

**REPORT OF THE INTERNATIONAL ADVISORY BOARD
for
DEPARTMENT OF MATHEMATICS
HIGHER SCHOOL OF ECONOMICS (MOSCOW)**

Naming conventions:

- Department = Department of Mathematics, Higher School of Economics
- Board = International Advisory Board for the Department.

Members of the Board:

- *Pierre Deligne* (Institute for Advanced Study, USA)
- *Sergey Fomin* (University of Michigan, USA)
- *Sergei Lando* (HSE, Dean of the Department, *ex officio*)
- *Tetsuji Miwa* (Kyoto University, Japan)
- *Andrei Okounkov* (Columbia University, USA)
- *Stanislav Smirnov* (University of Geneva, Switzerland, and St. Petersburg State University, Russia).

Chairman of the Board: *Stanislav Smirnov* (elected February 17, 2013).

Members of the Board visited the Department in Winter 2013. They met with faculty members, both junior and senior ones, and with students, both undergraduate and graduate. During these meetings, conducted in the absence of departmental administration, the students and professors freely expressed their opinions regarding the current state of affairs in the Department, commenting on its achievements, its goals, and its most pressing needs and problems.

The visiting members of the Board met with the key members of the departmental leadership team, including the Dean, several Associate Deans, and representatives of the main graduate programs. Lively and substantive discussions concerned all aspects of departmental life, as well as the Department's prospects for the future.

On February 18, 2013, four members of the Board (*S. Fomin*, *S. Lando*, *T. Miwa*, and *S. Smirnov*) had a 1.5-hour-long meeting with the leadership of the HSE, including the Rector Prof. *Ya. I. Kuzminov*, Academic Supervisor Prof. *E. G. Yasin*, First Vice-Rector *V. V. Radaev*, and Vice-Rectors *S. Roshchin* and *M. M. Yudkevich*.

Several members of the Board gave lectures at the Department. These talks attracted large audiences of students and professors.

This report summarizes the Board's overall impressions from the visits, provides a general assessment of the current state of the Department, and makes several recommendations for the future.

1. GENERAL ASSESSMENT

The Board is very much impressed by the current state of academic affairs at the Department. Within 5 years of its creation, the HSE has become the leading Russian institution of higher learning in pure mathematics.

We are most impressed by the Department's undergraduate program which is, in our opinion, among the best ones in the world. It currently attracts the strongest pool of mathematics students in Russia, offering them a challenging and thoughtfully designed curriculum.

In terms of research strength, the Department (including faculty members at satellite branches at Steklov and Kharkevich Institutes) may well belong to the top 100 mathematics departments at research universities worldwide.

The Department's graduate-level programs are still in their infancy, and are yet to achieve comparable status.

2. ADMINISTRATION AND GOVERNANCE

The Department does not have a charter (bylaws) governing its affairs.

Faculty members we spoke to do not see major structural deficiencies in the current scheme of governance. The recent elimination of "chairs" (subdepartments) appears to have been a sensible move. We have not heard any opposition to it.

The most important administrative decisions at the Department level are made by its Scientific Council elected by direct vote of all faculty members. Docents and Professors have the same voting rights. People who do not work at HSE are allowed to be Council members. There are no term limits for departmental administrators.

Relations with upper echelons of HSE administration are generally viewed as healthy. The HSE administration appears to recognize the exceptional quality of the Mathematics program.

3. ACADEMIC PERSONNEL

Current hiring procedures work fine but there is room for improvement.

The department acts on the hiring lines authorized by the HSE administration by selecting the best candidates available. While the selection process generally works well, it might be advisable to spread some of the hiring over several years, potentially increasing the quality of hires. This is not done out of the concern that those hiring lines may disappear if the Department does not use them immediately.

There is no established mechanism for hiring people on terminal (adjunct) appointments who could cover short-term teaching needs.

Some research areas are underrepresented among current faculty, primarily in the general field of Analysis. This includes probability, harmonic and functional analysis, analytic number theory, and PDEs. Some other mathematical disciplines (admittedly the areas of strength for the department) are overrepresented.

At the departmental level, hiring decisions are made by the Scientific Council. The faculty at large do not vote on new hires.

Hiring procedures are different for Docents and Professors. Docents are hired through a Western-style process: broadly advertised positions, open competition, letters of recommendation, etc. By contrast, Professors are hired through an opaque process that relies on personal connections; decisions are made without consulting rank-and-file faculty. We recommend extending the hiring practices currently employed for Docent positions to the appointment of new Professors.

