



## The future of science will soon be upon us

*The European Commission has abandoned consideration of ‘Science 2.0’, finding it too ambitious. That was the wrong call, says Colin Macilwain.*

As the staff of the European Commission head for the beaches this August, they have been asked to ponder the future of science. Research commissioner Carlos Moedas has announced his priorities as being “open science” and “open innovation”, and invited his team to report back with its ideas on how to achieve that.

These goals sound laudable enough, but they’re really rather anodyne. Sadly, the commission has closed the door on a more ambitious project. This time last year, it sought views on Science 2.0. That term infers truly radical change — including rapid evolution of the two main pillars that underpin science: the research paper and the single-investigator grant.

Predictably, the first noises to emanate from scientific leaders to the Science 2.0 consultation were sighs of scepticism. Science, they purred, organizes itself indigenously from the bottom up. Each discipline has developed its own processes and the arrival of the digital economy — the main spur for a Science 2.0 reboot — was an incremental change that the disciplines will accommodate in their own ways, in the fullness of time.

I fully understand why no one wants the commission to get carried away and do something drastic. I can’t help feeling, however, that an opportunity has been lost. A revamp of the commission’s €11-billion (US\$12-billion)-a-year research programmes to anticipate Science 2.0 might have nurtured the ability of a new generation of Europeans to develop knowledge in different ways.

Take the peer-reviewed paper, the main yardstick for success or failure in almost all academic research careers. The paper — as its name handily implies — has been rendered obsolete by the arrival of the online world. The constraints that paper publication places on overlapping authorship, evolution of content and links to other work and to other people’s data, have all gone.

A decade ago, many people in scientific publishing envisaged the broadening or abandonment of the discrete paper by around now. Yet because of the extent to which institutions, career paths, publishers and funding agencies rely on this essentially outdated concept, the paper stubbornly persists.

Indeed, the measurement of academic achievement in terms of papers published in highly cited journals, such as this one, has evolved into a kind of fetish. The 2012 San Francisco Declaration on Research Assessment, in which almost everyone in science declared their mutual abhorrence for reliance on citation data, stands, in truth, as testament to the manner in which such data now bestride the scientific world.

But the transformation of the paper is inevitable in the long run, as bulk data are shared, research outcomes can be continually updated

and people demand appropriate credit for their work.

The second pillar — the peer-reviewed, single-investigator grant — may hang around for longer. Since its development in the middle of the last century, after all, the distribution of such grants have evolved as the most tried-and-tested method of public support for science.

The difficulty here is growing political impatience with the promised outcomes from this grant funding. The annual budget of the US National Institutes of Health, the largest disburser of such grants in the world, has been frozen now for more than a decade at just over \$30 billion. As a result, it is increasingly older people, who know how to work the system, who get funding: people under 40 are finding it harder and harder to get their foot on the ladder. One consequence is the steady drumbeat from Congress for ‘prizes’ and other gimmicks to circumvent peer review.

The UK research councils are in similarly dire straits. The new secretary of state for business, Sajid Javid, who has been pressed to look for cuts of 25–40% in his budget, last month brought in the US consultancy firm McKinsey to look at how the research councils function. Bodies such as the UK Medical Research Council have a fine and well-deserved global reputation. But when McKinsey looks under the hood, it may well discover that the outputs are not what the politicians are after.

What politicians want, these days, is ‘innovation’: an odd hybrid, sitting somewhere between science, engineering, finance and human inclination. As everyone knows, ‘innovation’ thrives most visibly in places such as Silicon Valley. But would-be innovators there already occupy a culture in which spending several years on a PhD and then

grinding your way to a professorship simply isn’t part of the currency. The lifestyle changes that are under way in innovators during their most creative years do not align with the decade-old funding approaches used today by the European Commission and other major funding agencies.

There is no easy way to alter the architecture of these funding routes. The divisional structure of the US National Science Foundation, for example, is recognized even by its most senior officials as inappropriate in today’s multidisciplinary world. But they can’t propose change, lest Congress makes a hash of it.

By contrast, the commission has some room for manoeuvre — and the luxury of long-term planning. The programme that Moedas is starting to prepare now will run from 2021 to 2027, by which time changes triggered by the Internet and globalization will surely be impossible to resist. The commission should be planning for how the world will look then — and envisioning Science 2.0 would be a good place to start. ■

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