



Granada, March 6th, 2015

“Research: Present and Future”. Panel Discussion.**Magdalena Pérez Rodríguez and Antonio Rojas León. Editors.**

A panel discussion on the present and future of mathematical research in Spain took place on February 6th 2015, within the framework of the 2015 Congress of the Spanish Mathematical Society (RSME) held in Granada, Spain. It was moderated by Antonio Campillo López (professor at the University of Valladolid and president of the RSME) and the participants were of Gloria Ortega Haro (*Ramón y Cajal* postdoctoral researcher at Pompeu Fabra University), Joaquim Ortega Cerdá (professor at the University of Barcelona and member of the Barcelona Graduate School of Mathematics), María Pe Pereira (*Severo Ochoa* postdoctoral researcher in ICMAT and *José Luis Rubio de Francia* Prize in 2012), Joaquín Pérez Muñoz (Professor at the University of Granada and responsible for IEMath-Granada) and Bernard Teissier (researcher at the *Institute of Mathematics of Jussieu* and member of the IHP Renewal Committee and the Publications Committee of the EMS). This document aims to capture some of the conclusions and proposals for the present and the future of mathematical research in Spain that emerged from this event.

Concrete proposals are stated at the end of the document as recommendations. As suggested during the discussion, the conclusions are formulated as “claims”, and include the following:

- 1) To demonstrate the great potential of young researchers in Spain.
- 2) Recover public investment in research and attract private investment.
- 3) Increase the number of predoctoral grants, also in industry.
- 4) Bring researchers into universities with a clear and effective system.
- 5) Promote *Juan de la Cierva*, *Ramón y Cajal* and similar positions.
- 6) Encourage the quality of proposals, and eliminate the term "excellence".
- 7) Use scientific judgment based on content when evaluating proposals instead of only measuring quantity and bibliometrics.
- 8) Resize the ERC program and increase the number of contracts.
- 9) Eradicate uncertainty, bureaucracy and mistrust in research.
- 10) Encourage the work-life balance for researchers.



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In most developed countries, there has been in recent years a decline in official support for basic science. On the other hand, in developing countries like China, India and Brazil, despite their economic difficulties, investment has seen an increase. Lacking the incentives (eg, of military type) existing in the past to promote scientific research, technological development for commercial purposes has come to replace it in the priorities of governments, in spite of basic science being the fundamental basis for future technological applications, which are usually not immediately available. The applications of mathematics are unpredictable; a classic example of this fact is the application of number theory to cryptography and information theory, which are a fundamental part of our modern way of life.

In the near future, progress is expected in sciences applied to modern life challenges such as climate change, medical problems related to population growth and distribution of resources. A strong basic science is necessary for this progress. Developing countries have understood this better than industrialized countries. Much of the research in these and other mathematical challenges should be led by young researchers who have received extensive training in our country.

The increasingly scarce resources tend to concentrate on a few projects considered "excellent", rather than regularly financing a greater amount of quality projects. Those who speak all the time of "excellence" are like someone who has inherited a beautiful garden carefully tended for centuries, with a rich soil full of good bacteria, rhizomes and runners and who decides to water only the most showy flowers in order to save water. Quality should always be encouraged, and damaging it is not understandable or justifiable. When you have a breeding ground of research quality, excellence is something that arises spontaneously and unpredictably.

In the case of our country, the decline in public funding spent on research also means that there are fewer research and/or teaching positions offered (both temporary and permanent) in universities and other research centers. As a result, for the first time in decades, the number of active researchers has decreased (and not just stalled) and we are experiencing an aging workforce of researchers / professors in universities, with the consequent decline in productivity and overall quality of research in Spain. Specifically, the reduction in recent years of the number of researchers by almost 10%, and of 40% in research funds are among the most drastic in Europe.

Most researchers educated in our universities are forced to seek employment opportunities in research centers abroad, with little hope of being able to return with a worthwhile position (we are not referring here to postdoctoral stays, which are an essential part of a researcher's training nowadays). In this way we lose the huge investment by the state in the university level education of these researchers, due to the drastic reduction of the number of positions offered by universities and other research centers, which endangers the generational change necessary to ensure a good system. We do not mean that universities have to accommodate all doctors that graduate, but they should have a stable recruitment system in order to break the current deadlock in the universities.