Remuneration scales and teaching loads vary very little between the two ranks. The only exception are the special (named) professorships. There are very few of them in the Department.

There does not seem to be an established protocol (criteria, timetable) for promotion from Docent to Professor. Some faculty members would like to see it introduced. We did not observe any tensions related to the issue of internal promotion and difference in rank but some faculty felt that one should not wait until such tensions arise.

The Department is currently transitioning from a period of fast expansion to a steady-state regime. In the future, possibly soon, this may create a demographic situation with little or no turnover of permanent faculty. It does not help that HSE does not offer a pension plan. Consequently, faculty members never retire on their own volition---except when gravely ill or moving abroad. The Department needs a strategic hiring plan that would address the looming demographic gridlock, as well as the aforementioned imbalances in area distribution.

One serious deficiency in the current composition of the faculty is the lack of postdoctoral positions. We suggested, and the HSE leadership supported, an introduction of at least 3 new postdoctoral positions (with terminal two- or three-year contracts) in each of the next three years, so that in the steady state the department would have 7-10 postdocs. In our opinion, the department should not be allowed to hire its own Cand. Sci. degree recipients as postdocs.

We are unaware of attempted raids by other institutions on HSE math faculty---but this might start happening soon. It is unclear what the department and the university are going to do to respond to outside offers.

4. FACILITIES

The department has dramatically outgrown the space it currently occupies. There are no rooms for students to study in, or to spend time between classes or seminars. Classrooms are frequently filled to capacity, and beyond. The largest classroom's capacity is 54 whereas the size of the freshman class is about 60. This is bound to get much worse if the size of incoming class remains at the current level. Right now, the distribution of undergraduate population by cohort is approximately 60+50+40+30 (for freshmen, sophomores, juniors, and seniors respectively). If and when it becomes 60+60+60+60, as the HSE administration seems to want, there will be no physical space to accommodate the classes.

In our opinion, which seems to be shared by most people we spoke to, the ideal size of the incoming class is about 50 students. Besides space limitations, this size allows to maintain the exceptionally high standard of the student body. Office space for current faculty members appears to be adequate by Russian standards. It will become less comfortable with the arrival of postdocs, and especially if the department wins another mega-grant that would bring a number of additional researchers into the building.

We have not heard complaints concerning the quality of infrastructure (building facilities, furniture, computer and audiovisual equipment). While somewhat outdated by Western standards, most of it appears to be adequate.

Both faculty members and students are rather happy with the current location of the Department: not far from the city center and in close proximity to a Metro station. A move to an inconvenient location could be devastating to the Department.

Wi-Fi internet access is available throughout the Department. All students have access to MathSciNet. To download journal papers requiring subscription, they have to ask faculty members. This arrangement is viewed as sensible by the people we spoke to.

5. FUNDING

The HSE salary scheme depends heavily on a faculty member's publication record. Large bonuses are awarded to professors who regularly publish in foreign ISI-reviewed journals. This practice is supposed to encourage high-quality research. Within HSE, it effectively rewards the departments (including Mathematics) whose members pursue research programs that are recognized internationally.

While this reward system does benefit the Department, it is far from optimal. In particular, it may discourage mathematicians from pursuing ambitious long-term projects which could result in gaps in their publication records. One mechanism to alleviate this problem is provided by a promotion to the rank of Ordinary Professor. These are lifetime professorial appointments that ensures top-tier pay without the publication requirement. There is currently only one Ordinary Professor in the Department. This number is way too small, given the extraordinarily high research level of several faculty members.

Another deficiency of the current bonus system is that it undervalues publications in Russian mathematical journals, including the very best ones. As these journals strive to maintain the highest scientific level, they deserve our full support. In the Board's opinion, publications in top Russian math journals should count towards salary bonuses, as much as foreign ones do.

The HSE appears to have a reasonably robust funding scheme for trips of faculty members and students to international conferences.

Given the exceptionally high level of the Department, it is surprising that it has not been able to attract significant private sponsorship for its research and educational pursuits. This may be partly explained by the tendency among mathematicians to shy away from any appearance of self-promotion.

6. RESEARCH

The overall level of research activity at the Department is impressive. In the field of Mathematics, the only other Russian academic institution operating at a similar level is the Steklov Mathematical Institute of the Russian Academy of Sciences.

