

**HAMILTON INSTITUTE QUALITY REVIEW
NATIONAL UNIVERSITY OF IRELAND, MAYNOOTH**

27TH – 28TH JANUARY 2009

PEER REVIEW GROUP:

External Reviewer: Professor Jon Crowcroft

Internal Reviewer: Professor Ray O'Neill

Hamilton Institute Quality Review

Jon Crowcroft University of Cambridge, February 2009.

Executive Summary

I was asked to conduct the Complementary Quality Review of the Hamilton Institute at the National University of Ireland Maynooth, in January 2009. I was provided with the Self-Assessment document, and spent two days visiting the institute on January 27/28, during which time I had access to faculty, post-graduate researchers, MSc and PhD students, and administrative staff. I also received a briefing from the President, and was assisted by Professor Ray O'Neill, and Dr Richard Watson.

The Institute is a world class research department, with a unique constitution, being composed of a University unit, with faculty and research students, but without its own undergraduates. The Institute has grown rapidly over less than a decade to include 8 faculty, 16 post-doctoral researchers and 24 MSc and PhD students. The funding (largely from Science Foundation Ireland) is generous, and assured for the next 3-4 years. The budget permits the Institute to support an impressive visitor programme, locally arranged workshops, and presents no barrier to travel to international conferences and related events.

The objectively measurable outputs that I was able to examine include publications, PhD dissertations, research project reports and the peer reviews of those projects. Projects are mainly funded by SFI and other national funding agencies, and again this is evidence of a high class of work since there is much competition for these sources.

In talking to staff, post graduates and PhD students, I was also able to form an impression (more subjective) of the community that makes up Hamilton, and the confidence and trust that the members have in the organization and each other.

In discussions with the faculty, and especially with the Director of the Institute, it was clear that the plans for the next 4 years are viable. This includes a period of 2 years consolidation, and then a goal of diversifying the sources of funding, followed, potentially, by a further expansion. A follow-up review should be instigated in two years time, and should include systems biology expertise (possibly entailing two external expert reviewers). It would be useful also at that point to examine the relationship with other departments in the cognate disciplines within NUIM in some detail.

The Institute is to be congratulated on achieving such a high level of quality research so quickly. The unique mix of mathematical techniques, being applied to real world problems in a postgraduate academic institute with very strong industry validation is of enormous value both intellectually, and also in terms of potential economic and societal impact.

Introduction

This is my report on the Quality of the Hamilton Institute at the National University of Ireland, Maynooth, conducted in January, 2009, taking into account input consisting detailed statistics over the last 3 years, and a two day visit to the Institute

during which time I was able to interview most of the faculty, administration, postgraduate staff, and students.

In general, I looked at the scope of work in the Institute, and the usual metrics for output in terms of objective quality measures. I was also asked to look at the areas of research and consider their appropriateness. Finally, I looked at the size of the Institute and the scale of the work undertaken.

The report is mainly concerned with the quality of research, the quality of graduate education, and the quality of the interaction with industry. I was able to see the resources available to the Institute in terms of funding, buildings, support staff, and the to discuss the wider context for the Institute in the University with senior University staff.

The report ends with some recommendations, which can be taken more in the spirit of suggestions, for consideration over the next two years as part of input into strategic thinking about the future of the Institute.

Quality of Research

The research is uniformly excellent. It is a clear signal that the structure of the Institute is functioning very well, and that the light relationship with undergraduate teaching in other departments, and generous funding of projects and infrastructure, together with dedication from faculty and postgraduates is paying off.

The age profile of the Institute is largely one of younger researchers and faculty, and this is a huge advantage in terms of energy.

There are very few organizations in Europe with this form. Perhaps T-Labs funded by Deutsche Telekom in TU-Berlin is closest. Other institutes in Germany (MPI for example) are not so embedded within a University. Other laboratories exist with a mathematical foundation, but with application-led program of work, but are industrial in nature (Microsoft Research, Cambridge, for example). The Isaac Newton Institute in Cambridge is largely theoretical, and has a more ephemeral staff. Alternatively, industry has embedded its own laboratories within University departments (e.g. Intel Research so-called “labs”), but these have relatively short term agendas set by the parent companies.

In the specific area for which this reviewer is an expert (Communications Systems), it is clear that the Hamilton Institute is a peer with groups such as Steven Low’s at Caltech, and Frank Kelly’s in Cambridge in the department of applied Mathematics and Statistics. This is a stellar group to be part of. Indeed, the Hamilton Institute has worked with all these top players. Kelly and Debasis Mitra from Bell Labs are on the advisory board, as are other equally well-known names for the other areas of research in the Institute.

Research Projects

The simplest measure of the quality of the research given in the evidence for the quality of the institute is material in the peer reviews of Science Foundation Ireland projects. Phrases such as “highly qualified based on their extraordinary performance”, “has achieved a critical mass”, “excellent ideas for exploring innovative and important aspects”; “publications are excellent”, “the team is...internationally

competitive”; “have established themselves as one of the premiere research groups in the field”, “the PI should be commended”.

