.5% in the mid-2010s [26]. The role of circulation mobility, which is the most effective from the economic standpoint, is growing, since scientists have the opportunity to train and work abroad, receive unique experience there, and then apply it at home [28]. Apparently, this applies to a lesser extent to the border regions, where the possibilities of going abroad are wider, which leads to a decrease in the number of researchers. Thus, the example of the Baltic region shows the contradiction between the positive population growth and the negative dynamics of scientific personnel over the past six years: according to estimates, the annual external migration in the region is 5% [29].

Return mobility is becoming noticeable, meaning the repatriation of former Russian scientists who worked abroad for a long time [30]. Synchronous academic mobility is developing, i.e., the simultaneous work of researchers in several organizations, which forms a virtual international scientific labor market. According to the results of bibliometric analysis of affiliations, the spread of synchronous mobility in Russia in the 2010s is estimated at 10–15% [4]. In another bibliometric study, synchronous mobility is recognized as the most widespread form of international circulation of scientific personnel in the last decade: for example, among mathematicians who left to go abroad in 2008–2018, almost 50% (521 out of 1059 people) also indicate a Russian affiliation [13].

As for cross-sectoral mobility, its level remains lower not only in comparison with countries leading in science, including the United States, Britain, and Japan, but also the lowest among the BRIC countries, and mutual transitions primarily cover research organizations and the corporate sector but not universities, as is the case with other countries [25]. Meanwhile, there are certain positive shifts: the creation of innovative firms by universities and cross-training of representatives of science and business, which can contribute to the commercialization of research results.

As a positive trend, note the involvement of the state in controlling mobility and the development of a system of state support under international collaboration programs. For the first time, there is the opportunity to use the emerging brain drain from the United States and Europe in the interests of Russia [17]. Since 2012, mobility in Russian scientific and educational organizations, primarily in universities, has been developing due to the program of additional funding for universities within the framework of the 5–100 program for the entry of five domestic universities into the top 100 universities of the world [31, 32]. In addition to this project, the international competitions organized by the Russian Foundation for Basic Research and the Russian Science Foundation, as well as megagrant projects, contribute to an increase in the mobility of Russian scientists, although the share of funding for foreign internships by the Russian party,

according to some estimates, does not exceed a third [23].

These undoubtedly positive initiatives run counter to the ousting of international programs to support mobility and Western grant funds from the Russian scientific space [23], as well as the limitation of scientific and educational contacts of Russian researchers, which is associated with the observance of national security interests [2]. Repeated cases of accusations of Russian scientists of disclosing state secrets significantly undermine the foundations of collaboration between Russian specialists and their foreign colleagues, which is accompanied by a decrease in Western interest in Russian science and a decrease in foreign investment in it.

Therefore, despite a slight increase in the welfare of Russian workers in the fields of science and higher education, Russia remains relatively unattractive for the scientific community [12]. Economic motives for leaving the country, characteristic of the 1990s, are now increasingly being replaced by sociopsychological ones: among the main reasons for current emigration, researchers mention the desire to live under the rule of law, civil rights and freedoms, and the ability to avoid the arbitrariness of the authorities [17]. The negative assessment of the Russian political realities by Western countries hinders the repatriation of researchers who have already left [16].

#### WHAT HINDERS ACADEMIC MOBILITY IN RUSSIA?

*Common mobility models.* Among scientific workers in Russia, common is the practice that implies that the researcher remains to work in the same organization where he/she received education [1, 25, 33, 34]. In 2007–2016, two-thirds of Russian scientists did not change their place of work, and their mobility invariably decreases with age [1]. Up to 64% of the full-time employees of our universities are their former graduates [35]. The mobility of employees of research organizations is even lower, but they are more active in finding jobs abroad. The highest mobility is demonstrated by men (63.4% among those who change jobs) and doctors of sciences (37.1% versus 22% in the group of immobile scientists), as well as residents of large cities (69.9%) [1], and the share of men among representatives of the Russian diaspora abroad is even higher, 89.3% [36]. In the early 2000s, two-thirds of mobile scientists in our country were candidates and doctors of sciences [23], but only 10% changed jobs after receiving an academic degree [34]. Less than half of researchers participate in international conferences in Russia, and only a third do so abroad [1]. The practice of inviting foreign specialists is poorly spread in our country: in the early 2010s, they accounted for only 1% of the total number of scientific personnel, while in European countries, the United States, Can-

ada, and Australia, this level ranged from 8 to 21% [37].

