Dr. Shilowbhadra Banerjee

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Educational Qualifications

- Bachelor of Technology (Honors) in Metallurgical Engineering - IIT Kharagpur (1959)
- Master of Engineering in Advanced Metallurgy - University of Pune (1962)
- Doctor of Philosophy in Metallurgical Engineering - IIT Bombay (1966)

Positions Held

India

- Lecturer, Assistant Professor, & Associate Professor of Metallurgical Engineering, IIT Bombay (1962-75)
- Professor of Metallurgical Engineering, IIT Bombay (1976-85)
- Director, National Metallurgical Lab, Jamshedpur (1985-92)
- Director, SAIL; with Headquarters at the Research and Development Centre for Iron and Steel, Ranchi (1992-97)
- Consultant and Members of the Board of Directors of: Government of India Agencies and Private Industries and Business 1997 onwards
- Chairman, Zeus Numerix Private Limited; Adjunct Professor, IIT Bombay; & Consultant to Government of India Agencies and private business.

Abroad

- Fellow: University of Wisconsin, Madison (1964-66)
- Senior Fellow: NASA Ames Research Center, California (1977- 79)
- Consultant: North Western University, Illinois (1981)
- Senior Consultant: Wright Paterson Air Force Base, OHIO (1983-84)
- Visiting Fellow: Dayton Research Institute, OHIO, USA (1984)

Contributions, Awards and Recognitions

Author of 51 International Publications and 17 Patents, Recipient of 9 national and international awards, a Fellow of 7 prestigious academies, professional bodies and societies; a Chairman or Member of 23 technical committees and academic bodies; and a Member of the Board of Directors of public and private sector companies.

Experience

Dr. Banerjee's professional experience of 45 years was acquired in diverse roles as: Professor, Director, Consultant, and recently as an Entrepreneur and in different types of organizations: Academic Institution, R&D Organization, Industry, and Business.

His contributions have therefore, encompassed all the fields namely: Leadership; HRD; Entrepreneurship; Cost Reduction; Quality Improvement; Value Addition; Product Development; Environment; R&D; Science; Technology Development; Equipment and Instrumentation Development. His contributions imprinted a lasting value in whichever organizations he worked or led, since the ideas, systems and methods he scripted continues to be used decades after he left.

The impact of some of these R&D contributions (at RDCIS), is quantified, determined, certified and readily verifiable – in the form of Monetary Benefit and Customer Satisfaction. Such quantification in R&D is unique and produced remarkable performance improvement.

- While at IIT Bombay (1962-85), he authored several original ideas and innovations and demonstrated their application in: the areas of Teaching; Research; Technology Development; and Industrial Consultancy. His research was internationally acclaimed and he transferred many innovations to a variety of metals and materials industry; and contributed to IIT Bombay's long term policy formulation.

- Turned around National Metallurgical Laboratory (1985-92) from the verge of closure in 1985, to a dynamic centre of excellence - using new directions of Planning, Organization and Management. Consequently, its external funds, Patents, publications and awards increased tenfold during this period. He conceived and developed several major technologies on the production and use of metals and transferred some of them to industry.

- When he joined SAIL's R&D Centre in 1992, its employees, stakeholders and customers were dissatisfied with its outputs. This centre was soon turned around and transformed into a benefit-producing and customer-interactive unit of SAIL. The Centre was the first such R&D Organization to do so. Also, it earned the world's first ISO 9001 in Corporate R&D in 1994. In 1997 alone, this unit delivered Rs.188.5 Crores of Certified Annual Monetary Benefits, which is the net profit, attributable entirely to the actual use of the R&D innovations transferred. Thus the annual return on total expenditure on developing these innovations was 590%! The average Customer Satisfaction of the 91 R&D projects completed in 1997, was 93%. Also, he developed and demonstrated three novel iron and steel technologies.

  After superannuation as Director, SAIL in 1997, he worked as a Consultant to the government and private sector business. These are:

  - CSIR, New Delhi on the Customer Satisfaction Evaluation of CSIR's Laboratories (1997-99); Ministry of Environment for Life Cycle Analysis of India's Steel Industry (1997 - 00); Ministry of Information Technology for Project Management System at C-Met, Pune (2001-02) & Micro- Planning of Project (2003-04); Innovation and Technology Management at the School of Management, IIT Bombay (2002 ongoing).
  - Ispat Profile for Cost Reduction and Value-added Products (1997 - 99); TATA SSL for Cupola-EAF Process (1999 - 00); Tata Research and Design Centre on R&D

Management (2003); International quality Rating Systems (2000-02); Kirloskar Oil Engines (2001-04); and Cooper Engineering both for Innovation Management to reduce cost and improve quality.

Specific Original Contribution by Dr. S. Banerjee

Dr S. Banerjee's significant contributions during 45 years are listed under each of the six fields identified below: Leadership, Cost Reduction, Quality Improvement and Process & Product Development, Human Resource Development, R&D in Technology, Science and New Knowledge System and Entrepreneurial Development.

More significant is the methodology Dr Banerjee authored and installed at RDCIS for R&D Performance Measurement during 1992 - 97. Its use in the last 11 years enabled RDCIS, to produce a total Certified Annual Monetary Benefit (CAB) of about Rs 1650 Crores (= $ 350 Million).

As would be evident below, his contributions imprinted a lasting value in whichever organization he worked in or led.

