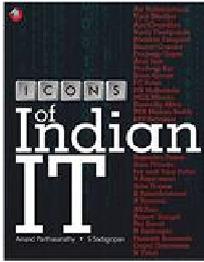


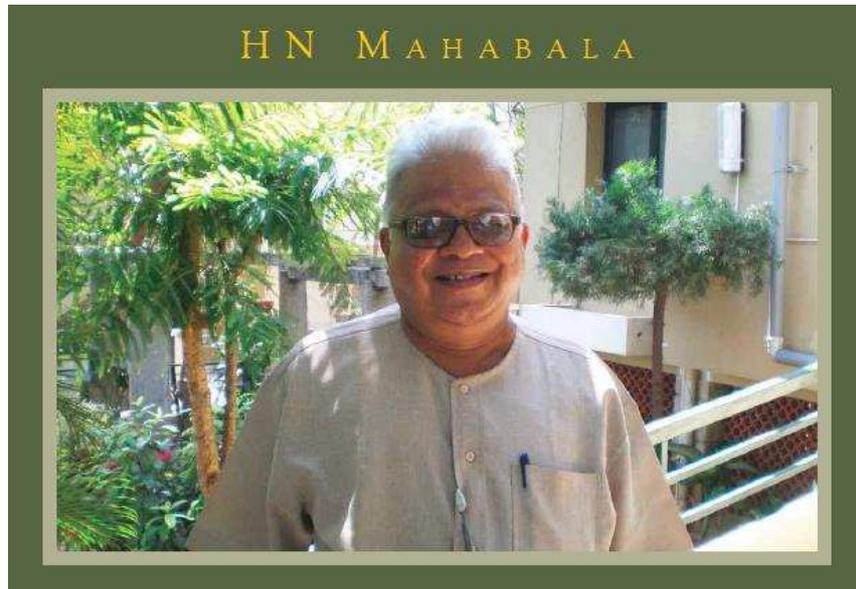
Driving the Change from Computers to Computerisation



Excerpts from the book

Icons of Indian IT

By Anand Parthasarathy & S Sadagopan
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Prof Mahabala never saw himself as just an academic, so while he helped to set up the first mainframe computers in India's leading engineering institutions, he also assisted in opening them up for research and industrial use. At the Indian Institutes of Technology (IIT) at Kanpur and Madras (now Chennai) and at the Computer Society of India (CSI), he kick-started the computer revolution and ensured it permeated every facet of societal change in India. Fresh from Canada, where he had obtained his doctorate in Electrical Engineering, Mahabala together with V Rajaraman and HK Kesavan, played a pioneering role in shaping IIT Kanpur into a crucible of Computer Science.

When Mahabala finished his doctorate in electrical engineering in 1964 at the University of Saskatchewan, Canada, he took a few days off to visit the IBM plant in Don Mills, Ontario. 'I saw an IBM 1620 being tested prior to shipping. It carried a placard "CAWNPORE"'. I was told that it was being sent to IIT Kanpur, and was, in fact, the first computer to be installed in an educational institution in India,' he recounts.

By one of those happy coincidences, Mahabala ended up in the same institution. He got a telegram from IIT Kanpur—'Come and join as an assistant professor'. He later found out this was the work of Prof HK Kesavan of the electrical engineering department, with whom he had interacted briefly on a previous short visit.

'It was pure serendipity that I landed at Kanpur and got to attend the Masters course in Computer Science. In addition, we used to conduct over twentyfive ten-day courses on computers every year, mainly on FORTRAN. Many of those who took our courses were not full-time students, but professionals sponsored by their organisations. In a way, IIT Kanpur displayed an evangelical spirit when it came to spreading the computer culture in India. The full-time students were among the best brains in India. NR Narayana Murthy, who went on to co-found Infosys, was one of the first—and the brightest.

'In our first batch at IIT Kanpur, we had nine students enrolled in the Masters programme in Computer Science but there were no jobs for them in India because there were almost no computers. Then, one day I got a telegram from Asit Chandmal, then director of computer services at TelCo (Tata engineering and locomotive Co ltd) Jamshedpur, saying, "Send all nine of them!" For days I carried that telegram in my pocket. The Tatas saved us time and again, first at TelCo and then with TCS. They had men of vision like FC Kohli and PM Agarwala who put their faith in computerisation in India. In fact, TCS got its first computer only because the workers of the Calcutta electric Supply Corporation would not allow a computer that had been ordered, to be installed! So, TCS took the computer and installed it in their office in Nirmal Building, Mumbai,' recalls Mahabala.