The uneven distribution of mobile researchers among organizations is noteworthy: there is a small number of institutions with a high proportion of employees who often travel abroad, up to 5%, while the average indicator is 0.7% [23]. As a rule, the intensity of mobility is determined by the research topic: it is higher among specialists in the field of basic natural sciences and lower among those who deal with regional problems.

The dominant idea is that low mobility of scientists has negative consequences both for themselves and for the organizations in which they work, as well as for the country as a whole; positive effects can be observed only in rare cases when it comes to the most reputable research institutions and universities [7, 38]. Scientists who are not inclined to change their place of work and residence have a much narrower circle of professional contacts, which means that they are less informed about the trends in the development of their field of knowledge, are focused on building a career exclusively within their organization, and make little effort to acquire a widely recognized authority.

In terms of publication activity, Russian mobile researchers surpass their nonmobile colleagues by almost two times [1]. The bibliometric indicators of Russian emigrant scientists and those who left to go abroad for a while approach the level of their counterparts from the host countries [4]: the higher the bibliometric indicators of the host country, the higher they are for Russian researchers working in the country on a temporary or permanent basis. The analysis of scientific productivity showed that nonmobile scientists mostly publish their works in university bulletins, while mobile scientists publish in authoritative journals of the Russian Academy of Sciences and foreign serials, the former more often using existing connections to publish their papers [39].

The absence of a difference in scientific productivity expressed in the number of publications was noted only among representatives of university science: both mobile researchers and their nonmobile colleagues are equally likely to publish articles in Russian and foreign university journals [35]. Meanwhile, for the university environment, first, there is a slight preponderance of mobile scientists in the possibility of publishing their results in international editions; second, this paper did not assess the quality of publications, which, according to other studies, is likely to be higher among mobile scientists. The smoothing out of the difference in the number of publications can be explained by the general strengthening of the role of publication activity and increased requirements on the number of published works when applying for grants, compiling reports on basic and additionally funded projects, recertification, etc., motivating nonmobile scientists to write more articles.

Among the causes of the low mobility of university staff is the system of attracting their own graduates as teachers, which was established in the Soviet Union. Presumably, universities prepare the most qualified personnel, the best of whom remain within the university walls [35]. Among other things, the development of mobility is hindered by the relatively low prestige of scientific and educational professions in Russia [8] and savings on their own graduates, whose attraction is estimated as cheaper, as well as by financial difficulties associated with moving to more attractive regions [35, 38]. In addition, the employment of one's own graduates reduces the level of uncertainty and risk since there is complete information about the candidates [34]. Middle-level universities cannot attract the best specialists, so they have to hire their own graduates. Still another factor that impedes the development of the mobility of Russian scientists is the regime of access to information constituting a state secret, which covers a large part of the research staff and often imposes restrictions on leaving Russia.

Some Russian researchers do not see a significant negative impact on the effectiveness of the scientific and educational system of attracting graduates to work at the university [35], and the management staff of universities considers such a practice inevitable [34]. Given the low incomes of workers in the scientific and educational sphere, the risk of their overflow to other sectors of the economy remains high; hence, mobility is not encouraged [34]. By the example of the economics departments of 28 St. Petersburg universities, it has been shown that up to 45% of researchers approve of the practice of hiring their own graduates, and only 12% of the respondents are ready to give preference to "outsiders" [39].

Note that with the inclusion of Russia in the international scientific and educational environment with a high level of competition, the negative consequences of the existing system of retaining personnel have begun to prevail over its advantages [34].

*State regulation.* One of the main problems in the field of scientific and technical policy throughout the history of modern Russia remains the unsystematic approach of the state to the processes of academic mobility [2, 17, 24, 40–42]. Among other things, the very concept of academic mobility has not received due elaboration at the legislative level. Although the severity of this problem has decreased over time, there are still many legislative gaps that impede the formation and maintenance of an optimal ratio of outbound and inbound scientific migration flows in Russia [17].

