The role of research in universities in India and elsewhere is inseparable from the aims of research as knowledge creation and from the broader context of knowledge creation in the educational process. The purpose of this chapter is to reflect on the basic purpose of knowledge creation in the university and then examine responsibilities of the university for promoting knowledge creation in a range of fields of investigation and levels of learning, as well as the ethical standards that apply. The conclusion will address the uncertain future of knowledge creation in the university and the alternative models for change.

The premise for this reflection on challenges of knowledge creation for Indian universities was captured on the eve of the March 2013, at the O.P. Jindal Global University Conference on ‘The Future of Indian Universities: Comparative Perspectives on Higher Education Reforms for a Knowledge Society’ (referred to below as the March
Conference) in the Hindustan Times, where Vice-Chancellor C. Raj Kumar wrote:

Because of their indifference to research, [Indian] universities have been unable to provide solutions to social, economic, and political problems that affect India. Indian universities ought to become fertile ground for the generation of ideas. Research produces knowledge that offers clarity and a more informed understanding of the subject at hand.¹ These reflections are offered as a contribution to discussion on why and how a research role for Indian universities can be part of their potential for attaining world-class status. We begin with a broader exploration of the purpose of knowledge creation and then focus on the responsibilities of the university for promoting knowledge creation and on some of the uncertainties in the context of the evolving approaches to addressing specific challenges for universities to contribute meaningfully to knowledge creation.

THE PURPOSE OF KNOWLEDGE CREATION

The concept of knowledge creation should be a self-evident function of a university. However, that function is ambiguous in at least two ways. First, do we mean creating knowledge in the learner or generating accessible research results? While the quotation above by C. Raj Kumar underscores the concern with a university’s capacity to produce research, it is also the university’s function to enrich the knowledge of students and faculty through learning. Second, are we treating knowledge as an end in itself or a means toward an end? Here also the answer is ‘both’ in the sense that a university is a place where individuals grow intellectually and contribute to knowledge others can access.

Types of Knowledge and Intelligence

Philosophers and psychologists have developed elaborate categories of knowledge. One study enumerates the following distinctions: ‘generic (or general) and domain specific knowledge, concrete and abstract knowledge, formal and informal knowledge, declarative and proceduralized knowledge, conceptual and procedural knowledge, elaborated and compiled knowledge, unstructured and (highly) structured knowledge, tacit or inert knowledge, strategic knowledge, knowledge acquisition knowledge, situated

¹ Kumar, C Raj, ‘Still Not in a Class of Their Own,’ Hindustan Times, Wednesday (20 March 2013).
knowledge, and meta-knowledge.\textsuperscript{2} These authors prefer the following four types of knowledge.

\textit{Situational knowledge}: ‘knowledge about situations as they typically appear in a particular domain, [which] enables the solver to sift relevant features out of the problem statement (selective perception) and, if necessary, to supplement information in the statement.’

\textit{Conceptual} (previously called \textit{declarative}) \textit{knowledge}: ‘static knowledge about facts, concepts, and principles that apply within a certain domain, [which] functions as additional information that problem solvers add to the problem and that they use to perform the solution.’

\textit{Procedural knowledge}: knowledge of ‘actions or manipulations that are valid within a domain [and] help the problem solver make transitions from one problem state to another.’

\textit{Strategic knowledge}: ‘a general plan of action in which the sequence of solution activities is laid down [and which] helps students organize their problem-solving process by directing which stages they should go through to reach a solution.’\textsuperscript{3}

They then identify qualities of knowledge (\textit{level} in terms of deep or superficial, \textit{structure} in terms of isolated elements or structured knowledge, \textit{automation} in terms of declarative or compiled knowledge, \textit{modality} in terms of pictorial or verbal, and \textit{generality} in terms of general or domain specific) and relate these qualities to each type, generating a matrix of 20 descriptions of knowledge.

In addition to kinds of knowledge there are also kinds of receiving minds or intelligences. Howard Gardner famously listed seven intelligences. His provisional listing may be summarized as follows:\textsuperscript{4}

\textit{Linguistic intelligence}: ability to learn and use languages

\textit{Logical-mathematical intelligence}: capacity to analyse problems logically, detect patterns, reason deductively, and think logically


\textsuperscript{3} de Jong and Ferguson-Hessler, ‘Types and Qualities of Knowledge’, \textit{Educational Psychologist} \textit{31}(2): 106.

