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Convergence or Divergence: Practice of Science by Migrant Faculty in India and the United States

Meghna Sabharwal[1] and Roli Varma[2]

Abstract

Do immigrant faculty trained in American higher education institutions adopt the outlook and practices of native US scientists and engineers ("convergence"), or do they diverge from such practices? The modern science paradigm holds that location will not matter significantly and that immigrants in either place will converge to a common standard of scientific practice. Drawing upon 134 in-depth interviews, this paper compares the scientific practices of two groups of Indian immigrant faculty in science and engineering: (i) those who studied and worked in the United States and then returned to India and (ii) those who continued to work in the United States. This paper shows that the two groups differed in important ways: ease of securing grants, management of grants, research environment, professional autonomy, and research type.

[1]University of Texas at Dallas, Richardson, TX, USA
[2]University of New Mexico, Albuquerque, NM, USA

Corresponding Author:
Roli Varma, School of Public Administration, MSC053100, University of New Mexico, Albuquerque, NM 87131, USA.
Email: varma@unm.edu

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This paper asks if there is diffusion of scientific practices when scientists and engineers trained in the United States return to their home country. It presents findings from an empirical case study on return migration of Indian faculty in science and engineering (S&E). It compares scientific practices of those who returned to India after study and work in the United States with those who chose to remain in the United States. Such comparison reveals whether scientific practices are universal or are influenced by the local norms prevalent in each country. It is assumed that these faculty members were born in India thus raised in the Indian scientific culture. They went to the United States for higher education and work, and so were socialized in the scientific culture of US academia. Socialization in the United States taught them how to conduct experiments, interpret results, judge their own work, and interact with their peers. Yet findings reveal that local setting matters and immigrants in both places diverge in their scientific practices in terms of how they secure grants, how they manage grants once received, awareness of the factors influencing their research, professional autonomy they enjoy in conducting research, and types of research they carry out.

Kuhn (1962, 113) suggested that "what a man sees depends both upon what he looks at and also upon what his previous visual-conceptual experience has taught him to see." This implies that one's past experiences and knowledge can influence his or her present value system and how he or she approaches problems. This affects basic, deep-seated underlying assumptions and knowledge of things, which Schein (1993) called "culture." While Schein's definition of culture is based on the study of organizations, it can be adopted to explain national scientific cultures. Thus, the culture of science is a set of acquired facts, assumptions, beliefs, and values that one obtains through their current and past organizational affiliations. The culture of science has its own sets of unwritten rules, which apply to scientists' practices, behaviors, expectations, and interactions.

Scholars have used Kuhn's notion of science, which introduced the idea that the practice of science takes place within paradigms. Accordingly, existing paradigms set the framework for what topics are explored, how they are studied, and what type of evidence matters. Several scholars, however, have argued that scientific knowledge is influenced by cultural, economic, and social factors, which are outside the realm of science (Noble

1984; Long and Fox 1995). Turnbull (1997) analyzed the scientific developments of various cultures and showed how several instances of knowledge creation and scientific advancement around the world have been shaped by the context and culture within which science exists. Traweek (1992) has shown similarities (i.e., convergence) and differences (i.e., divergence) between American and Japanese particle physicists in how they do physics, how their careers are shaped, how they interact with their colleagues, and how their knowledge shapes their social structure.

Scientific practices are typically defined as practices that translate into learning about the way science is done, collecting data and providing evidence to conduct empirical investigations, develop explanations, and evaluate claims for the creation of scientific knowledge (Bybee 2011). However, scientific practices are not just a result of conducting experiments; instead, they are influenced by the environment in which scientific knowledge is produced (Latour and Woolgar 2013). The environment consists of "people, organizational systems, and technical systems that interact to work toward a goal" (Hevner 2007, 89). As such, the organizational system (i.e., the administrative processes, funding mechanisms, and process of administering grants) is an integral part of the scientific practices.