At present, the attraction of foreign students and researchers to Russia is more regulated than the departure of Russian scientists abroad [2, 43], which, incidentally, is typical of other countries as well. To a certain extent, this approach is justified, since outbound mobility as such requires less attention from the state; more efforts, apparently, should be made for the

return of compatriots who received experience abroad [1]. In addition to measures to attract them to the country, attention should be paid to intellectual immigration, which can to some extent compensate for the outflow of intellectuals from Russia [17].

Russia ranks fourth in the world in terms of both emigration and immigration; in other words, the situation is somehow unique since either emigration or immigration usually predominates in migration flows [42–44]. However, regarding our country, we can talk about the balance only relative to its quantitative measurement: qualitatively, the flows differ significantly because mainly people with a high level of education leave, and mostly unskilled workers enter. The share of highly qualified immigrants is small, and most of them come from the EU countries, while from the CIS, SCO, and EAEU countries—which are the main sources of replenishment of the Russian labor market—people with a low level of education often enter, who do not influence the contingent of scientific workers in Russia [45].

From the standpoint of state regulation, an unsolved problem remains the undifferentiated approach to migrants, when no distinction is made between highly and low-skilled workers. In addition, entry is hampered by numerous bureaucratic difficulties in paperwork [11], strict reporting requirements for managers and executors of projects on spent funds allocated by the state for research, and overstated requirements on strictly regulated periods of stay in Russia, which vary in different programs from two (for example, FTP “Scientific and Scientific–Educational Personnel of Innovative Russia”) to four months (for example, the megagrant program) [36]. This is emphasized by both foreign scientific and educational workers and former compatriots involved in work in Russian research institutions and universities. The negative feedback is due to additional explanations to reports on work related to teaching and research already during their implementation and often at the end of the period of stay in the country [37], as well as with an unjustifiably high level of bureaucratization of the reporting system and public procurement and the complexity of tender documentation, the completion of which takes time allotted for scientific research [46].

The problem of nostrification (equalization) of diplomas and academic degrees is causing discussion. For example, in Russia, it is not enough for foreign researchers to have a PhD degree to supervise postgraduate students, which often becomes the reason for refusal of employment in Russian scientific and educational organizations [37]. At the same time, the mutual recognition of diplomas is rightly considered as a factor contributing to the strengthening of intellectual emigration from the country and damaging the intellectual security of the state [41]. The attractiveness of Russia for foreign researchers and former compatriots also depends on political processes: migratory

scientific flows are influenced by mutual sanctions of Russia and Western countries, which has yet to be quantified.

A significant and unsolved problem at the state level is the lack of available information on scientific vacancies in Russia. Analysis of the work of the portal The Territory of Opportunities led to the conclusion about its low efficiency in comparison with similar foreign resources [33]. According to a number of parameters, the portal is designed exclusively for Russian specialists: the absence of English-language job descriptions does not allow foreigners to get the necessary information; the level of the salaries indicated is often not true to fact; and the practice of preliminary agreement with a candidate for a position announced for a competition and drawing up requirements on his/her résumé is no secret, which is why the competition system is considered fictitious [35]. On the other hand, there is a low level of use by Russian organizations of international systems for finding employees, including portals on the sites of the *Nature* and *Science* journals.

Insufficient regulation of mobility is confirmed by the fact that most international scientific contacts were and remain the result of the personal initiatives of scientists and not of purposeful scientific policy [23]. There is not enough publicly available information on possible channels of communication with foreign specialists or financial support for mobility; moreover, due to hidden competition, such information is often deliberately not made public [23].

In the context of the shrinking population and the increasing shortage of qualified specialists, some authors suggest that migration and visa policies will be softened, taxation issues will be settled in relation to foreign researchers and graduates of Russian universities with foreign citizenship, and new agreements will be signed on the mutual recognition of documents confirming scientific qualifications [45].

## GEOGRAPHY OF THE ACADEMIC MOBILITY OF RUSSIAN SCIENTISTS

*Countries with which Russian researchers cooperate.* According to a large-scale survey of workers of Russian scientific organizations and universities, conducted in 2018, they cooperated with 115 countries, with Germany as the leader [3]. Half of Russians leaving for work or study in foreign scientific organizations go to Germany, France, and the United States [1]. In 60% of cases, Russian scientists are affiliated with the G7 countries and Switzerland and about 10% with Japan, China, South Korea, Brazil, and India [1, 4].