On the other hand, it is also necessary to understand that a better educated person has much to contribute to society in many areas, not just in academia. More and more companies are giving value to doctoral training, and we have to try to extend this and make the society aware of it, seeing the realization of a thesis as a future investment regardless of the researcher's continuation in academia. We also need to reflect on the lack of connection between society and mathematical research. To solve this, it would be desirable to increase the number of informative lectures and colloquia to bring mathematical research to society and raise awareness of how it affects the economy and development of a country. Thus (both public and private) funds to research in mathematics would increase. For example , it would be desirable to increase the number of research contracts financed by companies, similar to the industrial postdoctoral contracts offered by the Institute for Mathematics and Its Applications in Minnesota or the Industrial Doctorates and *Torres Quevedo* positions offered by MINECO.

The initial IEMath (Spanish Institute of Mathematics) project had as one of its main objectives to ensure generational change in universities and research centers in mathematics and prioritize mobility and exchange of ideas among young researchers via competitive calls for temporary contracts. But eventually the expected funding from the Government has not materialized (only funding for infrastructure was made available last year, which could not be used for mobility programs or research contracts). Focusing exclusively on the choice of topics and on quality, IEMath should promote research on topics which are not sufficiently developed in Spain, like the IHP does in France since its renovation.

In recent years, there also have arisen several centers and institutes, such as BCAM, CRM, ICMAT, and institutions such as ICREA or Ikerbasque, which have increased their research faculty in mathematics and have provided a research career more or less outside the University. Fortunately, these centers have hosted some of the more promising young scientists. It would be desirable that these centers and research institutes were not isolated from the university community and its environment, for instance by participating in masters and joint doctoral programs. A model which has been very successful, and would be desirable to encourage, is the CNRS in France (adopted by ICREA and Ikerbasque), where researchers are integrated into the various universities.

We believe it necessary to promote the recruitment of young researchers in the *Juan de la Cierva* and *Ramón y Cajal* programs (or similar), and ensure their stabilization at the end of their contracts. This would attract top researchers, both domestic and foreign, that would bring great vitality to the centers they incorporate to. Despite being constantly evaluated, the current situation of young researchers in Spain is characterized by uncertainty and low expectations of stabilization, which prevents them from working at their best performance or facing long-term projects (such as the direction of doctoral thesis). We regret that these programs (*Ramón y Cajal*

and *Juan de la Cierva*) have suffered serious budget cuts in recent years: for example, we have gone from 19 *Ramón y Cajal* positions in the first call to 4 or 5 positions in the last two calls (having even skipped a year); and a previous commitment to stabilizing the *Ramón y Cajal* researchers has been lost since 2012. It is also essential to stabilize the frequency of the various calls (either research or teaching positions), in order to make the system more competitive and remove uncertainties.

The criteria for evaluation and selection of candidates in these and other programs, and also for academic positions, can also be improved in several aspects. In recent years we have witnessed a great quantization of the evaluation methods: they focus on evaluating various aspects and adding up rather than performing a global evaluation of the merits of the candidate. On numerous occasions quantity is rewarded over quality. All this makes the top-rated candidates not necessarily be the most appropriate, on the contrary, they will rarely be. In certain cases, the score may be completely chaotic, as with engineers who publish joint work with mathematicians in which the authors are sorted alphabetically. A process which includes interviews and/or providing reference letters may help a better selection of the candidates.

In the various calls for both contracts and research projects, the originality and depth of the work done by applicants should be assessed, so it is important to have reviewers and evaluators in the same area of research. Indicators such as the impact factor of the journals, the number of citations and h-index of the candidates should be only an aid to the evaluation but in no case a crucial or decisive part of it. When choosing a journal to publish a research paper, not only their position in a ranking should be considered, but also the cost, accessibility of the publication or guarantee of the reproducibility of results (publishing code and data, for example). In fact, a negative correlation between the quality of scientific research in different countries and how much bibliometric evaluation criteria are taken into account is observed.

With respect to European calls, we suggest to resize the "ERC Grants" increasing their number in the field of mathematics, even if that means reduced funds for each of them. Actually there is no minimum of money requested for the proposals, but sometimes there is pressure from the recipient institutions for candidates to apply for a quantity close to the maximum amount.

It would be desirable to promote work-life balance. In the various evaluations, maternity and paternity should be taken into account, as is done, for example, in the call for ERC projects: in order to determine the number of years of postdoctoral experience, 18 months are deducted per birth for women and, in the case of men, the amount of paternity leave time is subtracted. Another example of work-life balance policy is the one recently adopted by the Department of Information Technology and Communication at the Universitat Pompeu Fabra, which has decided to grant a period without teaching load and management tasks for researchers returning after a maternity or paternity leave, so they can concentrate on research.

