Technically Speaking

By VAIDEHI IYER

The values that drive Microsoft Research India's education initiatives are universal: inspired thinking, generous funding and mentoring based on local needs.

On a visit to New Delhi in July, Microsoft cofounder Bill Gates spoke about India's need to focus on high-end research and boost the number of home-grown Ph.D. students. Microsoft Research India, a Bangalore-based wing of the American computer technology corporation, has been doing just that for the past five years.

Microsoft Research India's key goals since its inception have been to work toward advancing state-of-the-art research in computer science, contributing to Microsoft's businesses and services, and enabling more computer science students to acquire Ph.D.s in India, thus creating a new generation of researchers.

The facility in Bangalore is one of only six Microsoft research labs around the world, a testimony to the talent, scientific focus and skills available in India. The other labs are in the U.S. states of California, Massachusetts and Washington, Beijing in China and Cambridge in the United Kingdom. The researchers in India work in seven areas, including algorithms, cryptography, multilingual systems and software engineering.

MANISH SWARUP © AP-WWP

Indian Minister for Human Resource Development Kapil Sibal with Microsoft cofounder Bill Gates at a July 2009 event in New Delhi celebrating five years of Microsoft Research India.

"As an added benefit for the international student, an internship at Microsoft Research India offers the chance to collaborate with some of India's most talented and driven undergraduate and graduate students," says Aaron David Schulman, a computer science Ph.D. student from the University of Maryland, College Park, who recently completed his internship at the Bangalore facility. "Living in India, you have the opportunity to learn how to approach the world from a different set of experiences."

Some of the products developed in India have been used by Microsoft. One

Courtesy Microsoft Research India

"It's about finding the right problem to pursue, rather than finding a great answer to an easy problem."

—SRIDHAR VEDANTHAM

RESEARCH

Courtesy Microsoft Research India

"This is the right time for India to focus on computer science and nurture more Ph.D.s in the subject."

—VIDYA NATAMPALLY

of the successes is a tool for Microsoft's search engine, Bing, which enables users to find locations with even incomplete or incorrect addresses. Researchers also worked on the WikiBabel project that provides translation for Web pages in about 30 languages. This technology has also been used by the Microsoft Developer Network user community to make corrections on user guides and product manuals after translation from English into their local language.

"We must look at different kinds of research, and not only fundamental research," says Vidya Natampally, director of strategy for the Bangalore lab's External Research group. "There is development-oriented research, applied research and directed research. This is the right time for India to focus on computer science and nurture more Ph.D.s in the subject."

The External Research group works with Indian academia and the government to foster an environment for computer science research. India's minister for human resource development, Kapil Sibal, has spoken of the contributions this speciality could bring to areas such as agriculture, health care, energy and the environment. "It's mind-boggling, what computer science can do," he has stated.

Less interested in research for its own sake, however, Sibal had challenged Microsoft Research India during a 2007 forum to work on projects such as making 3-D computer representations of monuments and cultural sites available to students across the nation, which has now been done. (See article on page 28.) He also suggested a virtual science museum accessible to Web users and a sensor network to monitor water usage. "Research by itself is not a solution," Sibal said. "You need to move beyond research. Behind research is the face of an ordinary man living an ordinary life dealing with ordinary problems."

The External Research group is also looking for ways to give Indian research and students more international exposure. Foreign researchers are brought to India, and scientists are being approached to work on problems related to research. The group has a travel grant program, mainly for Indian students to travel abroad or around the country to attend conferences.

There is also a concerted thrust toward using computer sciences to speed up research in basic sciences. One example of this is Microsoft's collaboration in cell and protein research with the Indian Institute of Science, a pure science research facility in Bangalore.

The two Bangalore institutions support an annual summer school, an intensive three-week program for 80 to 100 undergraduates, Ph.D. fellows, young university faculty and peers from the computing industry. Microsoft Research India takes care of travel and accommodation for outstation students.

"The summer school provides students with exposure to international standards of research, helps them discover topics outside their textbooks, and motivates them to look at research seriously in the long run," says Natampally.

"The school completely revived my flagging interest in a couple of areas and re-energized my drive for networking.…" says Azeem Javed Khan, research scholar at IIT Bombay. "The highlight of the school was the open question-answer sessions twice a day, which helped us explore our horizons of understanding and interest."