Similar conclusions were reached by the authors of a thorough scientometric study, which took into account changes in the affiliations of Russian authors from 1996 through 2020 according to the Scopus database [12]: the top five countries involved in migration

scientific flows with Russia included the United States, Germany, France, Britain, and Ukraine, for the first four countries Russia being mainly a supplier of scientific personnel and for the latter, a host country. The distribution of migration flows by areas of knowledge, presented in the same work, showed a tendency for a brain drain from biological and other natural sciences (which is associated, among other things, with a high degree of standardization of research methods, as well as with a high demand for specialists in this profile [47]), while in the social and humanities cycle, a uniform circulation of researchers is observed, regardless of specialization [12]. Note that the research topic affects not only the intensity of academic mobility but also often determines its geography. For example, Russian scientists employed in the oil and gas industry will most likely choose oil-producing countries for cooperation or migration.

Israel occupies a special and one of the top positions in the list of countries chosen by scientists for work [5, 11]. Almost 80% of the emigration flow to this country from the Soviet Union/Russia consisted of representatives of the scientific and educational spheres, which ultimately had a significant positive impact on the economic development of Israel [22]. A characteristic feature of the migration of Russian scientists to Israel is its consistency, which is provided by the Israeli authorities, in contrast to the disordered flows to other countries [22]. In recent years, scientific contacts between Russia and Vietnam and Mongolia have become more active [2].

The share of foreign authors with whom Russian scientists collaborate is gradually growing, and in the 2010s, according to the bibliometric analysis of affiliations, it was 36% [4]. At the same time, working trips to the CIS and Eastern European countries, as well as cooperation with them, have become rare, which was confirmed in our studies on Earth Sciences, in which the share of collaboration with scientists from the countries of the former Soviet republics is only 2.6% [48]. Apparently, this may be due to the large-scale and incessant relocation of scientists from these countries to Russia for a permanent place of work and residence. According to some estimates, immigration from neighboring countries helps to compensate for the outflow of Russian specialists from the country [11, 12].

The choice of a country by Russian researchers correlates with indicators such as the gross domestic product, the Human Development Index, and the gross domestic expenditures for R&D [4]. The largest number of proposals for cooperation comes from the countries of the former socialist bloc, while a higher interest of Russian scientists has developed to the countries of Western Europe [2]. Scientific migration flows largely depend on the policies pursued by a particular country in relation to mobility and migration. For example, to Australia, which is interested in the

influx of highly qualified specialists, Russian researchers tend to move to a permanent place of residence, while for Italy, where the policy towards migration is more rigid, they leave mainly for short periods [20]. In the countries selected for scientific work, researchers expect higher earnings in comparison with Russia and the possibility of conducting large-scale and long-term research.

The distribution of states with which Russian specialists cooperate in higher education is somewhat different. Russia turns out to be attractive primarily for countries with which it has interstate alliances; in the field of higher education in the last decade, the most intensive cooperation has been noted with the CIS countries (although the level of scientific cooperation with them is very low), followed by the SCO and EAEU countries: the share of students in the total number of foreign students from the countries of these associations in the 2010s was 53%, 41.2%, and 22%, respectively. The least developed cooperation is with the EU countries, the share of students from which reaches a little more than 5% [45].

From the demographic point of view, the CIS countries, with their growing population and significant proportion of young people, are especially attractive to us [42]. Of interest to Russia are also China, India, Vietnam, and the countries of the Middle East, where education systems have not kept pace with economic growth, which causes educational migration abroad, and Russia can take a leading position here [42]. Since the historical factor plays an important role in scientific and educational migration, countries with which Russia has formed scientific and cultural ties occupy a special place in it. Murmansk Arctic State University [49], Siberian State University of Science and Technology [50], Ural Federal University [28], Kazan National Research Technological University [51], and the Higher School of Economics are good examples of collaboration and exchange of researchers, teachers, and students [37].

Just like with the uneven distribution of mobile scientists among Russian scientific organizations, international scientific ties are also unevenly distributed across the regions. Stable international contacts are typical of Moscow, St. Petersburg, and Novosibirsk: among those who went abroad to work or have an internship in the 2010s, every fourth scientist was from Moscow; every fifth, from St. Petersburg; and every seventh, from Novosibirsk, researchers from which led in the number of international journeys and the intensity of international collaborations. In other regions, the situation is different; hence, it seems, a separate state program should be devoted to the development of international cooperation at this level [23].