These comments cover the full range of activities, from the fundamental mathematical techniques, through to the applications in network science of control theory to congestion control and wireless network performance, and on to the systems biology work in Parkinson’s disease, HIV and other areas.

The Institute has succeeded in winning 33 grants under competitive proposal schemes in the last 3 years (2006-2008), 84% of which have come from SFI. A small, but significant amount was attracted from industry, of which more later. The funding level is running at just over 2M euros per year, which is extremely healthy for an organization of this size.

Publications

The members of the institute publish a very healthy number of journal papers each year. In the document on which this report was based, the last three years’ publications appear in Journals such as the joint ACM/IEEE Transactions on Networks (5 times), SIAM (6 times), the Journal of Mathematical Biology (several times), the Journal of Automatic Control (over 10 times) and many others. The institute publishes less in conferences, which is the norm in mathematical areas (although in Computer Communications, some of the conferences rank as high as the journals). However, when the research appears in conferences it is in the most relevant places for rapid dissemination to the community, and venues such as IEEE Infocom, PAM and ACM SIGCCHI are world class venues in which work has appeared several times. Postgraduates, PhDs and faculty are all represented in the publications list, and I was pleased to see a student winning the best paper prize at SIGMETRICS, which is one of the premier international conferences for which work at the Hamilton Institute is a perfect fit.

Other Measures of Esteem

Another measure of quality is the esteem with which members of the Institute are held. There are three sources of evidence for this:

- Firstly, members of the faculty have been invited to serve as PhD examiners in other institutes such as TU Eindhoven, Oxford University, the University of Cambridge, Uppsala University and others.
- Secondly, the Institute has an incredibly vibrant visitor program. This is no doubt helped by being able to support visitors travel with generous funds available. Nevertheless, these visitors come from far a-field, and from institutes as prestigious as TU Berlin, Caltech, Technion, Imperial College London, Oxford, Cambridge, Yale, UT Austin, Georgia Tech, Michigan, and from top industry labs (MSR) as well as top academic institutions. I count over 130 talks by high profile visitors in the last three years.
- Thirdly, members of the Institute serve on journal editorial boards and as Technical Programme Committee members for top conferences.

Post-graduate Researchers

I was able to spend an hour in a round table discussion with the majority (at least 10) of the postgraduate research assistants (RAs) of the Institute. I was very impressed by

the range of countries represented: Canada, China, India, France, Spain, Poland, Holland and others.

The discussion was very frank and open, and extremely positive:

The RAs appreciated the level of resource and freedom that they have in the Institute.

Specific comments included: the ratio of faculty to post-doctoral researcher to PhD was felt to be very conducive to a good working atmosphere; the bureaucracy is extremely light and well supported by the Institute and the University (an example of this was the level of support given in writing European Research Proposals, a well-known quagmire of paperwork); many of the researchers felt they were very well placed to build up a CV so that (in most cases) their next step (becoming an academic here or elsewhere) would be enabled. The ability to travel to conferences, even when the RA might not have a paper to present, was recognized as very valuable. The RAs all reported that they felt a great deal of freedom to decide to write a paper, or to approach each other, and faculty, with an idea for a paper, and pursue it. There were opportunities to write research proposals for funding, and, for some of the funding agencies, even to be a Principle Investigator (PI), which also helped with CV/Career Advancement.

Graduate Education

I was able to spend an hour in a round table discussion with the majority of the PhD students at the Institute. Again, countries from around the world were represented, with even more students drawn from China and India, but also a fair mix across Europe and some local students from Ireland.

The students were as positive as the postgraduate researchers about the experience of being in the Institute. They specifically volunteered (unprompted) positive comments about the faculty and postgraduate open door policy – the freedom to approach anyone and everyone in the Institute for advice at any point (and not just their own advisors); the wealth of local talks was commended; the ability to go on trips to relevant workshops and conferences. At the end of the session, several students queued up to tell me positive stories about advisors and other positive experiences.

The Institute ran advanced courses as part of the PRTLTI supported program in Network Mathematics. This was an inter-institutional graduate programme in partnership with the CTVR at TCD. The local students did not completely feel that this was a course for all local PhDs, but those that did attend were positive about it. It is clear from the 2008 module list, and the proposed 2009 modules that this is a very valuable national level initiative and fairly unique in my experience, across all of Europe.

Finally, while not part of Graduate Education by any means, the specialist nature of the skill in the faculty at the Institute has enabled another outreach activity in the form of the school mathematics challenge competition. This is a fantastically successful initiative, and can only pay off in the long run, although the payoff for the Institute in terms of recruiting post-graduates is, naturally, a rather long game plan. However, the publicity and good will this must bring can only have good value (although one would not want the institute staff to get over-loaded by a “success disaster” if the scheme continues to grow at the rate it has).