Microsoft Research India's internship program benefits 120 students every year, 70 per cent of whom are from India. Interns have also come from the United States, Europe, Sri Lanka and Pakistan.

"Two researchers at Microsoft Research India, now my mentors, contacted me," says Schulman. "Our conversations led me to develop an interest in spending a summer in India."

"Research as a career may not be well appreciated but, yes, there are many opportunities," says Natampally. "Right now, if you look at the number of labs and R&D centers being set up in India, the expansion of universities, the number of international universities that are likely to

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BHAVISH AGGARWAL

Courtesy Azeem Javed Khan

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come up in the future—there is a lot of work to be done."

Microsoft Research India is interested in increasing the number of Indian Ph.D. holders in computer sciences. India produces "between 250,000 to 300,000 engineering graduates every year in the area of computer science, as well as in related areas—information technology, electrical engineering, electronic engineering and so on. But out of these undergrads, we produce only about 100 Ph.D.s in computer sciences annually," says Natampally.

To develop the Ph.D. pipeline, the Microsoft facility awards five fellowships every year. The process is competitive and requires nomination. Those selected for the four-year fellowship are awarded $20,000 plus a travel grant of $5,000 and a laptop.

To collaborate in research and identify fellows, Microsoft Research India works with 16 universities—all nine Indian Institutes of Technology, the Indian Institute of Science, the Chennai Mathematical Institute and Chennai's

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GREEN EVOLUTION:

The Digital Green Project

There is more to Microsoft Research India than software and algorithms. Digital Green, created by its Technology for Emerging Markets group, spreads information about better agricultural techniques and practices through short videos made for farmers by farmers.

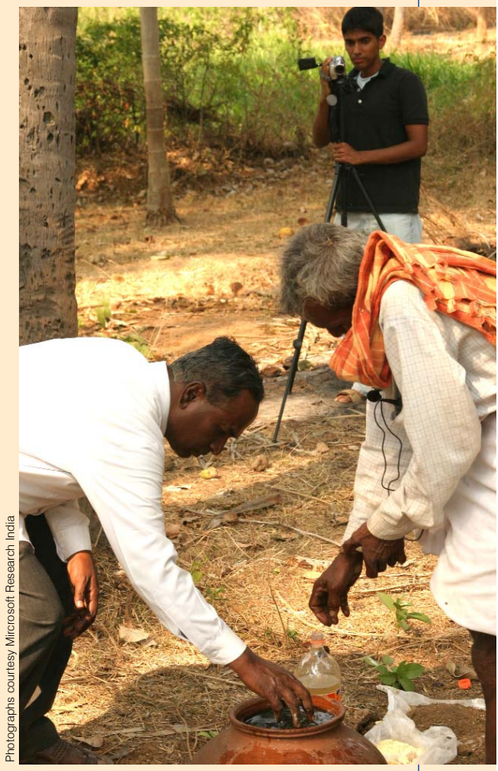
"Earlier, a farmer would learn by experience and say, 'This is good, why don't you do it, too?' " says Vidya Natampally, director of strategy at Microsoft Research India. "So, the Digital Green project identified a way of communicating this by video, recording the best practices of one set of farmers and taking them to another set of farmers, where the intermediary is a person known to that particular community."

The intermediary interacts with the farmers and explains how to use the video, "all of which is not very expensive since only a DVD player and TV is required," says Natampally.

Launched in 2006, Digital Green is deployed in 12 villages, primarily in Karnataka.

"The idea was to see if we could devise a system where the consumer of information could connect with the person creating that information," explains Sridhar Vedantham, head of communications at Microsoft Research India. "It's a Web-like approach, in that much of the content is user generated, except there is no Web involved." —V.I.

http://www.digitalgreen.org/



Photographs courtesy Microsoft Research India

Top right: Rikin Gandhi (rear) of the Digital Green project shoots a video of a farmer learning to make a natural fertilizer called Jeevamrutha from an extension officer (left) in Bhanavasi, Karnataka.
Right: A farmer records a vermicompost demonstration in Bhanavasi as part of the Digital Green initiative.

