A culture of global collaboration

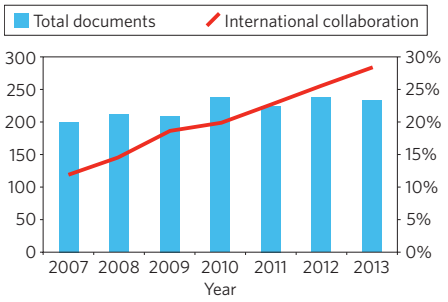
When tackling complex research challenges, photonics researchers often benefit by joining forces with scientists from other countries.

The wisdom contained in the well-known proverb "two heads are better one" is often just as applicable to scientific research as it is to other aspects of life. In the world of science, it typically finds expression in collaboration — a popular strategy for tackling complex and ambitious research projects. Such collaboration often goes beyond institutional and even national boundaries.

The good news is that there appear to be plenty of opportunities for international collaboration in photonics, with several funding agencies (such as the European Commission) actively supporting such partnerships. In the past, international collaborations were perhaps most popular for large-scale infrastructure projects involving gigantic facilities, but they now seem to have become popular for more modest projects. This view is supported by an analysis of all the content published in *Nature Photonics* since its inception in 2007 (see figure). In the past few years, the number of articles (of all types) published per year has remained reasonably constant at around 220. In contrast, the percentage of articles authored by researchers based in more than one country has more than doubled, increasing from 12% in 2007 to 28% in 2013.

One can only speculate regarding the reasons for this rise — greater government support and encouragement could be a driver, and perhaps increased mobility and greater networking of researchers through activities like attending conferences is another possible cause. Whatever the exact reasons, researchers often benefit both tangibly and intangibly from international collaborations.

With experiments in photonics becoming increasingly sophisticated and requiring ever more complex techniques and instrumentation, collaboration can be a useful way to bring together the needed expertise. For example, an active researcher in quantum optics, Jian-Wei Pan from the University of Science and Technology in Hefei, China, told *Nature Photonics*, "In the study of solid-state quantum information, one needs not only the finest clean room growth and fabrication, but also sophisticated quantum optical tests and demonstrations. For this purpose, in my quantum dot project, I'm happy to receive complementary expertise from overseas research groups."



The total number of articles of all types (blue bars) published per year in *Nature Photonics* along with the percentage written by researchers from more than one country (red line).

Sharing state-of-the-art laboratory equipment can substantially reduce the time required to achieve a goal and hence accelerate progress. "If one wants to continue to work at the forefront of research, one needs to work with the very top layer of researchers in the world," commented another quantum-optics expert, Jeremy O'Brien from the University of Bristol in the UK. By developing collaborations across the globe, one can communicate directly with experts in all fields and very quickly gain access to knowledge regarding the key aspects of emerging scientific fields. This helps to address important experimental challenges.

Collaborations often form not only between different academic institutions but also between academic institutions and commercial entities. Yusuke Mori from Osaka University in Japan, an expert in crystal growth, collaborates with pharmaceutical companies in all corners of the world. His femtosecond laser irradiation technique for crystallizing membrane proteins, which is indispensable in most drug development, has attracted great attention from companies wishing to explore its potential. Industry feedback can be invaluable for developing and supporting new academic fields.

However, collaboration does not necessarily guarantee success, and it does have associated risks and complexities. For example, when a team encounters a major problem in the course of a collaborative project, differences of opinion regarding how best to proceed can emerge; team members can often be divided between continuing with the originally proposed plan or trying new avenues. It is not always easy to attain consensus between collaborators with different backgrounds. Without a willingness to negotiate and, if necessary, compromise, setbacks can jeopardize a collaboration. Another potential difficulty is issues pertaining to the ownership of the intellectual property generated by a collaborative project; it is important to discuss such matters prior to commencing a project.

The governments of some countries strongly encourage young researchers to work at an overseas research institution for a certain period of time. "Some Chinese universities request their young faculty members to spend one to two years overseas to gain international collaboration experience in order to qualify for promotion," Xi-Cheng Zhang from the University of Rochester in the USA told *Nature Photonics*. Naturally, socializing with researchers from different cultures and research fields often spawns future collaborations.

There are also some secondary benefits from participating in international collaborations, especially in terms of recognition. "Being part of such a consortium is a label of quality that opens up many opportunities to researchers at the national level and also within the university or institution where the research is conducted," explained Carlo Sirtori from Université Paris Diderot in France.

As to whether the popularity of international collaborations will continue to increase, much appears to depend on government funding policies. "A recent US presidential science advisory board has recommended launching a new photonics initiative. Similar trends probably exist in Asia and the European Union too," commented Xiang Zhang from the University of California, Berkeley. Historically, the European Union has strongly promoted international projects as a means of supporting countries in Eastern and Southern Europe with less strong economies, and there is no indication that this emphasis will change in the near future. Also, as China becomes increasing powerful, it may look to further strengthen international ties. It appears that the sentiment expressed by the proverb "two heads are better than one" will prevail for the foreseeable future. ❐