Musical intelligence: skill in the performance, composition, and appreciation of music

Bodily-kinesthetic intelligence: using one’s whole body or parts of the body to solve problems

Spatial intelligence: ability to recognize and use the patterns of wide and narrow space

Interpersonal intelligence: capacity to understand intentions, motivations and desires of peoples

Intrapersonal intelligence: capacity to understand oneself, including feelings, fears and motivations

This understanding of kinds of knowledge and intelligence helps frame the problem of knowledge creation in universities, whether it is in how students learn or how university-based scholars carry out research. However, it is useful to consider whether universities should consider knowledge as an end, a means, or a process.

Knowledge as an End in Itself

Drawing on an example from my own university for the purpose of clarifying what I mean by the concept of knowledge as an end in itself, I would cite a 2007 task force report that recently redefined the set of requirements, outside the concentration (major field of study), that all students must meet before they can receive a Harvard degree. The task force put it rather eloquently in describing a ‘liberal education’ as ‘an education conducted in a spirit of free inquiry undertaken without concern for topical relevance or vocational utility.’ The report continues in a philosophical vein:

[It]his kind of learning is not only one of the enrichments of existence; it is one of the achievements of civilization. It heightens students’ awareness of the human and natural worlds they inhabit. It makes them more reflective about their beliefs and choices, more self-conscious and critical of their presuppositions and motivations, more creative in their problem-solving, more perceptive of the world around them, and more able to inform themselves about the issues that arise in their lives, personally, professionally, and socially.\(^5\)

Such an understanding of the role of the university reflects the concept of knowledge for its own sake, of the learner’s awareness of the world,\(^5\)

independent of what they do with that knowledge. But what they do with it also matters.

Knowledge as a Means

No one denies that the university prepares young people to become productive members of society. ‘A liberal education is also a preparation for the rest of life,’ according to the same report, which adds

The subjects that undergraduates study and, as importantly, the skills and habits of mind they acquire in the process, shape the lives they will lead after they leave the academy. ... A liberal education is useful. This does not mean that its purpose is to train students for their professions or to give them a guide to life after college.⁶

So, knowledge acquired through university learning is not primarily aimed at preparing careers, but more about preparing citizens capable of critical reasoning and understanding the world. It is only after knowledge creation that it can be reproduced through education and training and translated into applications in the worlds of government, commerce, policy, medicine, and health, as well as in changing social mores and political preferences.

Knowledge as a Process

Knowledge is also a process. How is knowledge created? In the university setting, it can be considered to come from research and writing of a theoretical, empirical, evaluative or speculative, prescriptive, descriptive, or applied scientific research. One way of understanding the process is the production-re-production-translation cycle. This cycle of knowledge involves stages that loop: First, there is knowledge production, through research; then there is its re-production, through education and training; and finally its translation, which, when subject to scientific evaluation, feeds back into the production of new knowledge.⁷

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Reporting on their work for a commission on post-secondary education in medicine, nursing, and public health, Frenk et al. identified three key dimensions of education, which are relevant to all institutions of higher education (IHE): institutional design, which specifies the structure and functions of the education system; instructional design, which focuses on processes; and educational outcomes, which deal with the desired results (see Figure 9.1).

They also found four crucial functions that also apply to educational systems: (1) *stewardship and governance*: ‘norms and policies, evidence for decision making, and assessment of performance’, which ensures strategic guidance for the educational system; (2) *financing*: aggregate allocation of public and private resources for educational institution,

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which provides resource flows and incentives to each educational organization; (3) resource generation: primarily external funding for faculty research and development, which meets the knowledge generation and translation functions; and (4) service provision: educational services primarily through instruction, which meets the knowledge transmission function.9

During the March 2013 Conference on 'The Future of Indian Universities', several participants argued that such a financial and institutional model fails to address several vital features of knowledge creation.10 The vitality of knowledge creation is enhanced by the freedom of faculty to dissent from established wisdom or the preferences of funders of research. Innovation in teaching and generating new ideas often depend more on the audacity of members of the academic community than on established institutional incentives. Alternatives to the US model of private universities with government-funded research have emerged in Singapore and South Korea. Therefore, one of the challenges facing India is to develop its own approach to world-class knowledge creation. As one Indian scientist put it, 'given that the world in the 21st century is crowded and resources in India are comparatively scarce, such institutions may not represent the best models for India to follow'.11 He also argued that 'focus of the discussion should be on identifying the knowledge required to alleviate suffering from poverty, hunger, disease, injustice, and inequity; prevent environmental degradation; conserve the region's unique biological and cultural heritage; and meet developmental challenges'.12

