IBM Fellows – Indian presence

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Bright researchers with impressive output on a sustained basis need to be identified by clear criteria, encouraged and rewarded with freedom to pursue their interest. How IBM does this is described and naming them IBM Fellows. A remarkable number of IBM fellows is of Indian origin. A road map for progressive Indian industry to encourage innovative research by bright Indians working in India is elaborated as an urgent, worthwhile pursuit to put India and Indian industry on the global innovation map.

Keywords: IBM Fellows, Indian presence, research and development, science and technology.

IBM is a well-known company in the field of technology, with emphasis on computer science and engineering, and associated fields. It has 12 research laboratories in 6 continents – the prominent ones are in New York and California, USA as well as in Zurich, Switzerland. Thomas J. Watson Jr started the IBM Fellows programme in 1963, stating 'Creativity has made the difference between an ordinary and one of the great companies of the world. We are humble in the shadow of what our IBM Fellows have accomplished, proud to be associated with them, and excited about what they will achieve in the years to come'.

The title of 'IBM Fellow' is the company's premium distinction granted in recognition of outstanding and sustained technical achievements and leadership in engineering, science and technology among others. The basis for selection as an IBM Fellow is that an employee must meet four important criteria[1]:

- Sustained innovation in some of the world's most important technologies.
- Significant recognition as a leader among IBM's technical communities.
- Broad industry acknowledgement of the individual's accomplishments.
- A strong history of new technologies and business models being deployed at scale.

Thus, IBM Fellows have a history of pushing the boundaries of S&T to deliver improved solutions for the constantly changing global business needs. On the occasion of honouring the recent set of IBM Fellows, Ginni Rometty, IBM Chairman, President and CEO said, 'These extraordinary men and women join a select community made up of some of the world's most creative thinkers. Our new IBM Fellows play a critical role in defining the next era of technology, society and business, with vital contribution to IBM's position as the world's leading cognitive solutions and cloud platform Company'[1]. On a similar occasion in 2015, Rometty said, 'Innovation is the life blood of IBM. The men and women we honour today as IBM Fellows are the driving force behind that innovation. They are tackling some of the toughest and most urgent technical challenges facing business and society. In the process, they are leading the tech industry and a new era of computing where cognitive systems, Big Data and analytics, cloud, mobile and security technologies are changing the world'[2].

IBM Fellows are given broad latitude to identify and pursue projects in their area of expertise. This is based on their sustained demonstration of developing cutting-edge technologies benefiting the business and community.

The first IBM Fellows were selected in 1963. Every year, typically 2–5 Fellows (an average of 5.1 over the past 54 years) are awarded. There are two years (1978 and 1992) when only one award was given and in two years (2014 and 2016) as many as 11 were named IBM Fellows. Between 1963 and 2016 a total of 278 IBM Fellows have been selected (Table 1)[3]. Besides professional recognition, IBM Fellows generate a large number of patents. The 278 Fellows received 9329 patents, with an average of 33 patents per Fellow[3]. As of 2015, IBM has had the reputation of being an industry leader topping in patent grants for the past 23 consecutive years as evident in the list of annual US patent recipients[4].

IBM annually invests approximately US$ 5–6 billion for R&D, which amounts to nearly 6% of its total revenue and about 8% as return on research capital (gross profit/R&D expense of previous year) (Table 2). Thus it is not surprising that the innovations emerging from R&D maintain the company's reputation and leadership internationally.

As a new initiative in the 50th year of the IBM Fellows Programme, each Fellow is encouraged to adopt a country as Technology Ambassador in key regions. These

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Fellows will be highly visible in reinforcing IBM's commitment in technical distinction worldwide. Each Fellow Ambassador will leverage his technical skills and expertise to assure that IBM has a technical leadership role in the country to which he/she is assigned. By establishing partnership with local universities and research institutions and by mentoring employees, Fellow Ambassadors will help maintain a two-way visibility between IBM leadership and local markets. A key goal is to provide these markets with a preview of future technologies being developed across IBM. This will enable IBM clients and employees to influence those technologies, while the IBM Fellows themselves gain a greater understanding of the unique challenges and opportunities in these markets. This fits in with Watson's vision of giving IBM Fellows creative freedom and responsibility[5].

