

Nature releases white paper—Turning Point: Chinese Science in Transition

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Nature Publishing Group today releases 'Turning Point: Chinese Science in Transition,' a White Paper which takes the pulse of China's scientific research at a critical time in its development. It is the first report of its kind to be undertaken in China by a global publisher, drawing on quantitative and qualitative data NPG has recently gathered through interviewing and surveying more than 1,700 leading Chinese researchers.

As its pace of economic growth slows, China's stated aim is to move towards a more sustainable knowledge-based economy which will be driven by scientific and technological innovation. But the White Paper notes that average academic impact of Chinese research is not yet matching its growth in output, and lags behind the world average in a number of subject areas in normalized citation impact, one of the indicators of impact from research. The Chinese research environment therefore, like its economy, is at a turning point, and faces some unique challenges that need to be overcome in order to improve the quality and impact of the scientific output that will support sustainable growth.

A positive trend - the 'brain boomerang'

The White Paper starts by focusing on a positive trend in Chinese science. It shows that China's long-lamented 'brain drain' has become a 'brain boomerang', with the vast majority of young Chinese scientists planning to return quickly to China after a period overseas: 85% plan to return within 5 years. This trend of faster-returning 'haigui' (homing turtles, as they are colloquially referred to in China), reflects the country's increased standing in global research, and a greater confidence Chinese scientists have in the country's future. China's increased efforts to attract, develop and retain talented researchers are also securing greater numbers from abroad.

In order to develop and retain these scientists, the

White Paper argues that it is vital to implement policies and funding schemes that better address their needs and concerns. In a bid to better understand these, the White Paper looks into three key stages of research process: funding, conducting and sharing research. It concludes that the picture of the fundamental components of the research ecosystem in China is overwhelmingly positive, but there are still anomalies and barriers that frustrate researchers and thwart progress towards a culture that recognizes and rewards excellence and innovation. A full summary of key findings and recommendations regarding funding, conducting and sharing research is included below.

Commenting on the White Paper, Charlotte Liu, President of Springer Nature in Greater China, said: "Just like China's economy, Chinese science is at a turning point. The range of proposed suggestions and solutions found in this White Paper are based on our first-hand, wide-ranging study and explicitly address some of the issues our research identifies. They are intended to help China become more successful in this transition period. We believe that if they are refined, detailed and implemented by the key stakeholders associated with the research process, they provide the opportunity for China not just to be seen as a research giant but to establish an entrenched culture of innovation that can establish it as a global science and technology leader."

Annette Thomas, Chief Scientific Officer of Springer Nature, added: "China is pursuing an economic and social transformation driven by research and innovation. This White Paper and its recommendations are part of our contribution to that process. They reflect our commitment to facilitate China's growing contribution to global science and to help its researchers to publish, discover and succeed."

Summary of findings and recommendations

1. Funding research

China's funding system has already made some significant progress towards more rigorously meritocratic assessment, but the surveyed scientists still identified several key areas for improvement. More than 80% of those surveyed said China should devote more funding to basic research. Three quarters believe that funders do not take enough risks in funding research whose potential impact or practical value is unclear. "Take Nash's game theory as an example ... no one saw any commercial value of this purely theoretical study back then ... but it has made very significant impacts later on ..." said one researcher. Many respondents also want funding bodies to invest more in young scientists, offering them larger and more stable programmes. In terms of funding application processes, two thirds of those surveyed said that fairness and efficiency have improved, largely due to procedures implemented by the NSFC, the leading funding source for Chinese scientists. However there is still room for improvement, particularly with respect to megaproject grants. Moreover, many respondents see excessively rigid regulation of grant spending as a major impediment to scientists' efficiency and productivity. Around two fifths reported spending more than 20% of their time on funding-related activities.

Key recommendations:

- Funding bodies can drive profound innovation by funding more basic research.
- Continued investment in "blue sky" ideas will generate long-term rewards.
- Funding bodies can improve productivity and derive longer term benefits by investing more in young scientists.
- Research efficiency can be transformed through increasing funding allowances for human resources.
- Funding bodies can further strengthen funding efficiency and transparency with more merit-based peer review.
- Engagement of the broader research community when conceptualizing and awarding megaproject grants can promote fairness in funding allocation and improve

return on investment of these projects.