The paper first briefly presents some important aspects of scientific practices in the United States, namely external funding of research, management of grants, research environment, professional autonomy, and research type. This is followed by the details of the study, its findings, and discussion. The paper examines the role of external grants to support scientific research, as it has become a norm in research universities in the United States. Most research costs money without which scientists and engineers may not be able to carry out the research they would like to do. Once external grants are awarded, their implementation becomes researchers' and institutions' responsibilities. A focus on the management of grants, therefore, is imperative as it outlines the activities that ought to take place within given time period. In addition, the paper examines the research environments; an environment that is supportive of research activities would lead to the production of scientific knowledge in timely fashion better than an unsupportive environment. A related element of the research environment is the autonomy given to scientists and engineers to use their knowledge and skills to conduct scientific research. The paper, therefore, examines autonomy. Finally, the paper focuses on the division of research into two distinct types: basic versus applied sciences and disciplinary versus interdisciplinary research in order to show how scientific knowledge production has been organized.

Government Funding of Academic Research

Before the end of World War II, academic research was seen as researchers' and universities' responsibilities in the United States. Research was funded by donors, personal funds, and university teaching budgets (Kaiser 2011); federal funding of academic research was uncommon, except in aeronautics and agricultural studies. Bush (1945) argued that scientific progress is essential for US prosperity, military security, the war against disease, and public welfare. His report set the structure for the federal government to provide funds for academic research and development (R&D). In the post-war era, a number of new federal agencies were created or reformulated to provide support for academic R&D.

Academic R&D relies on funding support from a variety of sources, including the federal government, universities' and colleges' own institutional funds, state and local government, industry, and other organizations. Although the federal government has consistently provided the majority of funding for academic R&D, its share has declined from 68.8 percent in 1972 to 57.7 percent in 2014. Similarly, state and local governments' funding share has declined from 10.2 percent to 5.6 percent for the same years (National Science Board 2016). It should be noted that most decline in government funding for academic R&D has taken place since early 2000. Funding rates in many National Institute of Health and National Science Foundation (NSF) programs are now at historical lows, declining from more than 30 percent before 2001 to 20 percent or even less in 2011 (Howard and Laird 2013).

Academic researchers can no longer carry out their research with support only from their universities; consequently, they seek funds from external sources to carry out research (Etzkowitz 1983). As the number of researchers has grown, the number of applicants for government grants has also grown (Bloch and Sorensen 2015). They must submit more proposals than ever to ensure they maintain adequate research funding. The current system is ultimately an inefficient use of researchers' time (Editors 2011). Subsequently, academic researchers are encountering fierce competition for grants. In fact, finding funds for university research from sources other than government has become a major priority for administrators.

University–Industry Partnerships

In the past, US academic institutions did not depend upon industry for support. However, it began to change in the beginning of the twentieth century, as top universities began to institutionalize partnerships with the private sector (Leslie 1993). By the mid-1970s, university–industry research centers began to emerge. The main goal of such joint ventures was to develop knowledge in S&E fields that will assist US industry, providing them access to both, cutting-edge academic research and a downstream employment pool (Aronowitz 2000).

Although industrial funding of academic R&D constitutes approximately 6 percent of academic R&D expenditures, the funds provided by industry for academic R&D have grown faster than funding from any other source. University–industry linkages have been further solidified with the establishment of industrial liaison offices, technology-transfer bureaus, joint ventures, science parks, and business incubators. The availability of funds through industry and other commercial sources has made faculty less dependent on other agencies to fund their research.

Universities see industrial collaborations as providing substantial resources to conduct research. They believe that industry has information about real-world problems, which academics may not have. Also, partnerships with industry can facilitate job placement for students. Overall, universities like to have diversity in sources of funding. Critics see industry-funded research as restrictive, with limited convergence between academic research mission and public goods (Varma 2000). The need to contribute to economic development has made commercialization more acceptable and commonplace within academia (Siegel et al. 2004). Increasing global competition has influenced faculty to engage in academic projects that are useful to industry, and this imperative has been present from the beginning of research (Slaughter and Rhoades 1996).

Professional Autonomy

The university as an educational institution grants intellectual autonomy to faculty to advance scientific knowledge. Yet faculty do not enjoy absolute autonomy; their autonomy is constrained by at least two factors: availability of funds and partnership with industry. Critics argue that the increasing industry–university partnerships are leading to a paradox of opportunities and problems (Welsh et al. 2008). Such partnerships restrict the university's broader public-interest mission and academics' autonomy. It is hardly disputed that industrial sponsors tend to be motivated by their own goals of making profits. Industrial funding decisions are made by private companies rather than through peer review. Accordingly, academics' efforts are diverted to those scientific projects that are of greater interest to industry than to academics themselves (Varma 2000). In addition, there are tensions among academics when they work with students on industrial projects, problems centering on intellectual property (Slaughter et al. 2002). Academics' autonomy to set their own research agendas is constrained by general goals of industry sponsors.