Mahabala thinks back on those early days of computers in India, 'India was not working for itself; at best, it tolerated those who did, especially in areas like computerisation. There was no one to understand us or appreciate us or guide us. But the attraction of computers swept us off our feet and there was no going back. My own first exposure to computers was on a Royal McBee IGP-30 at the University of Saskatchewan. Input to the machine was through a teletype machine and to debug a programme one had to read the "printout" waveform on an oscilloscope! one of my first programmes took thirty-six hours. later on, at IIT Kanpur on IBM 1620, it took thirty minutes and a few years later, I could run it on an IBM 7044-1401 in three minutes. That was progress!

'By that time we could forget about teletype machines, but the input/output was through Hollerith punched cards (yes, that's true!). one could read the output cards using a special printer. At IIT, we had some of the sharpest Indian brains and one of them even speeded up the input-output operations faster than what IBM had provided, by making a hardware change that enabled the overlap of I/o and processing operations! IBM ordered the modification removed since it did not come from them! In those days, IBM's marketing people dominated their engineers and decided how much computer technology the customer could officially get.

'In 1965, Computer Science was not a recognised discipline. Prof V Rajaraman and I had to create our own syllabus for the Masters course. Thanks to the vision of Prof HK Kesavan, the electrical engineering department allowed us to offer courses on computers as part of their MTech syllabus. In fact, IIT Kanpur made it mandatory for students of all branches to take a course on FARGo (predecessor to RPG and FoRTRAN). Gradually, we introduced more advanced courses in machine language programming and compiling. We added elements of operations research and numerical analysis to enhance the content of the MTech syllabus. In due course, Prof Rajaraman was able to propose a three-year programme called Masters in Computer Applications (MCA).

'We had to wait for a decade till 1975 for IIT to create a separate department of Computer Science and engineering. But the great thing about Kanpur was that it produced stalwarts in Computer Science in all disciplines, including mechanical engineering and metallurgy. Almost all on the faculty had studied in the United States and IIT Kanpur was sponsored by nine American universities, so a lot of their culture of openness and egoless sharing rubbed off on the faculty and students.

Other IITs were less fortunate and had more rigid structures. 'In IIT Madras, everything was controlled from Germany in those days. It was a very bureaucratic system. "Der Professor" was supreme. We used to joke that "a lecturer's dog could not dare bark at the professor's dog!"' he says in good humour.

After eight years in Kanpur, Mahabala was invited by IIT Madras (IITM) in 1973 to set up a computer centre with assistance from Germany. The responsibility included selection of the computer. Strongly supported by the director, Prof A Ramachandran, the chairman of the selection committee, Prof S Sampath chose the IBM 370 Model 155 as the best computer for IIT Madras. This was a time when there was strong pressure from the Department of electronics (Doe) not to increase the presence of IBM in India and to go for the only other option, the British ICI. 'When we stuck to our decision, the government virtually "blacklisted" IIT Madras and those of us who were responsible were not invited to any Doe meeting for some years!' he muses. They were vindicated in the sense that ICI went out of business soon after.

Germany envisaged giving a computer with sufficient capability to teach programming to students. Prof Mahabala argued strongly that the machine should also be deployed to meet the R&D needs of the industry in the region. The Government of India, by giving an additional grant, supported the idea of a research computer and not just a teaching computer.

In hindsight, Prof Mahabala's forethought in establishing what was to be a de facto national computing resource led to sharing IITM's resource with agencies like oil India and Bharat Heavy electricals Ltd (BHEL). This sharing helped the students to learn from interaction with industry. Incidentally, IITM also earned through charging more than what was spent on acquiring the computer, by charging these agencies for their use of the IBM 370.

In Madras, Mahabala had to work in a system where Computer Science was not yet recognised as a separate discipline. However, he was 'allowed' to run a Masters course in the computer centre and separate degrees were awarded some seven to eight years later when the Computer Science department was formed. Mahabala brought a change in the administrative culture too by fixing the tenure for the head of the computer centre to two years, a revolutionary thing then in Madras! He also introduced the system of course credits, semester system and the like along the lines of IIT Kanpur.

'We could bring in these changes only because of the strong support of Dr Arcot Ramachandran, the then director of IIT Madras. We did things that were considered "out of the way" but always in the interest of rapid progress of Computer Science,' recounts Mahabala.