Table 1. Cumulative number of IBM Fellows

Year	Fellows	Indian origin Fellows	Women Fellows
1963	8		
1964	13		
1965	15		
1966	17		
1967	26		
1968	30		
1969	37		
1970	40		
1971	43		
1972	46		
1973	50		
1974	56		
1975	59		
1976	63		
1977	66		
1978	67		
1979	70		
1980	74		
1981	77		
1982	79		
1983	83		
1984	88	1	
1985	92		
1986	98	2	
1987	103		
1988	106		
1989	111		1
1990	116		
1991	121		
1992	122		
1993	128		
1994	133		3
1995	137		
1996	143		
1997	146	4	
1998	148		
1999	155	5	4
2000	158		5
2001	165	7	6
2002	170	8	
2003	175		
2004	180		7
2005	185		
2006	193	9	8
2007	199		9
2008	209	10	10
2009	217	11	12
2010	223	13	
2011	231		
2012	238	15	13
2013	246	17	14
2014	257	20	17
2015	267	22	20
2016	278	26	23

The IBM Fellows have won Five Nobel Prizes in Physics (Leo Esaki, 1973 (semiconductors), Gerd Binning and Heinrich Rohrer, 1986 (scanning tunneling microscope) and J. Georg Bednorz and K. Alex Mueller, 1987 (superconductivity)), one Kyoto Prize, one Presidential Medal of Freedom, five ACM Turing awards besides Academy memberships and professional society recognitions. This is indeed impressive for a company-based and funded institution.

In the age of discussions on gender inequality, it may be mentioned that the first woman, Frances Allen, became an IBM Fellow only in 1989 (26 years after the start of the IBM Fellows programme). However, in the next decade (1990–1999), three women became IBM Fellows and in the succeeding decade (2000–2009), seven women became IBM Fellows. Most recent years resulted in greater recognition (3 out of 11 in 2014, 3 out of 10 in 2015 and 3 out of 11 in 2016) of women achievers, totalling 9 in the three-year period. Thus, there is a steady improvement, but no parity as yet (Table 1).

Indian presence

In the list of IBM Fellows, is there any presence of Americans of Indian origin? The first was Rao R. Tummala in 1984 (21 years after the start of the IBM Fellows programme). Then there were practically none or only 1 or 2 for the next several years. The year 2014 had 3 out of 11, and 2016 had 4 out of 11 new IBM Fellows (Table 1). Thus, 26 are of Indian origin among the 278 IBM Fellows (Table 1)[6]. The steep rise in the number of IBM Fellows of Indian origin in recent years is noteworthy and impressive (Figure 1).

One may seek reasons for this slow start of the Indian presence in the early years of this programme. One of the criteria for selection, as pointed out above, is demonstration of sustained creation of new knowledge and its usefulness. The timescale for this is typically 15–25 years of service in IBM. The number of Indian students who went to the US for higher studies was small in 1960s and 1970s. After completing their studies in the US, some joined IBM. Therefore, the number of people of Indian origin joining IBM was significant in 1970s and later. This may partly explain why only in recent years, 25–40%

Table 2. Income and R&D expenses of IBM, 2011–2015

Year	R&D expense (1)	Total revenue (2)	Gross profit (3)	Return on research capital (3)/(1) of previous year	(1)/(2)
2010	6.026				
2011	6.258	106.916	50.138	8.320	6.14
2012	6.302	104.507	50.298	8.037	6.03
2013	5.743	99.751	48.505	7.697	5.76
2014	5.437	92.793	46.407	8.081	5.86
2015	5.247	81.741	40.684	7.483	6.42

(1), (2) and (3) are expressed in billion US dollars. The ratios (1)/(2) are computed by the present author.
Source: http://www.ibm.com/annualreport/2015/assets/img/2016/02/IBM-Annual-report-2015/pdf.