With government sponsorship, it appears that academics would enjoy autonomy to select research problems and how to carry them out. Unlike industry, funding decisions by government are made on the basis of peer review, and research is not sponsored to make profit. However, the areas of interest to government funding agencies tend to change over time, which direct academics into those areas where funding is increasing or those areas favored by government funding agencies (Goldfarb 2008). With increased global competitiveness, government funding agencies tend to favor areas that contribute to US economic growth. When academics pursue research goals that are overshadowed by the goals of government funding agencies, their autonomy in research is limited.

Research Type

Historically, research has been separated into two distinct types: basic and applied. The National Science Board (2016) defines basic research as research conducted in order to gain more comprehensive knowledge of the subject under study without specific applications in mind; applied research is undertaken to gain knowledge to meet a specific, recognized need. Basic research is seen as first generating fundamental knowledge, which is then transformed into useful products and processes through applied research. Distinguishing between such types of research has been criticized, as it renders basic and applied scientific activities as a linear process (Longino 2002). Despite such limitations, the National Science Board (2016) considers the basic/applied framework useful in providing indications of differences in the motivation, expected time horizons, outputs, and types of investments associated with R&D projects. In 2013, basic research activities accounted for around 18 percent of total US R&D, applied research was about 20 percent, and development was 63 percent (National Science Board 2016). Before 1980s, both industrial and academic sectors were performing substantial amounts of basic and applied research. However, with the challenge to US global dominance in the 1980s, the support for basic and applied research has declined (Varma 2002). Even government funding agencies are supporting those academic research projects that can be useful to industry (Varma 2000). There is a concern that without undertaking fundamental basic research, new scientific facts will not be discovered; instead, scientists will be making incremental advances and industry will make good use of academic research.

Traditionally, production of academic knowledge has been organized into disciplines situated within universities. Using Kuhn's (1962) terminology, disciplinary research is "normal science" within a paradigm. In disciplinary science, the aim is to produce knowledge by using a specific set of research questions and by utilizing the same set of methods and perspectives (Gibbons et al. 1994). Interdisciplinary research is heterogeneous and is not rooted in one discipline. The National Science Board (2016) takes interdisciplinary research as a mode of inquiry that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines to advance knowledge or solve problems whose solutions are beyond the scope of a single discipline. Both government funding agencies and industrial sponsors tend to favor projects that promote interdisciplinary research. As scientific problems are becoming complex, they require expertise of researchers from various disciplines to come together to solve problems of local and global importance. Thus, interdisciplinary research is the new mantra for universities (Brint 2005). It should be noted that interdisciplinary research tends to be application oriented, and thus it stresses applied rather than basic research.

Methodology

Data for this paper come from an NSF-funded qualitative study of the return migration of faculty from the United States to India that was conducted in 2013. Two groups of Indian immigrant faculty were compared: the first group chose to stay and work in the United States after finishing their study (hereafter "stayers"). Stayers were selected from institutions that are geographically located in states with the highest Indian populations: California, Florida, Illinois, New Jersey, New York, and Texas. Within these states, institutions were selected from the Carnegie Classification of research-intensive universities. A list of Indian faculty in S&E departments was compiled from their curriculum vitae (CV) posted on web. Stayers were those who received a bachelor's degree from India and doctorate from the United States. Overall, stayers included fifty-one Indian immigrant faculty who were employed in eighteen doctorate-granting institutions with very high research activity.

The second group consisted of Indian immigrant faculty who moved back to India after study and work in the United States (hereafter "leavers"). These leavers were selected from research-intensive higher education institutions located in six states/union territories: Andhra Pradesh, Delhi, Karnataka, Maharashtra, Tamil Nadu, and West Bengal. A list of Indian faculty in S&E departments who returned from the United States was compiled from their CV or biographical information posted on web. We selected leavers who had worked a minimum of five years at a US institution to insure that they were more than visitors and had the opportunity to become socialized into US science practices. Overall, leavers included eighty-three Indian immigrant faculty who were employed in fourteen prestigious institutions of higher education.