*Collaboration with the Russian-language scientific diaspora.* Work with the Russian-speaking scientific diaspora, which has formed since the early 1990s, mainly in the United States, Canada, the EU coun-

tries, Australia, Japan, China, and Singapore, seems to be significant for enhancing the scientific potential of Russia [17, 23, 24, 42]. At the end of the 1990s, the Russian scientific diaspora numbered 30 000 people, and at least 120 000 researchers worked abroad on a temporary basis [14, 17]. From 1992 to 2008, about 70 000 specialists in science and higher education left Russia for permanent residence in other countries [10]. Note that a significant part (approximately 50%) of scientists who have migrated from our country, as is shown in a recent study by the example of mathematicians, actively cooperate with Russian colleagues, continue to be listed in Russian scientific organizations, and indicate them as an additional affiliation in their works [13]. In addition, a significant part of Russian research with foreign collaboration is carried out with former compatriots. Further development of ties with them can increase the representation of Russian science at the world level [46]. Also note the high degree of readiness of the Russian diaspora to provide gratuitous assistance to Russian colleagues, including reviewing research applications and manuscripts [36].

Over the last decade, there has been a departure from the perception of the Russian diaspora as the country's scientific potential forever lost. With a well-organized policy of building cooperation with it, it can make a significant contribution to the development of science in Russia [13, 40]. Awareness is coming that scientists who have left their homeland are better informed than foreigners about the problems of Russian science, which means that they can contribute to their solution.

In the 1990s, the interaction between the diaspora and Russian scientists was at the level of personal ties, when our researchers were attracted by former compatriots to joint projects, while from 2009 the state began to involve itself in this process to transform the ongoing brain drain into brain circulation [46]. In particular, former compatriots began to be involved in megagrant programs, "mirror laboratories," in project 5–100, and in the expert evaluation of applications for scientific and business projects [40]. To a lesser extent, representatives of the diaspora are involved in the work of the editorial boards of Russian journals [36], where their participation is often formal [52]. An important feature was the invitation of foreign compatriots to some organizations, for example, scientific and technological centers such as Skolkovo and federal universities [46]. Cooperation with the diaspora in attracting specialists with international scientific work experience to Russian universities is especially important since the language barrier remains a significant obstacle for foreign scientists when considering the possibility of working in Russia [37].

Thus, interaction with the Russian scientific diaspora is developing and, according to some estimates, is one of the most promising forms of international scientific and technical cooperation [13]. Meanwhile,

studies on the diaspora, as well as on matters of state regulation of academic mobility, note the incoordination and inconsistency of government measures [40]. At present, the program for the development of ties with the diaspora is still in the stage of formation; there is a lack of comprehensive approaches, goal setting, consistency, as well as methods of forming a reliable database of former compatriots. One of the main tasks is the collection of their contact information, and here bibliometric approaches can play an essential role [13, 26, 53].

#### RESEARCH ON ACADEMIC MOBILITY IN RUSSIA: PROBLEMS AND CHALLENGES

Currently, information on the mobility of Russian scientists is available from a number of sources: the Ministry of Economic Development; Rosstat; the Ministry of Science and Higher Education (a database containing information on the performance of scientific organizations carrying out research, development, and technological work); the Ministry of Internal Affairs; scientometric databases with information on the affiliations of researchers; and sociological and statistical reports, including in the host countries [30]. However, data from different sources often contradict each other: for example, the data on the emigration of scientific personnel of the Ministry of Internal Affairs significantly exceed the figures of the Center of Research and Statistics of Science [10]. By the example of a comparative analysis of fixing the migration flows of scientists to Israel by the Russian and Israeli sides, a significant underreporting of data by the Russian statistical agencies is shown [22].

The incomplete assessment of the annual intellectual losses in Russia is concerning, in particular since the calculations did not include information on the emigration of students, many of whom later become researchers in other countries. For example, in the early 2000s, the number of foreign students in Russian universities was taken into account, while the number of Russian students abroad was not considered [18]. The general complication of the structure and types of migration flows in comparison with the previous decades is also important [30]. Thus, the development of more accurate tools to assess migration scientific flows is of relevance in the study of the mobility of Russian researchers [53, 54].