One very minor note of discord (which we discuss briefly below) is that the dependence on faculty and postdoctoral research for computer technical support,

which has clearly worked very well in the small-scale, younger days of the institute, is starting to break down a little, and the cracks beginning to show need more than papering over. However, the required resource is on the order of 50% of a technical support officer, and should not strain the budget of the Institute at all, and if this means that delays in software updates are eliminated, or test-bed support is expedited, rather than relying on willing, but over-committed faculty, so that research can continue at the current ferocious pace, then that is a modest price to pay.

Interaction with Industry

The list of companies with whom active research is conducted is very impressive. An A-list of large international players from a wide range of industries is yet more evidence of the quality, but above all, relevance of the research in the Institute. Names include: Daimler, Ford, Cisco, Intel, Bayer Schering, Merck and other Pharmaceutical companies.

While the income from direct funding is a small (although non-trivial) part of the Institutes overall grants, the activity level with the industrial partners is clearly high. The clearest objective evidence of this is from the list of patents, although the specific relationships were also discussed in the review meetings with faculty.

There are 10 patents granted or applied for, listed in the Quality Review documentation. They cover the range of areas active in the Institute. The potential license income from these patents may not be huge, although future work in the bio-medical areas may pay-off in that regard, but the Intellectual Property (IP) represents a true measure used more by industry than academia, and is impressive.

Some of the Institute's communications research also has measurable impact on industry through members activities in the Internet standards related organizations such as the Internet Research Task Force, and through the IEEE with Intel, with regards the wireless work. Again, this is highly visible, and represents impact derived from the research, making itself felt in the real world.

Management and Administration

I also spent a half-hour with two of the administrative staff of the Institute (Currently, there is 1 full-time and two part-timers)

It is clear that they are very constructive members of the Institute, and the smooth running of many aspects of life here depend on these people. They shadow the University's accounts (fairly standard practice in my experience) so that rapid responses on queries can be given locally. They organize travel (not just of Institute staff, but for the extensive visitor program). They manage arrivals of staff (including PhD students) which entails not just travel, but interaction with visa/immigration bureaucracy from time to time, inevitably.

The scale of administrative staff is about right at the moment, although it may be that if the Institute grows, there may be a need for a slightly disproportionate increase in administrative support, since the tight-knit community mechanisms that work so well in a modest scale may not operate in a larger group, with more people absent at any time, and less familiarity between everyone and each other.

The facilities are excellent – we used meeting rooms for the review and the building is in good shape. I was able to see offices and labs and the space seems well used, although probably now just about as full as it should be.

Operations (as discussed above) may be being stretched to the maximum with the current lack of a person with the formal role of technical support. This puts load on faculty and postgraduates as well as on the administrative staff. I do not recommend that this move to a central service, as the Institute has some local special requirements (e.g. from test-beds) which would be better met with a local person.

Recommendations

The structure of the Institute is sound as evidenced by the review. The strategic plan in place is good. The size is about right for 1-2 years, but after consolidating on the current size, a further review should be undertaken.

I recommend that the next review is carried out by two external experts, one with expertise in the underlying mathematical methods, and the other to review the systems biology side (I realize that this is a wide topic, but then that should make it easy to find someone with at least some overlapping research experience).

I recommend that the next review also include at least some interaction with the University departments that do or could have research and teaching overlaps with the Institute. Indeed, there should be some strategic thinking about perhaps modest increases in undergraduate teaching contributions, since this may lead to local recruitment of Masters and PhD students. National recruitment campaigning may also be needed to raise the number of Irish Nationals in the graduate programmes. This may be a good time to have some light campaign (a mail shot to all Irish University relevant departments, and a set of visits/talks to undergraduates maybe) while the economic downturn may be leading more smart people to consider further degrees.

I would also suggest that the timing would be very good for a fairly close examination of the diversification of funding, and given the economic climate at the time of writing, plans be put in place to ensure an even longer term viable plan (e.g. 5 years) starting from that review (say 2 years from now, leading to a horizon of 2016).

A watching brief should be kept on possible IPR licensing opportunities, especially in the more medical side of the Systems Biology work, where other institutions (notably Oxford University in England) have been able to extend their income over a long period from a stable source.

I recommend that even in the next 2 years, some inroads are made into seeking some funding from the ERC if possible, and from the Framework Program, if a high quality consortium with strong management can be formed or found. One reason to do this might be to offset the reduction in willingness of industry to fund research in the next few years due to economic downturn – this could be mitigated by seeking EU funding which would support the industry side at least in part. Of course, it is entirely possible that the economic situation will rectify itself. It is also possible that the biology work undertaken by the Institute will continue to be of interest to an industry that may be less impacted – a watching brief should be kept on this (no doubt already is!).

Summary and Conclusions

In summary, the Hamilton Institute is to be commended for managing a Quality Review with transparency and clarity. The outcome is that:

- The Quality of research is world class
- The Graduate Research is world class
- The Interaction with Industry is highly impressive

Overall, I find the Institute to be an excellent organization in all regards, and am very happy to have been the reviewer that is able to report this.

Professor Jon Crowcroft

Professor Ray O'Neill