Among the general problems researchers face, we highlight the excessive bureaucratization of control tasks in research spending: reports, economic justifications ... The creation, for example, of a database of CVs that all administrations can use would be a big step towards simplifying bureaucratic tasks. These problems add up to the existence of a certain distrust between the Government administration and universities and researchers. A sign of this distrust is the generalization of audits in research projects. It is unacceptable that there are systematic audits where no systematic fraud exists, because the energy cost and workload caused for the system is massive, taking time away from actual research tasks.

In recent decades, with the help of both researchers and government, we have built a very solid, high quality and internationally recognized system of research, which is supported by good pillars, as are our young researchers. In recent years, this system has been severely weakened: the pillars have shrunk and some "peaks of excellence" have risen instead. So far, the system has continued to operate and tall peaks have emerged due to the inherited inertia. If we do not feed the basis of our system, we face the danger of collapse. To prevent this from happening, it is essential to promote a clear and effective system that systematically inserts good young researchers in university departments and research centers. For this purpose, It is necessary to improve the criteria for awarding research grants and contracts to be sure they follow appropriate scientific quality criteria, without abusing bibliometric criteria or requirements of management experience which do not conform to the typical profile of the young researcher (such as management experience). For the system to be effective it is also necessary that all calls adhere rigorously to these principles.

To conclude, we collect some recommendations that could help improve improve the research system in Spain:

- Raising awareness among public administrations in particular and society in general about the need for greater investment in scientific research, since it contributes to technological, economic and cultural development. It is also necessary for the adaptation of technology to the new challenges.
- Promote initiatives involving a space for dialogue and interaction among multidisciplinary researchers and between companies and research teams with the participation of young people. Enterprises should support these initiatives.
- Promoting meetings organized by and for young mathematicians (such as *Meetings for Young Mathematicians in Sedano* or the RSME Congress of Young Researchers), which are an excellent instrument for mathematical training. Its importance should be valued and they should be promoted and expanded (eg. to the field of applied mathematics).
- Recovering a sufficient number of calls for predoctoral grants, and seeking private funding for them, raising awareness of the importance of having better trained employees.
- Increasing the number of research and/or teaching contracts at universities and other research centers (in recent years the number of active researchers has decreased, producing an aging workforce of researchers / professors in universities, with the consequent decline in productivity and overall quality of research in Spain).
- Giving stability to the various calls for research and/or teaching contracts at universities and other research centers, following a fixed yearly schedule.
- Enhancing the recruitment of young researchers in the *Juan de la Cierva* and *Ramón y Cajal* programs, and ensuring the stabilization at the end of their contracts.
- Removing the incompatibility between the *Juan de la Cierva* and *Ramón y Cajal* programs, in order to favor the selection of the best researchers for each call. In addition, the number of contracts in each area should be decided following global criteria, without depending on the number of applications in each area, which could distort the distribution of the contracts among the different areas.
- Adapting the criteria to each position: It does not seem reasonable, for example, to require a number of publications for predoctoral contracts, or direction of doctoral thesis for postdoctoral ones.
- In the evaluation criteria and selection of the candidates in the various programs, globally assess the candidate's merits, avoiding rewarding quantity over quality. A process of interviews or providing reference letters could help to that end.

- Giving stability to the evaluation criteria. They are often changed in the middle or end of the process, making the system unfair and unpredictable for applicants.
- In the various calls for contracts and research projects, assess the originality and depth of the work done by the applicants. It is therefore important to have reviewers and evaluators in the same area of research. Indicators such as the impact factor of the journals, the number of citations and h-index of candidates should be only an aid to the evaluation but in no case a crucial or decisive factor.
- Regularly funding a greater number of quality projects instead of concentrating resources on a few projects, considered "excellent."
- Increasing investment in IEMath (Spanish Institute of Mathematics), allowing the financing of mobility programs and temporary research positions for young researchers that promote exchange of ideas, especially in areas that are not sufficiently developed in Spain.
- Encouraging the creation of institutions to develop a research career more or less outside the University (preferably following the ICREA or Ikerbasque model, where researchers are integrated into the various universities).
- Encouraging work-life balance.
- Simplifying bureaucratic tasks: for example, creating a centralized database of CVs for all administrations.