The total sample size for this study is 134 subjects from thirty-two institutions. The names of the subjects and institutions are not provided to comply with the institutional review board's requirements for anonymity. Basic characteristics of the two groups are presented in Table 1. These two groups were similar with some important differences. For instance, a higher number of leavers (46 percent) were assistant professors than stayers (27.5 percent). Similarly, most stayers (78.5 percent) worked in engineering rather than in science departments; in contrast, leavers were distributed in both engineering (55 percent) and science (45 percent) departments. Most of the stayers (94 percent) held permanent residency, including US citizenship, compared with leavers, most of whom were on temporary visas (82 percent).

A semi-structured interview guide was used to conduct in-depth interviews with both groups, which lasted anywhere from one to two hours. The interviews were recorded, transcribed, and entered into NVivo for analysis. Two independent coders coded the data. Typically, subjects gave multiple responses, which were categorized by concepts that allowed us to identify patterns within the entire text. A phenomenological approach—the meaning of their lived experiences of a concept or a phenomenon for several individuals—was employed to compare scientific practices. The following three questions pertained to the scientific practices in the United States and India and thus formed the basis for this paper: (i) can you talk about your experiences as a faculty member in the United States/India? (ii) what are your thoughts on the research environment in the United States/India? and (iii) can you compare your experiences in terms of research in the United States and India? Findings are reported with interview excerpts to highlight the complexity of concepts. Because of the low number of female faculty in both groups, gender is not taken into account in the analysis.

Table 1. Characteristics of Stayers and Leavers.

Demography	Stayers ($n = 51$)	Leavers ($n = 83$)
Department		
Engineering	78.5%	55%
Science	21.5%	45%
Rank		
Full professor	47%	32%
Associate professor	25.5%	22%
Assistant professor	27.5%	46%
Residency		
Mean number of years in the United States	23	9.5 (prior to return)
Mean number of years in academia	15.5	13
Mean number of years in India	Not applicable	9.3
Immigration status in the United States		
Temporary visa	6%	82%
Permanent residency	94%	18%
Age-group		
30–39 years	33%	44%
40–49 years	31%	30%
50–59 years	22%	20%
60 years and beyond	14%	6%
Gender		
Male	94%	84%
Female	6%	16%
Family status		
Married	86%	96%
Had children	73%	74%

Findings

Data show important differences in scientific practices by stayers and leavers in the two countries (Table 2). These are highlighted in the following sections.

Research Funding

Stayers identified the federal government as the largest source of public funds and industry as a source of private funds in the United States. Many believed that funding from the private sector was due to “declining financial support from federal agencies.” Stayers pointed out several challenges in obtaining funds for research in the United States. According to them, the

Table 2. Scientific Practices Experienced by Indian Immigrant Faculty in the United States and India.

Scientific Practices	American Academia	Indian Academia
Sources for research fund	Research is heavily dependent on funding from federal agencies and industry	Research is heavily dependent on funding from government and university and very little industrial funding
Acquiring research fund	Shrinking funding opportunities, difficult to obtain external grants, and extremely competitive	Increasing funding opportunities, easy to obtain external grants, and moderately competitive
Administration of grants	Low administrative burden, post award management streamlined, and little red tape	High administrative burden, post award management cumbersome, and high red tape
Research environment	High quality and quantity of research output, international visibility of research productivity, transparency in the research processes, decentralized administrative structure, availability of up-to-date equipment, critical mass of researchers, and high quality of graduate students	Average quality and quantity of research output, national visibility of research productivity, nepotism in the research process, centralized administrative structure, lack of up-to-date equipment, nonexistence of critical mass of researchers, and low quality of graduate students
Research type	Applied research is promoted and funded and interdisciplinary research is encouraged	Basic/fundamental research is widely accepted and supported and disciplinary research is pursued
Research autonomy	Research heavily dependent on funding, often restricting freedom to choose risky topics and those of researchers' interests	High academic freedom, guaranteed funding leads to pursuing risky topics and those of researchers' interests

process for obtaining grants is highly competitive as a result of the increasing number of researchers competing for grants, and there is generally a low acceptance rate for grant proposals. They further emphasized that funding and grant opportunities available to faculty from federal funding agencies are shrinking. As one stayer said, "Things are getting tougher because all the universities now are putting a [greater] premium on funding than they did before." Another said, "It is common for very good ideas to not get funded as the success rate is about 10 percent." One generalized, "Getting grants is a frustrating process, but this is how research is done in the United States." A few described the barriers faculty face when seeking grants from federal agencies due to their citizenship status—for example, noncitizens are ineligible to apply for funding in sensitive areas.