Leadership

Three decades ago he authored reforms and improvements, which continue to be a corner stone in IITB's undergraduate program. The program is internationally acclaimed today.

He turned around National Metallurgical Laboratory (1985-92) from the verge of closure in 1985, to a dynamic and vibrant laboratory delivering impressive outputs in 1992. Consequently, its outputs: patents, publications and the awards it won, increased tenfold. External Funds became 50% of its budget. NML&339;s scientists were charged with a confidence and urge to excel and deliver. Even today, each NML employee recalls his own contribution in the remarkable turnaround with pride.

In 1993, he conceived and installed novel and unique Structures, Systems and Procedures at RDCIS (see Sections 3.1 at Pages 6-7). For the last 11 years, RDCIS has zealously used these to deliver spectacularly improved Input Accomplishments, Output and Performance.

- Input Accomplishments, such as: Engineer-Day Utilization, Project Completion, and Milestone Completion, exceeded 100% of their planned targets.
- Outputs: Publications, Patents, Presentations, Awards Won, Royalty, CAB and External Funds increased annually by 20 to 50% during 1992-97. Thereafter, these have either improved or remained constant.

The remarkable results reported above, are the direct outcome of Performance Determination at RDCIS, as explained below:

- Performance: the Performance Determination of R&D, had been a long-standing problem, the world over. To solve it, in 1993, Dr Banerjee defined and quantified two parameters: Benefit to Cost Ratio (BCR); and Customer Satisfaction Index (CSI). He then wrote and installed procedures to determine these in each project. Since these parameters are dimensionless

numbers, they are independent of the size and nature of the projects. Therefore, they unambiguously represent the performance of an R&D project.

- Therefore, BCR & CSI, when targeted or determined, enabled a project team to directly compare the performance of its project with that of another team and also with that of the entire RDCIS. Such comparison spawned a competitive spirit in each project team and division, to outperform the others and its own target. As a result, by 1997, BCR had increased spectacularly to 590%, and CSI to 93%.

Cost Reduction, Enhanced Capacity Utilization, Decreased Energy Consumption, Quality Improvement, Productivity Improvement, Process Development and New Product Development

During 1993-2004, RDCIS completed about 850 R&D projects specifically targeted to achieve the improvement in one or more in all the above fields. These projects used the Structures, Systems and Procedures which Dr Banerjee had authored in 1993. These projects enabled RDCIS to produce a total CAB of about Rs 1650 Crores during the last 11 years. This figure is an underestimate since the CAB calculation ignores the substantial benefit produced by an R&D project, beyond three years of its use. CAB directly contributes to Net Profit.

Human Resource Development

Dr Banerjee developed and taught 18 new courses, most of which were highly rated at IITB. These were targeted to inspire the students to learn and explore on their own as voluntarily recalled by his students during their chance meetings with them after 2/3 decades.

Most of his 12 Ph. D and 43 M. Tech ex-students occupy key positions as Professors all over the world, or as CEOs or Entrepreneurs. He designed and implemented highly innovative Review, Monitoring and Evaluation systems at NML and RDCIS, to stimulate originality, creativity and innovation in the R&D projects. These improved the quality of outputs, BCR and CSI of a project.

He prepared and implemented comprehensive long range Human Resource Development Plan for the Training; Recruitment; and Redeployment of all the employees both of NML and RDCIS.

He designed 5 new Training Modules to train the entire population of R&D executives at RDCIS.

Research and Development in Technology and Engineering

Dr Banerjee developed and transferred NML's Magnesium Production Technology which had remained unutilized for 13 years:

- He introduced, organized, managed and pursued at NML
    - Four Large, Externally-funded Thrust Area Projects and
    - Three Interactive Programmes in collaboration with the industries at Jamshedpur

- He invented four new processes and proved them first in a laboratory scale and later in pilot and technology demonstration scale
    - Resiness Process Technology

- SG Iron Pipe from Cupola
- Desulphurization of Hot Metal and
- Cupola-EAF Process

Science, New Knowledge System, Hardware Engineering & Technology

Dr Banerjee contributed seminal ideas in transformation, structure and properties of materials.

He pioneered a school of Fracture Mechanics in India (at IITB) and made internationally acclaimed contributions while at IITB and NML.

- Evaluated the size and geometry dependence of crack tip plasticity in small scale yielding, to control brittle fracture in large and thin structures
- New insights into fatigue life prediction based on the concept of crack closure
- Fatigue Crack Growth Rate and the Fracture Toughness of Advanced SiC-Reinforced Alumina Ceramic Composites
- Explained the cause of pop-in crack extension in materials to prevent the resultant catastrophic fracture
- Characterized microstructure-independent creep deformation, to reliably predict creep life of power plant components

He developed new laboratories and designed several sophisticated instruments, software, equipment etc. A typical example: designed and fabricated a novel fixture to pre-crack ceramic specimens hitherto considered unachievable; the fixture was readily adopted all over the world.

Entrepreneurial Development

Dr Banerjee's significant contribution during the last 7 years of his career is in Entrepreneurial Development, wherein he advised his clients (usually CEOs), to strategize their resource inputs: Human; Financial; Plant and Equipment; and Technology and Intellectual Property to delight customers.

Recently, a group of highly capable and brilliant IITB Faculty and Alumni invited him to join their Company as a Shareholder, Director and Chairman. This company innovates computer-aided solutions in Computational Fluid Dynamics, Heat Transfer and Stress Analysis to benefit business, industry and society. The company has had a head start.