The scientific quality and quantity of the research produced by the members of the Department's faculty is excellent, at the level of some of the best mathematics departments in Europe. The Department is particularly strong in algebraic geometry, representation theory, and mathematical physics.

The Department hosts a large number of vibrant and productive seminars. Unfortunately, the access to these seminars is not readily available to the Moscow mathematical community, as the entry into the building is controlled by security guards. While it is generally possible to arrange entry for visitors, such arrangements have to be made in advance of each visit, and depend on personal connections. Removing these obstacles would benefit both the Department and the Moscow academic community at large.

As mentioned above, the distribution of faculty members in the Department by area (subfield) is rather uneven. This is admittedly hard to correct. It would certainly be wrong to base hiring on area quotas as opposed to overall academic strength of the candidates. Still, area diversity can perhaps be used as a secondary (tiebreaker) criterion in hiring.

Research areas underrepresented in the department include:

- applied mathematics (both discrete and continuous);
- number theory (both algebraic and analytic);
- probability, and more generally analysis.

7. STUDENT BODY

The academic level of undergraduate students is rather remarkable, on par with the very best undergraduate programs in mathematics worldwide, such as Ecole Normale Supérieure (France), Harvard and MIT (USA), Peking University (China), University of Cambridge (UK), and University of Tokyo (Japan). It is clearly at the very top among all math departments in Russia.

The general tone of students' comments that we received was rather enthusiastic: they are happy to be in this Department, and they are by and large very loyal to it. There is a strong sense of pride among the students to be part of this exciting enterprise.

Professors, and especially students (of all grade levels) told us that the overall strength of the student body has gone up over the years. This is rather remarkable given the expanded enrollments.

The current admission scheme seems to be working rather well. There may be other reasons for the rising academic levels of the incoming classes, such as the increased awareness in Moscow and beyond of the exceptional quality of the department.

There appear to be very few students who are struggling academically. Attrition rate is less than 10%. Departing students are replaced by transfers from other institutions. These transfers, on average, appear to increase the overall strength of the student body.

Cheating (including unacknowledged collaboration and internet downloads of solutions) does not appear to be a concern.

8. UNDERGRADUATE PROGRAM

The core educational mission of the Department is realized through its flagship undergraduate program. The current curriculum is generally working well, and is still being perfected as the Department adapts to the changes in the size and composition of the student body.

During the first two years of the Bachelor's program, the curriculum is rigid. The distribution of courses by mega-areas in years 1-2 is as follows:

- Algebra: 7 modules
- Analysis and Differential Equations: 14 modules
- Geometry and Topology: 6 modules
- Logic and Discrete Mathematics: 4 modules

Years 3-4 offer plentiful choices of courses, both of fundamental and specialized nature. The list of elective courses offered by the Department looks impressive.

Undergraduate students appear satisfied with the choice of courses, their content, and the quality of instruction.

Curricular changes the Department might potentially consider:

- make the transition from rigid to flexible curriculum less abrupt;
- make the first two years less heavy on Analysis;
- include basic Number Theory and Probability in the core curriculum;
- teach a couple of undergraduate math courses in English.

A key feature of the Department's undergraduate program is the "Mathematical Practicum" format used in many of its core courses. In one-on-one discussions with faculty, students report on their progress on assigned projects of varying scope and duration. While very effective pedagogically, this format is rather labor-intensive, as instruction has to be done in small sections of at most 10 students. Unfortunately, HSE regulations do not currently provide for teaching basic math courses in sections of such size. We support the Department's request to allow the inclusion of the Mathematical Practicum format in official university schedules.

There is no public record of the placement of Department's alumni upon graduation. It would make sense to create a web page describing the graduate programs, industry jobs, etc., for the students who graduated in each year.

9. GRADUATE PROGRAMS

While the Department's undergraduate program is thriving by any measure, its graduate programs (Master's and Ph.D.) are yet to achieve a comparable level of

success. They are underpopulated; the student body is a mix of people from very different backgrounds; the goals of the programs are not articulated clearly, and the overall curricular setup appears to be in flux. This situation arose for a number of historical as well as administrative reasons largely beyond the Department's control.

The Department is trying to attract foreign students to its Master's program by offering classes in English.

Recruitment of (non-Russian-speaking) foreign students is hindered by the inadequate state of departmental English-language website. To help fix this problem, individual faculty should be allowed to modify their personal web pages without getting approval from the administrators of HSE's English portal.