Leavers labeled the national government and university as the largest sources of public funds in India. According to them, there is very little industry funding for university research. In contrast to stayers, leavers discussed the positive funding situation in India compared to what they faced when they were in the United States. In fact, many gave this as one of the main reasons to return to India. There was a general agreement among leavers that ample funds are available for research in India, which allows them easily to fund their research, support students, and access high-end technologies and other resources. One leaver even declared that "Funding is relatively easy to obtain in India." Another said, "You get free students, paid by the institute . . . You do not have to write grants for them like in the US." Several indicated that the process of applying for grants and getting funded is not as competitive and stressful as it is in the United States. As one leaver indicated: "You do not have to be that crazy here. You are writing grants all the time in the US, and have little time for what you exactly want to do. So that kind of pressure is not here [in India]."

Administration of Grants

Despite the challenges in securing funds, the stayers acknowledged that their universities have research units that help them find funding and prepare and submit proposals. Since securing external grants plays a major role in the survival of research universities, administration is deeply engaged in supporting activities so faculty can apply for and manage grants. Faculty and university administration share responsibility for maintaining the flow of grants. There was some concern about funding agencies' "burdensome" reporting requirements and their institutions' restrictive rules on procurement of funds. However, there was general agreement that administration of grants is streamlined, though it could be improved.

Just because ample funds are available for research in India does not mean administration has worked out the details of how to manage grants. Leavers described the existence of bureaucratic barriers in allocating and/or spending funds. Several indicated that spending funds is an inefficient process that consumes much of their time. Further, administration restricts the use of already-procured funds. Many leavers believe that the procedures and protocols must be streamlined to speed the research process. One leaver summed it up as: "Getting funding in India is not a problem, spending it is a major problem." Another indicated that "Spending money is a problem because of the writing that goes in terms of buying an instrument. So much paperwork, it just slows you down." It seems the cumbersome bureaucratic procedures in India are slowing researchers down.

Research Environment

A large majority of stayers credited the positive research environment in the United States to its decentralized administrative structure, research-minded faculty, intense competition for grants, availability of resources and state-of-the-art equipment, the positive mind-set for collaborations, and attracting outstanding students and scholars from around the world. They also described the standardization and transparency of research processes, particularly peer review and dissemination of results. According to them, the competitive environment causes the best research ideas to be funded, high-quality research to be published, and merit to be rewarded. Some stayers explained that a critical mass exists in multiple areas in the United States. This often results in a discussion about the environment of collaboration and all-around institutional support for research. As one stayer indicated, "In the US, you find a lot of people with similar interests interacting with each other. It is very rich. You get to see a lot of experts in related fields." Another said, "Research in the US is really cutting edge. It is really high impact."

Most leavers indicated that the research environment in India has improved or is improving, but it is not close to what they experienced in the United States. According to them, India does not have an environment that fosters research. Several felt that India does not value research. They indicated that fewer publications are being produced by researchers in India when compared to journal articles published in other countries. Furthermore, research published is Indo-centric. As one leaver said resentfully, "Unfortunately people are not very excited about publishing. I have not seen that rigor in India." For some leavers, the issue was that India lacked the critical mass, resources, and research equipment required to develop and sustain research. As one said, "We do not have a critical size. We do not have enough people, big enough group that they can themselves feed on each other." Many indicated that Indian institutions of higher education are primarily focused on education, causing research to be neglected. Teaching and administrative responsibilities are very high, which takes time away from research. One leaver summarized the situation as "The amount of time you put in for teaching is extremely high . . . There is so much teaching, so I get little time for research." Even in premier institutions, "the focus is on undergraduate teaching and not on research," noted another leaver. Most importantly, students are not trained to have a research mind-set.

Research Type

Stayers indicated that it is challenging to find funds for fundamental basic topics in the United States. They emphasized that federal funding agencies are more interested in supporting research with a focus on applied topics. They also indicated that the research being pursued by faculty was aligned with industrial research interests, which tends to be applied and relevant to industry. Although there were some concerns about the lack of support for basic research, stayers considered the increased amounts of interdisciplinary research and industry collaboration occurring in the United States as positives. Some welcomed the shift in emphasis away from basic to applied research. According to them, the world is facing too many problems and applied research can help solve such problems. One stayer summarized the situation as:

> What people want funded today is applied research. The funding agencies do not want to give you funding for research that might pay off five or ten years down the way . . . It will kill innovation. If we could roll the clock forward ten to twenty years from now, we will find that the basic knowledge needed for new innovations does not exist because nobody worked on it.

