



Crowds gather in Moscow to protest against reforms to the way the Russian Academy of Sciences is run.

RUSSIA

A faltering recovery

A decade of economic growth has not led to a renaissance of Russian research.

BY OLGA DOBROVIDOVA

Crowded streets in Moscow boast some unusual adverts. Instead of touting property or consumer goods, they offer services for improving one's *h*-index and other metrics that will boost the impact of published scientific papers. A thriving market of academic fraud is one ugly side of post-Soviet science. Lamenting former prowess in everything from space exploration to nuclear power is another.

Over the past 15 years, Russia has doubled its total spend on research and development (R&D). But this increase has failed to make up for the calamitous decline in Russian science during the 1990s, following the disintegration of the Soviet Union. According to the Russian Academy of Sciences (RAS), total R&D spending in 2013 still hovered about 40% below 1990 levels. And in 2014, the country spent 1.19% of its gross domestic product (GDP) on R&D, according to estimates by the Organisation for Economic Co-operation and Development (OECD) — only a slight improvement on the 1.05% it invested in 2000, and well below the 2.38% OECD average.

But funding issues alone cannot explain why Russia has been on the sidelines of the international research stage for years — a lack of competition, poor infrastructure and an

inability to retain talent have all played their part. Now a stumbling economy threatens the modest recovery in science made in the past decades, and the chances of reform.

RISE TIDE, LEAKY BOATS

In 2014, Russia's R&D spending rose to a post-Soviet high of US\$38.2 billion (in 2010 dollars). But Victor Kalinushkin, head of the RAS's trade union and a laser researcher at the A. M. Prokhorov General Physics Institute in Moscow, says that the current level of funding "is a minimal survival level" that does not allow for development, "keeping up with the others or compensating the losses incurred in the 1990s".

Twenty-five years into a market economy, R&D is still a state-dominated affair: from 2000 to 2014, the government's share of funding rose by 14%, to 69%, but private funding dropped by a few per cent. By comparison, in countries such as the United States and China about 75% of R&D funding comes from non-government sources.

"Regrettably, we have failed to create the stimuli needed for the private sector to at least maintain the level of investment," says Irina Dezhina, a science-policy researcher at Moscow's Institute for the Economy in Transition. And we cannot change the situation without large-scale economic reforms, she says.

Instead of setting new rules to distribute the additional government funds through competitive grants, "this new money started pouring into the old system", says Mikhail Gelfand, deputy director of the Institute for Information Transmission Problems in Moscow. "It was spread thin," he says. "We have failed to build a new system, and the one we have is inelastic relative to investment. Funding has increased significantly over the last 15 years, and productivity, however you choose to measure it, has hardly increased at all."

The transition to a competitive-grant-based funding model has been slow. In 2014, just 11.1% of total R&D spending went on research foundation grants, barely up from 9.5% in 2010. Most R&D money is allocated through institution budgets.

Adding to funding woes is the fact that precious extra resources are often distributed through politicking rather than through a transparent process. An analysis of 2016 budget plans (go.nature.com/2aisci7, in Russian) by Evgeny Onishchenko, a trade-union activist and semiconductor researcher at the Lebedev Physical Institute in Moscow, revealed that the Kurchatov Institute will receive 40% more funding this year than it did in 2015. The institute is headed by physicist Mikhail Kovalchuk, who is the brother of the businessman Yury Kovalchuk — a close friend of Russian

ITAR-TASS/ARTYOM GEODAKYAN

President Vladimir Putin.

Alexei Khokhlov, vice-rector at Lomonosov Moscow State University and chair of the advisory council for the Russian Ministry of Education and Science, says that the Federal Agency for Scientific Organizations, which was created in a swift reform of the RAS in 2013 to manage the network of institutes, has been “timid” in its efforts to change the status quo of competitive funding.

COGS IN THE MACHINE

Khokhlov thinks that the amount of research funding is not the central issue. Instead, he says that the lingering Soviet idea that every scientist should have a permanent salaried position that is largely independent of job performance, known as a *stavka* and much like a tenured professorship, has prevented meaningful reforms. The bulk of research spending will be paying for “payroll for positions set years ago”, he says.

He also notes that this rigid personnel structure means that labs lack autonomy, allowing little room for scientists to work in emerging fields. This is reflected in how Russian science is represented internationally: the bulk of articles indexed by Web of Science and Scopus are related to physics, astronomy, chemistry, engineering and maths — all areas with a strong Soviet legacy. But the country is poorly represented in disciplines such as medicine or neuroscience.