To study the mobility of domestic scientists, it seems important to form a unified system of indicators for its assessment. In contrast to the goals of increasing academic mobility, declared by the state, a unified system of indicators has not yet been worked out. Although over the past 20 years there has been an increase in state-supported forms of mobility, there has been relative chaos in the indicators (as evidenced by different sets of metrics in the Federal Target Program for the Development of Education for different years) and increased attention to student mobility as

**Table 1.** The main thematic areas of the study of scientific mobility in Russia

Main categories in the study of mobility	Research topics	Research examples
Factors influencing academic mobility	Motivation to leave and return to one's country	[16]
	Geographical, social, and other factors influencing mobility	[20, 56]
	Science policy and its impact on mobility, mobility regulation	[11, 17, 54]
	Interaction with the Russian scientific diaspora	[13, 23, 40, 46]
Consequences of academic mobility	Impact of mobility on the scientific productivity of researchers	[35]
	Impact of mobility on the career development of scientists	[1]
	Impact of mobility on the development of scientific collaborations and research networks	[31]
	Mobility in the context of national security	[24, 41]
	Mobility and nonmobility	[35, 38, 39]
Flows of academic mobility	Research on international and regional mobility, synchronous mobility, intersectoral mobility	[3, 19, 25, 26, 53]
Development of methods for studying academic mobility	Development of research approaches to the study of mobility and its consequences	[4, 12, 26, 28, 30]
History of the development of academic mobility	Diachronous analysis of scientific mobility and the history of its development	[6, 22, 57]

opposed to the mobility of scientists [18]. An exemplary exception is perhaps the indicator “The number of researchers sent to work in leading Russian and international scientific and educational organizations,” which has been unchanged over the past several years and is used in assessing the effectiveness of scientific organizations.

The stages of developing a system for assessing mobility at the state level are described in detail in [18]. In the early 2000s, there were no clear recommendations from the state regarding the short-term mobility and mobility of scientific personnel. Since 2006, the development of all forms of mobility has been declared as state goals in this area, but the targets were formulated only in relation to the study of foreign students in Russia. A more thorough approach was taken in the federal target program for the development of education for 2011–2015, where the provisions on the possibility for Russian students to study abroad and on the cooperation of scientific workers were elaborated in sufficient detail. Meanwhile, a full-fledged state program on mobility was not launched, just as there were no clear requirements on advanced training programs abroad or scientific and student exchange, although formally all indicators were achieved. In the education development program for 2013–2020, real indicators of mobility began to be calculated; this is probably why, in contrast to the previous period, the declared indicators are not always achieved [18].

It seems that the interaction of supervisors of state programs for the development of mobility with the expert community, which develops indicators on various grounds, with the involvement of methods of sociology, bibliometrics, and other areas of research, could have a positive effect.

\* \* \*

The phenomenon of Russian academic mobility maintains steady interest from the scientific community and is reflected in the intensive flow of publications on this topic. Table 1 summarizes the main thematic areas described above in the study of Russian academic mobility on the basis of the classification that we proposed earlier [7, 55].

On the one hand, the areas listed reflect the current field of interest in the study of academic mobility in Russia and emphasize its features. Thus, special attention, atypical of world trends, is paid to the problems of the country's intellectual security associated with the outflow of qualified scientists. On the other hand, one can note a certain disregard for the topic of environmental protection, which the world community is concerned about in connection with the hypermobility of scientists and their frequent flights that pollute the atmosphere.

One can state that, despite the generally accepted classification of Russia as a country with a low degree of academic mobility, in recent years there has been



more active involvement of Russian scientists in international migration processes. To date, there are positive trends in the decrease in the rate of brain drain from the country, the inclusion of the state in the regulation of mobility processes, and the intensive involvement of the Russian scientific diaspora in research projects that are significant for Russia. This is partly hindered by the increased state control over mobile researchers and the ousting of foreign programs to support academic mobility from the Russian scientific space. Such multidirectional and, to a certain extent, unsystematic actions, combined with the already familiar formal approaches to achieving target indicators, have resulted in the replacement of economic motivations for leaving the country with social ones. Thus, there is a wide margin for developing a more balanced science policy regarding the mobility of scientists.

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