Institute of Maths and Science, the Indian Statistical Institute in Kolkata, the Birla Institute of Technology in Pilani, and its branches, and the International Institutes of Information Technology in Hyderabad and Bangalore.

"I came to know about the Microsoft Ph.D. fellowship program from past Microsoft fellows at IISc," says Raghavendra Kagalavadi Ramesh, a third-year Ph.D. student in the Department of Computer Science and Automation at the Indian Institute of Science. "The fellowship is ideal for a research student.... The travel grant as part of the fellowship gives ample scope for attending conferences and workshops, and getting exposed to state-of-the-art research ideas and concepts. The internship enriched the breadth and depth of my research in the areas of formal methods, cryptography and provable security."

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—RAGHAVENDRA KAGALAVADI RAMESH

Courtesy Raghavendra K.R.

Another group at Microsoft Research India focuses on rigorous software engineering. It's "a complex task, and the complexities of building reliable software only grow as the software becomes larger and larger," says Sridhar Vedantham, a spokesman. He said the group is exploring ways to make software engineering "dramatically more productive through innovative tools, languages and methodologies." One example, he says, is using analysis and testing to find bugs in large scale software. Researchers have the freedom to identify and work on a project or problem and to find a collaborator at their university. The priority, says Vedantham, is to publish papers.

"A very large percentage of whatever research is done is published in open journals and conferences, which are peer reviewed…. In MSR, the actual validation of good work or research being done is by the peer community outside the company," he says.

"It is a very open, academic-style research. This has been MSR's goal since its inception. It is also long-term research that is not tied to any product cycles or launches. It is research done in a lab, and it is of a very exploratory nature. It's about finding the right problem to pursue, rather than finding a great answer to an easy problem."

For more information:

Microsoft Research India

http://research.microsoft.com/en-us/labs/india/

WikiBabel

http://research.microsoft.com/en-us/groups/mls/default.aspx

Vaidehi Iyer *is a journalist and editor based in Chennai.*

Photographs courtesy Microsoft Research India

Visitors can go on a virtual tour of the Sri Andal temple in Tamil Nadu to see the gateway (from left), Tulsi garden, inner and middle courtyard.

Past Continuous: The India Digital Heritage Project

It is now possible to tour the Sri Andal Temple in Srivilliputhur, Tamil Nadu, without actually making the journey. One can instead go on a virtual trip of the temple through the India Digital Heritage project.

"We actually put together a pilot demo on Srivilliputhur, using some technologies like Photosynth and HDView on the Windows platform," says Vidya Natampally, director of strategy at Microsoft Research India. "It's an interactive experience. Five or six of us went from the MSR India lab and took 5,000-6,000 2D digital images at the temple. We came back and looked at how to utilize it and put it together into a realistic experience for a user."

They worked on presenting the overall structure and spaces of the temple such as the inner and outer courtyards, the marketplace and the tower. "We created a drop down menu so that you can choose and click and it takes you through, say, the whole inner courtyard and gives you an idea of how a circumambulation is done or how we can create a walkthrough," says Natampally.

Visitors can go on a guided tour with a narrator explaining the historical and cultural importance of what they see. One can pause anywhere during the presentation. "We can literally stop, zoom in and look at what is written on the wall," says Natampally.

The project was unveiled during Microsoft Research India's TechVista symposium in Chennai in 2008. "We thought it made sense to show what is relevant rather than doing something totally unfamiliar," says Natampally, explaining the choice of the Srivilliputhur temple for the demo version. A revered shrine with soaring towers and life-like sculptures, the tower at the temple is the official emblem of the Tamil Nadu government.

Natampally says that they showed the India Digital Heritage project to the Indian Department of Science and Technology, which "brought the computer vision and graphics community together with art historians, historians, architects, archaeologists and various other specialists who have deep knowledge of the cultural and academic part of heritage." In fact, then-Minister for Science and Technology Kapil Sibal had suggested such a project when he gave a keynote speech at a Microsoft forum in 2007.

"We come up with projects and proposals like the India Digital Heritage project, bring the community together to set up the program, and then continue to participate in the program from a research perspective," says Natampally.

—**V.I.**

http://virtualindia.msresearch.in/DH/index.htm