Since computers were really new in India (in 1965-75), one had to 'hand-hold' to encourage enthusiasts to build computer applications in their area. It was often very difficult to convince the users that there was no magic in computers and the programmer just had to code the manual mathematical process. Naturally, it was difficult to convince the user that one could not use a computer if one did not know how to perform the necessary mathematical operation manually!

'In the evangelical efforts, many of us took on roles that we had never thought of. one morning, a gentleman came to my house on the IIT Madras campus and wanted a computer output. I told him that he was free to go to the computer centre and pick up any output he wanted! He was from an illumination company GeNeleC and explained that he had to submit a bid for illumination design for the Asiad stadium being built and the government would not accept a bid unless the computer output was attached. He had no idea of how illumination design was done on computers, nor did I, but he kept pleading for help.

'I had to learn the basics of illumination design, which was that each lamp produced a cone (circular or elliptical) of light and its intersection with the ground plane was its illumination. I had to brush up my knowledge of basic Physics and arrive at the equations needed before programming them. Plotting, as yet, was not available. I had to use a line printer to represent the illumination plot by choosing appropriate characters to plot. The plot was geometrically degenerated and we had to provide an explanation for the user to interpret the correct illumination achieved on ground! I did the programming required and the illumination plot was generated. He was satisfied and was even awarded the contract. later I visited their headquarters in England on my way to the United States and the engineers in their illumination design lab could not believe I was not an illumination engineer!'

There were many such cases in extending computerisation to application areas: Mechanical engineers wanted to use it for designing, doctors wanted it for data analysis, space scientists wanted to control launching and so on.

'Teaching FORTRAN programming alone was not enough to promote computer applications in various areas. BHEL needed to do a computer simulation to bid for a contract to build a power plant in Singapore and we said, "oK we will do it, give us the equations!" NR Narayana Murthy once said to me, "Sir, you keep saying computers will do this and that, will it find a bride for me?" and I said, "Why not? you tell me how to choose a bride algorithmically and we can programme it!" I saw my role as a pioneer, to help people use computers,' recounts Mahabala.

The South east Asia Regional Computer Confederation (SeARCC) conducts an annual programming competition for high school students of member nations. 'I was interested in sending our students sponsored by the CSI. Students had to programme four problems in two hours and test them. The winner was selected on the basis of judges running the programmes using their inputs and the time at which the programme was submitted. I selected four students from India based on a similar contest. I trained our students on using a "software engineering" approach, namely, review at each stage and exhaustive testing and correction if needed, thereof. We won the first prize which was a PC that cost '1,00,000 for two consecutive years. Many other societies wanted to know our training methodology and suggested jocularly that we retire!' says Mahabala.

The advent of the microprocessor in the 1970s saw all the IITs incorporate the device in their hardware courses. But Prof Mahabala felt that computers should be introduced in every engineering college in the country and not just in a few elite institutions. He recalls, 'I got valuable support from Prof CS Jha, then the technical adviser to the Ministry of education, and was able to push through a programme for training the teachers and then providing microprocessor kits to 150 colleges across the country. I was personally thrilled when in later years some of these institutions became national centres of excellence in microprocessor design (Indian Institute of Science (IISc) Bangalore, BITS Pilani, REC Trichy and others) who provided Indian industry with some commercially viable innovations.

Mahabala's interest in Indian language computing, particularly in the relevance of Sanskrit, had interesting origins. The University of California at Berkeley allowed Computer Science students also to get credits for a class in Sanskrit. one of these students, Rick Briggs, who went on to work at the NASA's Ames Research Centre, wrote a paper for *Artificial Intelligence* magazine in 1985 entitled 'Knowledge Representation in Sanskrit and Artificial Intelligence' which argued that elements of Artificial Intelligence (AI) were very similar to the structure of Sanskrit grammar called *shabda bodha*. Immediately people in India asked Mahabala what was he doing about it? In response he says, 'I organised a conference in the Sankara Mutt in Bangalore, taught computer programming to Sanskrit scholars. But it was in Melkote (near Mysore) at the Academy of Sanskrit Research and at Sanskrit University, Tirupati, that considerable work was done by many, including one of my students then at IIT Kanpur, Dr Vineeth Chaitanya, later associated with Dr Rajeev Sangal at the Hyderabad University.