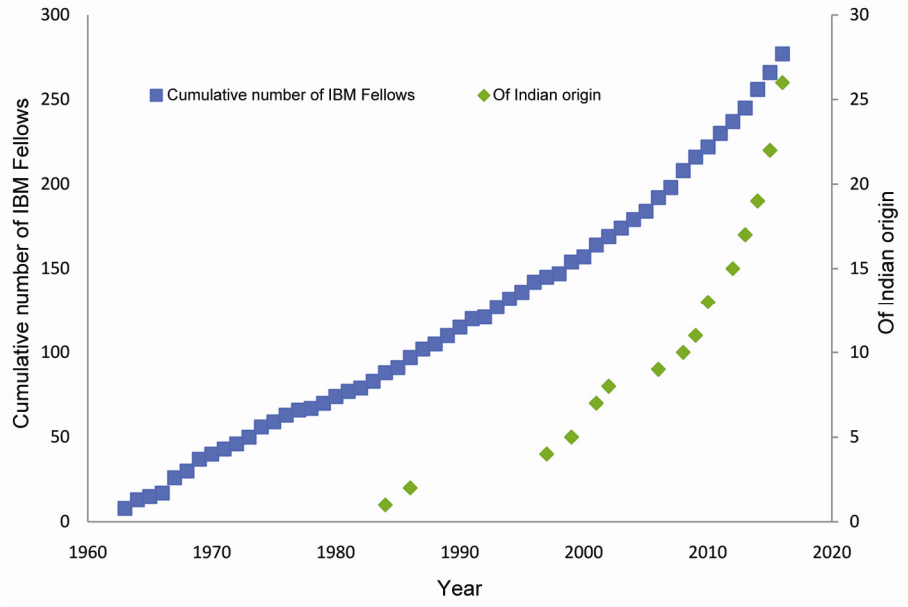

Figure 1. IBM Fellows and those of Indian origin.

of the IBM Fellows each year are of Indian origin. This is particularly significant because people of Indian origin do not constitute anywhere near this percentage among the total employees (about 400,000) of IBM. In the US, people of Indian origin number are less than 1%.

It is interesting to note that many of these IBM Fellows had their Indian education in the premier institutions (IITs and IISc), but several attended other colleges (NITs, Madurai College, Sardar Vallabhbhai Vidyapeeth, Osmania University, etc.). There is one Fellow from AIIMS also. They have attended a variety of institutions in the US and Canada (from MIT to lesser known universities). In this connection, one IBM Fellow – Ravi Arimilli – was born in India and migrated as a 6-year-old to the US with his parents and studied there. Incidentally, Arimilli has the distinction of receiving a large number of patents (e.g. 78 in 2002 and 53 in 2003, nearly 1–1½ per week). He has more than 500 patents[7]. Arimilli has won the IBM's Innovator of the Year Award each year since 1998, and is currently listed among the top 20 patent holders alive in the US.

The IBM Fellows of Indian origin also led some key emerging areas, e.g. Ajay Royyuru – health sciences and J. R. Rao – cyber security.

In line with the general trend, women scientists of Indian origin have started taking their rightful place among the IBM Fellows (Chitra Dorai, 2015 and Tanveer Syeda Mahmood, 2016).

Pointers to Indian industry

The above facts clearly establish that an investment of about 6% of total revenue in R&D has paid rich dividends for IBM in terms of technology innovations, cutting-edge technologies, resulting in business opportunities, and, most importantly, in productive, bright human resources. The stars of sustained technological leadership,

productivity and professional recognition globally are recognized as IBM Fellows, with wide latitude in the areas they pursue as a reflection of the confidence of their continued professional contributions based on their past records.

The Indian companies, particularly the larger ones, can emulate IBM. The present investment of Indian companies in R&D is relatively meagre[8]; it should be raised to 10–12% of the gross income and if properly used, can help their bottom line markedly. Equally rewarding is the new respect with which customers and clients view a company based on its clear leadership in cutting-edge technologies. The customers see direct benefits accruing to their performance by working with such a leading company.

The important approaches include:

1. Encourage multidisciplinarity.
2. Encourage patenting in India and abroad.
3. Encourage high-quality publications in prestigious journals.
4. Build strong links with academia in India and abroad[8].

Besides improving facilities and infrastructure through increased budget allotment, seeking outstanding and promising personnel for R&D has to be pursued on a continuous basis[8]. These people should be given sufficient freedom to grow to their fullest potential and follow their innovative instincts. The innovations that emerge should be patented and either exploited in the company or sold to potential users[8]. A transparent, continuous evaluation of the R&D staff, similar to the one followed by IBM, using an announced set of criteria, would identify stars who demonstrate sustained technical excellence evident to the company, clients as well as professional community. Such stars are rewarded financially, but more importantly, by giving greater freedom to pursue their creative ideas. Adding administrative responsibilities to such individuals should be scrupulously avoided. Instead of designating them as Vice Presidents, etc. they should be awarded the title of Fellow, Distinguished Scientist, Engineer or Technologist. Their professional stature attracts discerning and forward-looking clients to the company.

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