to produce a supply of excellent students and scientific talent. Yet, as discussed in a News story on page 297, too many Russian labs produce too little. Why is Russian science unable to take full advantage of its resources?

Putin would never admit it, but China — the other great power in the East — helps to highlight where Russia is going wrong. China also has a state-dominated economy, yet one that manages to create favourable research incentives. China's state-funded science system has its own problems, but is increasingly based on merit and competition and attracts foreign talent. Lively academic exchange with the West adds constant stimulus. And oriented towards the global market, industrial research in China operates in accordance with global demands, quality standards and management practices.

Russia, where anti-Western sentiment prevails, follows a quite different path. Fixed-term academic employment of postdoctoral researchers, who produce the majority of research in most countries, including China, is virtually unknown in Russian universities and research institutes. Instead, most academic scientists enjoy permanent positions for decades and feel little pressure to perform. Only a small fraction of public research spending comes as grants allocated through competition, with the rest being simply handed out by officials. The Russian Academy of Sciences — the country's foremost basic-research organization — is struggling to get on its feet after years of unproductive wrangling over money, direction and leadership.

Russia also puts too much trust in top-down innovation by state-owned companies— in aerospace and energy, for example. But these have struggled to develop, let alone export, innovative goods and ideas.

Russia's international political isolation, inflicted by Putin's erratic course and exacerbated by nationalistic rhetoric, is another obstacle. A recent crackdown on 'undesired foreign agents', including science-funding charities, sends a hostile signal to the outside world. Cronyism and corruption start at the very top and undermine trust in research (and business) opportunities.

Putin clearly understands this. He has promised to increase science budgets further and to tackle funding bottlenecks that hurt competitive science. And on the face of it, a new national science strategy he launched in 2016 looked positive.

Under that plan, government funding was supposed to focus on a set of societally pressing topics — including energy research, health, digitalization, and security — which many other industrialized countries have also prioritized. Underperforming institutes run by the Russian Academy of Sciences would be restructured, or closed, and funding decisions spread over more shoulders to eliminate wheeling and dealing. None of this has happened yet.

***"The country must remove notorious bureaucratic hurdles to doing science."***

Russia must wise up. If it's serious about science, then the steps are simple. Most urgently, the scattering of scarce resources indiscriminately among many large research organizations must stop. Grant money should be targeted towards the best projects and research groups. That's a goal that requires transparency, fair competition and international expertise to review the research — all eminently possible. A competitive programme to encourage young researchers to run independent groups for up to five years was launched last year by the Russian Science Foundation, a government-run grant-giving agency, and is a first step.

The country must go further, and remove notorious bureaucratic hurdles to doing science, including obstructive customs rules and import restrictions on research equipment.

A stronger Russia relies on a strong research base. Russian scientists — and the watching world — are tired of empty words. Putin defines himself as a man of action. Let's see some. ■

# Making plans

*They sound dull, but data-management plans are essential, and funders must explain why.*

Data are the alpha and omega of scientific and social research. A versatile good, they exist both as raw material for producing knowledge and, when processed and interpreted with an expert eye, the end product of the exercise.

So it might sound like a truism that researchers should conscientiously handle, preserve and — where appropriate — share the data they generate and use. The problem is that this can be hard to do.

As science produces day by day a huge volume of data, it's a growing challenge to manage and store this information. To encourage this, many funders now ask applicants to submit a concise data-management plan with their grant proposals: effectively, a to-do list that details how they plan to collect, clean, store and share the products of their research.

Such plans are important, and are something that *Nature* supports (we discuss them in detail in a Careers article on page 403). But to accelerate acceptance of what some might deem just another administrative burden, science funders and research institutions must work to streamline the process and to explain the need and benefits.

First, rigorously collected, well-preserved data sets — including meaningful descriptors or metadata — will help the data owners to reach solid, meaningful results. Second, they will help future investigators to make sense of and reuse data, thereby enhancing utility and reproducibility. Preserving comprehensive data, ideally for many years, also reduces the risk of duplicating science done by others.

Still, there is no single recipe for proper data management. The task varies according to the field of science, project size and the specific types of data in question. That makes cross-disciplinary common standards unlikely, so research agencies need to engage with different scientific communities to create formats that best serve specific disciplines. To avoid a hotchpotch of standards, formats and data protocols — undesirable in our increasingly global scientific enterprise — research agencies in all parts of the world must engage.

An initiative for voluntary international alignment of research data-management policies, launched in January by Science Europe and the Netherlands Organisation for Scientific Research, is an important step in that direction. And existing data stewardship in particle physics and genomics shows that internationally aligned data governance not only is perfectly doable, but also has a positive impact on collaborative research. NASA pioneered this approach, setting up a centre in the 1980s to specifically curate the data from the Infrared Astronomical Satellite.

The message must now be passed on to scientists who work in fields less familiar with big data. Many of these, at all career stages, are worryingly unprepared. A survey of European researchers last year revealed that many have never been asked to provide a data-management plan, and that most are unaware of policies and guidelines already in place to help them. Only one-quarter of respondents to the survey, carried out by the European Commission and the European Council of Doctoral Candidates and Junior Researchers, had actually written a data-management plan, with another quarter saying they didn't even know what such a plan might be. There is nothing to suggest Europe is unusual in this.

Funders and universities, then, must ensure that the rationale of data management, and the basic skills of exercising it properly, become part of postgraduate education everywhere. Training and support must go further and be offered at every career level.

The laudable move towards open science — under which data are shared — makes the need for good data management more pressing than ever: there's no point in sharing data if they aren't clean and annotated enough to be reused. If you haven't got a plan for your data, you need one now. ■