In the 1980s, Prof Mahabala once more associated with the nationwide computer education programme, Computer literacy and Studies in Schools (CIASS). Government used some credit available with the United Kingdom to import the BBC microcomputers with the intention of later getting them manufactured at the Semiconductors Complex limited, near Chandigarh. It was a joint effort of the education Ministry and the National Centre for educational Research and Training (NCERT) for preparing courseware and the Computer Maintenance Corporation for maintenance and support.

In retrospect, the CIASS programme was not a notable success. Mahabala feels the government did not adequately fund it and did not think it necessary to give incentives to teachers like additional allowances for the time and effort they put into the CIASS programme in schools. He rightly feels, 'Idealism of a few people at the top is not enough, you have to motivate everyone in such a programme. The other mistake was that the BBC computer was not manufactured in India nor was it

upgraded. In hundreds of schools, they became expensive foot rests!' By then, PCs had become affordable and available indigenously.

As president of the Computer Society of India (CSI), Mahabala had another opportunity to help kickstart non-formal computer education. He worked with the DoE and set up an accreditation programme called DoEACC for which the CSI was empowered to conduct the examinations at O, A, B and C levels. He also had a mandate to promote Indian language computing in an era when computer monitors had just come. This allowed his students to work with bit plane graphics to display Indian fonts. He remembers: 'The actor Kamal Haasan sought our help for one of his films, to display the title in Tamil after the main titles had appeared in English!'

Mahabala's active involvement in promoting computer culture in all walks of life continued beyond his professional tenure into the twenty-first century. 'At that point, we had to yield to newer things. We had reached a point when there were no limitations on hardware and software. After that came an explosion beyond our wildest dreams. But databases were still a challenge. Now they talk of "very large databases".'

Mahabala looks back today on an action-packed career of over half-a-century. He says, 'Computer to computerisation was a big leap and I was privileged to join a few inspired people of my generation who helped make that happen.'

Icons of Indian IT featured in the book

ACADEMICS

- **HN Mahabala:** Driving the Change from Computers to Computerisation
- **V Rajaraman:** First 'Guru' of Indian Infotech
- **S Ramani:** The Dawn of the Internet in India
- **Rajeev Sangal:** He Gave Computer Programming the Panini edge

GOVERNMENT & PROFESSIONAL ORGANISATIONS

- **Vijay Bhatkar:** He Made India a Supercomputing Power
- **Kiran Karnik:** For a Crucial Decade, the 'Face' of India's Burgeoning Software Brand
- **S Ramakrishnan:** He Implemented the Rollout of India's First Internet Avatar— ERNET
- **N Seshagiri:** Indian IT's True Visionary
- **N Vittal:** The Man Who Unshackled Indian Infotech

INDUSTRY

- **Ajit Balakrishnan:** He Rode the Internet Wave and Took India Along With Him
- **Ajai Chowdhry:** The Genesis of the Computer Hardware Industry in India
- **Vinay Deshpande:** Affordable Computing Platforms for the Rest of Us
- **Bhaskar Enaganti:** The Architect of the First Packaged Software Product from India for the World
- **Pradeep Gupta:** Pioneer of India's Technology Media
- **Arun Jain:** Putting India on the Global Map for Financial Services
- **Pradeep Kar:** He leveraged the Internet Economy for India
- **FC Kohli:** Bhishma of Indian Information Technology
- **Biswadip Mitra:** Pioneering Leadership and Innovation in the Semiconductor Industry in India
- **Rajendra Pawar:** He Pioneered Technology Training in India
- **Jay and Vijay Pullur:** They Took on the Goliaths of the App Server Business
- **Hemant Sonawala:** Singular Focus on Excellence in Electronics and Instrumentation
- **Srini Rajam:** Unleashing Indian Innovation in Digital Signal Processing Design
- **Raj Saraf:** Challenging Global PC Brands with Paisa Vasool Indian Options
- **Gopal Srinivasan:** Pioneer of Hardware Manufacturing in India

OTHERS

- e-Munshi to the "other" India – Bharat Goenka
- India's CAD/CAM Man – BVR Mohan Reddy
- The Pathfinders – TCS (S Ramadorai) , Infosys (Nandan Nilekani, NS Raghavan, Kris Gopalakrishnan, NR Narayana Murthy, SD Shibulal and K Dinesh), Wipro (Azim Premji) & Cognizant (Lakshmi Narayanan)