Leavers specifically pointed to the lack of opportunities for researchers pursuing theoretical topics in the United States, which is highly encouraged in India. They preferred to do research to gain knowledge for its own sake. They found basic theoretical research to be intellectually satisfying. They talked about generating theories with their research and hoped it would result in useful applications. Commercial value resulting from their research, however, was not their immediate goal. Similarly, they were focused on research within their own disciplines. One leaver echoed, "In India, I can explore theory . . . In US, there is not enough room for people who want to do theoretical stuff." Another indicated:

> In the US, it is not enough to do fundamental research. If you are doing applied research then that is good, you get funds for it. If you are doing fundamental research, you will have to market it. But this is not the case in India.

Research Autonomy

Stayers were clear that they decide how to conduct research, how much time is needed to finish the work, which technique or experiment is best suited to conduct research, what resources are needed, and so forth. In this sense, they enjoy autonomy in the research. Yet their autonomy is not absolute since it falls within the general goals of federal funding agencies and industrial partners. They have to get grants and thus learn to align their research interests with funding agencies. Close to half of the stayers indicated that they shifted their research focus to "chase the dollars." Some considered the need to adapt to topics that are funded as a normal part of research. A few believed that "the funding situation in the US is poor," which was a hindrance to developing long-term research for topics as well as the time faculty can actually devote to research. Most mentioned that they "spend a large amount of time writing and submitting grant proposals."

In India, funding for all sorts of projects that faculty would like to pursue is easily available. Further, government and/or institutions provide financial support for students, and so leavers' freedom to pursue topics of their own interest is not restricted. One leaver indicated that "In India, anything I find interesting, I work on. No problem because it does not have to be funded . . . India is the place where you can take up high-risk research." A leaver summarized the situation as "India gives me much more freedom than I got in the US. In the US there is a lot of talk about freedom, but they turn the lever by controlling the supply of money. The situation in the US was highly concentrated in few hands." Yet their autonomy is restricted by an extensive teaching load, which leaves little time for research. Most leavers enjoyed teaching though some described it more negatively due to the course load they are required to teach, the subject matter they are given to teach, and of teaching particular audiences (e.g., undergraduate vs. graduate).

Discussion

Although India does not come close to the financial resources available in the United States for academic R&D, access to funds is easier to obtain in India than in the United States. The study has shown that stayers have to raise funds to support their research in the United States whereas leavers easily obtain funds to conduct research in India. The study also shows that the process of obtaining grants is more competitive in the United States than in India. Stayers spend a larger amount of time writing grant proposals than they do actually conducting research, but this is not the case in India. Since many grant proposals are unfunded in the United States, some research ideas and time are wasted, which is not true for India.

Since stayers must obtain funds from external sources, they acquire grant-writing skills, which differ significantly from paper-writing skills. In addition to having scientific abilities, they must be able to recognize funding opportunities and know which research endeavors are most likely to get funded. They must find sources of funding, know funding agencies' priorities, and keep in touch with funders. Further, stayers must keep improving their grant-getting skills. This study, therefore, supports Etzkowitz's (1983) notion of entrepreneurial academics. In contrast, leavers are not required to be entrepreneurial. They are supposed to focus entirely on research for which the Indian government and university provide funds. The ability of faculty to obtain funding is not a required skill to pursue an academic career in India.

Globally, the United States comes out on top, by a wide margin, in scientific research productivity (King 2004; Editors 2015). The United States remained the largest R&D performing country in 2013, with total expenditures of US$456.1 billion, a 27 percent share of the global total (National Science Board 2016). The study has shown that both stayers and leavers agreed that research output in the United States is greater in quantity and quality. Although research in India has grown more visible, it lags behind India's great growth in overall publications. Leavers were disappointed with the weak research culture in India. There are important differences in the research environment of the United States and India, which lead to different research productivity in two countries. Both stayers and leavers agreed that the United States has high research productivity, mostly due to vast R&D expenditures, updated technical equipment, decentralized administrative structure, high competition to secure external grants, strong emphasis on research publications, transparency in the review process, and high-quality graduate students. Leavers recognized that the landscape of research in India is changing, but they were disappointed with its research productivity compared with the United States. According to them, India's low research productivity was mostly due to high-administrative red tape, lack of a premium on research, deficiency in necessary technical equipment, absence of a critical mass of researchers, inadequate quality of graduate students, and nepotism in the review process. Also, Indian academia, unlike that in the United States, does not promote the appropriate amount of university–industry collaboration required for India to be an innovator in research. Leavers recognized the importance of having a competitive research environment like that of the United States to promote a mind-set for research and improve the overall research environment. Yet they were cautious about blindly adopting US scientific systems of research, which, according to them, will stifle creativity.