- Funders can help scientists to be more productive and efficient by minimising administrative hurdles and optimising flexibility in grant spending.
- Streamlining fund reporting, evaluation and financial audit processes will allow more time for scientists to focus on research itself.

2. Conducting research

In recent decades, more and more young Chinese scientists have started to run their own laboratories and research projects. However, more than three quarters of those surveyed felt they did not receive enough mentoring at an early stage, and young scientists were more likely to feel the mentoring they received was insufficient. This problem is more prevalent for researchers that have not been overseas with a large majority of home grown PhDs (66%), post-docs (72%) and PIs (77%) in China saying they have not received sufficient mentoring. Beyond funding and mentoring, other forms of support are needed, including training for writing papers and grant applications, data management and research project management. NPG's survey also revealed that the lack of postdoctoral fellows and lab technicians represents a challenge. Experienced postdocs can make a principal investigator's (PI) time more scalable and can also play a key role in mentoring junior students and staff. In terms of collaboration, almost all of those surveyed agreed that opportunities for collaboration are improving in China, but they still identified several barriers that should be addressed, such as competition for first authorship and tedious administrative procedures. "We over-emphasize the institution of the first author or even the first corresponding author ... This is ridiculous and obviously shows the sign of administrative intrusion. This is a barrier rooted in our system," was one telling comment. In addition, the survey explored the global problem of scientific misconduct. While two fifths of the researchers surveyed thought that the level of misconduct in China is about the same as that abroad, a similar proportion felt that misconduct is a more serious problem in China and the lack of sophistication of ethics training was highlighted by some: "For

instance, I had ... a student in my lab... [who]used the same graphs and text from a submitted article in another article. He didn't know that this is not allowed," said one PI.

Key recommendations:

- Research institutions could free up senior scientists' time for hands-on mentoring of young scientists by reducing their administrative workloads.
- Improved training in writing papers and grant applications is needed to help Chinese scientists compete on the global stage.
- Expanded training in data management and research project management will increase productivity, efficiency and reproducibility.
- A promotion of the value institutes place on the positions of lab technicians and post-doctoral fellow, greater compensation for contract based researchers and less emphasis on hiring rules such as quotas for full-time positions would help address shortfalls identified in terms of China's scientific workforce.
- By reorienting hiring decisions to focus on research output rather than overseas training experience, institutes can keep more talented scientists in China.
- Funders and institutes can promote domestic collaboration by considering more nuanced ways of assessing research to ease the competition for first authorship.
- Chinese authorities can also facilitate international collaboration by removing administrative barriers to healthy academic exchange.
- Measures to reduce such misconduct in China include systematic training and, when necessary, the setting up of independent investigations that penalize those found violating codes of ethics.

3. Sharing research

Sharing science encompasses disseminating research outcomes with other scientists, together with engaging the wider community, policy makers and business leaders through science

communication. But NPG's survey suggests that Chinese researchers have little enthusiasm for, or even awareness of, the global trend towards openly sharing data. Paper writing is usually the last step in research. The majority of those surveyed reported spending more than one working day per week on paper writing, and some reported spending more than half of their time writing. Language barriers are not the only issue: "In Western countries, they start writing essays early. It's integrated in their undergraduate education. Or ... even since primary school ... But this is lacking from our education system." As the number of papers coming out of China increases, Chinese scientists are aiming higher, with 87% of the surveyed scientists indicating that they are likely to publish relatively fewer papers each year in future, but with the aim of targeting higher profile journals. Making sure there is a level playing field is a major concern: "I feel there is a bias against Chinese authors in publishing. Most editors and reviewers are from western countries. It's not surprising that they will give more time and trust to an article from a famous (western) institute or lab, and they tend to be harsher to an article from a Chinese lab that they never heard of," one group leader commented. Although Chinese scientists recognize the importance of communicating their research to the wider public, only around half of those surveyed had experience of some type of science communication in the past three years.

Key recommendations:

- Implementing measures that better encourage researchers to share their data and research would benefit their participation in the global movement towards openly sharing data.
- Better training in scientific writing for researchers would address the problems they report experiencing when writing papers and communicating research.
- To address issues with commercial editing services, a global industry-wide accreditation system would help to maintain quality standards.
- Chinese institutes and funding bodies should encourage researchers to play an active role in improving public

understanding of science, by providing support and incentives for excellent science communication.

- More professional and effective science communication outlets are needed.

Provided by Springer

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