Opinion

Infrastructures and Policies for Mathematicians

Lately, in many countries, the financing of research has been following a very common trend, according to which, to be financially viable, a project should have a pre-defined critical size as well as cluster a number of activities. There are undoubtedly disciplines for which this is all well and good, but except under very special circumstances this is not at all what fits mathematicians' needs. This trend underpins a number of calls for projects that have flourished recently in many countries: Germany, Japan, France, and Austria, to name a few. In a sense, the first programmes of the European Research Council (ERC) allocating starting grants and senior grants are also of this nature. Thanks to the vision and the vigilance of the mathematicians who have, over time, occupied executive positions at the National Science Foundation and in the councils advising them, it seems that U.S. mathematicians have not (yet?) suffered too much from this negative trend. Nevertheless, mathematical research being an authentically international enterprise, I feel that the issue is worthy of concern to all *Notices* readers.

Obvious questions include: what forms should infrastructures have in order to help mathematicians develop their research in the best possible conditions? How can these infrastructures be made to grow and become viable in the long run? Even though the Mittag-Leffler Institute (MLI) opened in 1916 in Djursholm, near Stockholm, and the Institute for Advanced Study (IAS) in 1930 in Princeton, it was in the second part of the twentieth century that a number of mathematical infrastructures besides mathematics departments of universities were established in several countries, some of them joining MLI and IAS as landmarks. The Mathematisches Forschungsinstitut Oberwolfach (MFO) is one of them; the Institut des Hautes Études Scientifiques (IHÉS) is another. We owe the creation of both of them to the initiative of single individuals. This is the case too for many that were created later, even if better organised mathematical communities actively helped.

A rough typology of mathematical infrastructures goes as follows: research institutes leaving total freedom to visitors to pursue the goals that matter to them; research institutes organising thematic periods; conference centres hosting events one week after the other; bibliographical databases; networks of libraries; repositories of specific pieces of software; and computing grids. By their very nature, their impact, and their use, mathematical infrastructures are truly international. Just to give an example, a small institute such as IHÉS has been welcoming visitors from more than thirty countries each year for the last ten years, with an average of seventy-eight visitors per year from the U.S.

What characterises these structures when successful? Long-term commitments, as it is indeed in the long run that they can establish their reputation; open-mindedness vis-à-vis other disciplines—and also within mathematics, as one of the strongest impediments to mathematical research is the insularity of mathematicians themselves; support to a very broad base of subjects, critical to the health of the discipline in the long run, just the opposite of the fashion frenzies that erupt too often here and there; and, last but not least, their limited cost albeit they are infrastructures impacting a whole community.

As one can see, these characteristics are almost word for word in conflict with the fashionable criteria that govern the media-dominated society we live in, namely short-term objectives, clustering as a prerequisite for attractiveness, and also a biased way of interpreting accountability as very short-term. This goes along with the widespread use of numerical indicators, among which bibliometric ones have a leading role. With the specific pattern of publication for mathematicians, this is not a minor problem for us. Fortunately, the recent report prepared by the International Mathematical Union[1] should help mathematicians tackle it. But mathematicians do not have any choice: they must fight for policies that take their needs into full consideration. To do that effectively, they must find allies who recognise the diversity of needs of scientists as the cornerstone of any sound scientific policy.

A critical component of this battle is to win long-term financial support for the mathematicians' infrastructures. Indeed many are struggling to get the special role they play for the community recognised. In fact, quite often, the limited size of their budgets plays against them. This is the case at the level of the European Commission where, presently, all mathematical infrastructures are being refused this status. Note that IAS has achieved this decisive independence almost from the start, thanks to an efficient management of its initial endowment and further efforts to strengthen it. Some of the mathematical infrastructures have finally won a status that puts them in a stable position thanks to specific state commitments. This is the case for several German infrastructures. IHÉS is presently supported by a state grant covering half its budget, and around thirty other sources, almost all of them outside France. It took steps towards acquiring more financial sustainability only recently, running (successfully) its first international fundraising campaign from 2001 to 2004 and, taking advantage of the celebration of its fiftieth anniversary in 2008, IHÉS has now launched its second fundraising campaign, hoping to guarantee some 30 percent of its annual budget (if successful), still a long step away from full independence.

For a community whose most visible event is called the International Congress of Mathematicians, it should be a natural obligation to learn how to make the case for infrastructures that really meet the needs of mathematicians.

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[1] *Editor's Note: See "Citation statistics: An IMU report",* Notices, *September 2008.*