In the United States, a larger portion of the total R&D budget is allocated to development and applied research (83 percent in 2013) than for basic research (18 percent in 2013). Furthermore, since 2000 federal funding for basic research either has been constant or has declined (National Science Board 2016). Both stayers and leavers discussed challenges in securing funds for basic research in the United States. In contrast, Indian universities are viewed as the center of fundamental research, and applied research is carried out elsewhere. Leavers discussed their commitment to carry out basic research. They also acknowledged that faculty in India work in disciplinary silos; there is little cross-disciplinary collaboration to determine the solution for particular research problems. Stayers, on the other hand, pointed out that support for interdisciplinary research has been increasing in the United States. It should be noted that participants in both countries noted the distinction between basic versus applied and disciplinary versus interdisciplinary research on their own; we did not ask them whether they make such distinctions. It is also interesting to note that despite the funding and promotion of fundamental research, India is not among the top producers of scientific knowledge in the world (Bhattacharya and Kaul 2015). An interesting paradox uncovered in this study is that while Indian faculty have ample funds and the freedom to do basic research, their research is not on par with that of most Western nations. Future studies can explore why the emphasis on basic research in India does not result in output recognized as world class. Interestingly, despite challenges in getting support for basic research in the United States, its academic institutions continue to generate such knowledge compared with India (and other countries).

This study supports studies (e.g., Varma 2000; Slaughter et al. 2002), which have shown conflicts between scientific values and practice of scientific research in the United States. It found that Indian immigrant faculty in the United States do not experience absolute autonomy in their research because they are restrained by availability of funds and topics that are being funded. Due to dependence on funding agencies and industry for their research, stayers feel restricted in pursuing research that interests them. In contrast, leavers have more research freedom in India because they are not under the pressure to find funds and publish within given time period to secure tenure. In fact, stayers have come to view research in the United States as a more entrepreneurial than academic endeavor; in contrast, leavers look down upon industrial influence in research and have somewhat purist view of the academic enterprise.

Conclusion

In summary, research in the United States and India is influenced by various factors, and each country has developed a research culture of its own. This study finds support for Traweek's (1992) idea that scientific culture cannot be seen as a single and unified category. Research in the United States is highly dependent on the availability of funds and the ability of researchers to seek grant dollars. Furthermore, transparency, quality graduate students, an environment that fosters creativity, innovation, collaboration, and interdisciplinarity with federal government and industry support have contributed to United States maintaining its lead in scientific research. On the other hand, shrinking funds, increased competition, and constant pressure on academics to fund their research and students are causing some faculty to return to India (Sabharwal and Varma 2016). While the ease of securing research funds and the freedom to choose any topic of research cause optimism among faculty in India, they also experience the inadequate quality and quantity of research produced in India. This they attribute to various factors—a lack of critical mass, inefficiencies in the funding structure, higher administrative burdens, heavy teaching load, lack of collaboration among faculty and disciplines, poor industry support, and unavailability of quality graduate students. Problems chosen by faculty in India tend to be Indo-centric rather than geographically broad. The bottom line is that science is influenced by society, culture, and location. Whether Indian faculty in the United States and India realize it or not, sociocultural factors play a role in scientific activities. Leavers and stayers differed in their practice of science even though all were socialized in the same scientific milieu.

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Author Biographies

Meghna Sabharwal is an associate professor of public and nonprofit management at the University of Texas at Dallas. Her research interests focus on public human resources management as it relates to workplace diversity and high-skilled immigration.

Roli Varma is the Carl Hatch Endowed professor in the School of Public Administration at the University of New Mexico, Albuquerque. Her research focuses on women and minorities in information technology and immigrants in the science and engineering workforce.