In the past 20 years or so, an exodus of researchers from Russia has contributed to the scientific workforce falling by about one-third, to some 373,900 people. This follows a previous catastrophic loss between 1989 and 1994, when a similar decreased happened in just five years. Pinning down the scale of cross-border ‘brain drain’ is tricky: estimates range from 30,000 to 200,000 scientists having left since the early 1990s. A small proportion of the researchers have returned, encouraged by initiatives such as a mega-grant programme to establish new labs in universities and research institutes — a total of 162 projects have been supported since 2010, in areas such as metamaterials, climate change and stem-cell research.

Gelfand thinks that, apart from money, the science community’s biggest problem is the lack of “a set of career paths with clear rules” for researchers. He says that there are too few opportunities for researchers to establish independent research groups, as well as little mobility in a system that, owing to its inflexibility and red tape, “does not encourage changing research areas, labs or institutes”.

RAS president Vladimir Fortov has publicly stated that a renewed outflow of younger researchers in the past couple of years is evidence of this problem, a sentiment shared by Gelfand and others. Konstantin Severinov, a

molecular biologist at Rutgers University in New Brunswick, New Jersey, who returned to Moscow in 2004 to also work at the Skolkovo Institute of Technology, has compared working in Russia to “swimming in a pool without water”. He says that staying in the country precludes young and promising scientists from competing internationally.

GAMING THE SYSTEM

By 2015, Russia had planned to increase its Web of Science share to an inexplicably precise 2.44%, a target set by Putin’s 2012 decree. This did not happen, but the focus on performance indicators is unlikely to go away. Dezhina says that Russia places too much importance on



Russian postage stamp commemorating Yuri Gagarin's space flight.

metrics. “Most science-led economies have already passed this stage and now have a stronger appreciation for the role of experts,” she says. Kalinushkin also questions whether replacing peer-review assessments with statistics and metrics is a good strategy for evaluating scientists work.

Resistance to what is seen as excessive focus on ‘scientometrics’ has put a spotlight on those who exploit loopholes in the system. One recent case of fraud involved two senior researchers at a biophysics institute who added irrelevant references into student conference papers that they edited to boost their own metrics. The two were exploiting a national science-citation index, which was established in 2006 as a way to measure the impact of Russian science that was largely invisible to the international audience. One analysis showed that some 90% of papers published by Russian scientists in 2014 were not indexed in Web of Science or Scopus (N.G. Kurkova *et al.* *The Economics of Science* 1, 6–14 (2015); in Russian).

With little reaction from governing bodies to cases of academic fraud and plagiarism, some scientists have taken it upon themselves to expose university boards that routinely rubber-stamp plagiarized or ghostwritten PhD dissertations. Gelfand, who co-manages Dissernet, a volunteer organization dedicated to exposing this fraud, says that the ‘immune

response’ by government has been weak, and groups such as his are in an arms race with unscrupulous people who are abusing the systems designed to protect the integrity of science. “Reputation as a social institution has been destroyed in Russia,” he says. “Nothing is shameful.”

WINTER IS COMING

During a panel discussion at the St. Petersburg International Economic Forum in June 2016, historian Loren Graham, of the Massachusetts Institute of Technology in Cambridge, was asked if Russia can compete with the rest of the world in science and innovation. He reiterated the “contradictory and strange” fact that Russians tend to be excellent inventors, able to come up with new ideas, but very poor innovators, not able to make commercial successes of those ideas.

Russian leaders prohibit demonstrations, suppress political opponents and twist the legal system, creating a regressive authoritarian regime that does not encourage entrepreneurship, Graham told the forum audience. “They want the milk without the cow.” Until such policies change, he concluded, “the scientific genius of the Russian people, for which I have such respect, will remain economically unfulfilled”.

But things may get worse before they get better, as the Russian recession looks likely to deepen. In June, the Moscow-based Higher School of Economics said that it could see no signs of recovery in the economy. The recent turbulence has led to a 10% cut in science spending in 2016, and further cuts are expected to follow.

Limited funding will require better prioritizing. Khokhlov thinks that any attempt to do this should reflect challenges that are specific to Russia. The world in general “will do just fine without us”, he says. He cites a statement by the advisory council for the Russian Ministry of Education and Science, which calls for Russia to prioritize communications, transportation technologies that are appropriate for the country’s size, and a transition to automation.

Gelfand, however, highlights the importance of a more results-based approach. “I think there’s one top priority in Russian science now,” he says. “And that is protecting everything that still has a heartbeat.”

The country’s leaders have paid lip service to the importance of research. Indeed, in a speech at the RAS, just two weeks after his first inauguration in a May 2000, Putin called science “a crucial resource for economic growth”. Sixteen years later, although the economy has grown, Russia’s scientific enterprise has a long way to go to regain past glories. ■

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