What is said about education in general applies to research and publications in particular, as research is a more narrow understanding of knowledge creation. The two types of knowledge creation (learning by students and research by faculty) are synergistic in the sense that faculty members are


10 These observations were inspired notably by remarks made at the Conference by Professors Shiv Visvanathan, Dhruv Raina, Devesh Kapur, and Madhav Menon.

11 S. Bawa, Kamaljit, 'India's Path to Knowledge'. *Science* 30 335 (6076) (March 2012): p. 1573. DOI: 10.1126/science.335.6076.1573-e.

12 S. Bawa, Kamaljit, 'India's Path to Knowledge'. *Science* 30 335 (6076) (March 2012): p. 1573. DOI: 10.1126/science.335.6076.1573-e.
able to pursue research and publish works that challenge young people in ‘beliefs and choices ... presuppositions and motivations,’ in the words of the Harvard Task Force. This is only possible if they either are paid to balance a reasonable teaching load with writing and publication, or have access to research grants. The problem here is that paying faculty to think is expensive and those with resources would rather fund research that will contribute to productivity in society, which treats knowledge as a means towards an end or even as a commodity itself.

Knowledge is transformative. In society, knowledge is acquired from experience, socialization, formal education, informal learning, investigation, exploration, and all means through which the cognitive, analytical, affective, and ethical reasoning functions of the brain are modified. The social settings are as varied as human experience. New neural connections in different parts of the brain create new understanding skills, capacities, and emotions. All these modes of acquiring knowledge continue in a university setting; however, the privileged means are one form or another of the production-re-production-translation cycle (see Figure 9.2). Transformative change depends on possibilities that did not exist and

Figure 9.2 The Production-re-production-Translation Cycle

sound research is the first step toward transformation. Thus, knowledge is both a means and an end. It is a means of innovation through research and translates evidence-based research into evidence-based policymaking.

FOUR CHALLENGES OF KNOWLEDGE CREATION IN INDIAN UNIVERSITIES

Assuming that a university is committed to knowledge as both an end in itself and as a means toward achievement, it faces four special challenges of knowledge creation, which constrain institutional instructional design. First, what is the optimal range of fields of knowledge that the university must cover? Second, what levels of education will be provided and how should knowledge creation be adapted to each? Third, what ethical standards apply to knowledge creation and how will the university enforce them? Finally, how does the university deal with the reality of politicization and commodification of knowledge?

Challenges Due to Disciplinary Fragmentation

The first challenge to knowledge creation in the university is the fragmentation of knowledge. Given limitations in available human and financial resources, each university must strike a balance among the potential academic fields. Ideally, a university should be a place of knowledge creation in all the arts and sciences but in practice very few can cover them all well. The investment required offering courses and degrees, engaging in research, and produce publications is significant in each field. Among the hundreds of fields of knowledge a university can offer, four broad groupings summarize the complexities of the challenge of selecting fields of knowledge creation.

1. **Humanities and philosophy**: aesthetic and interpretive understanding, culture and belief, ethical reasoning, etc.
2. **Natural sciences**: life sciences, physical sciences, medical sciences.
3. **Policy and social sciences**: law, institutions, management, international relations, political science.
4. **Applied sciences**: application of scientific knowledge to the physical environment, including agronomy, architecture, engineering and computer technology.

A related challenge is to encourage interdisciplinary knowledge creation, rendered all the more difficult as faculty and administrators in
each of the established disciplines understandably seeks to maintain the integrity of the discipline with scarce resources. A sociology department is likely to be more concerned about surviving in a university than in creating opportunities for students and faculty to challenge sociological methods by introducing creative alternative ways of addressing the questions sociology is supposed to address. There is an unavoidable tension between specialization leading to fragmentation and unifying knowledge leading to impoverishment of disciplines.

In *Our Underachieving Colleges*, Derek Bok expressed this challenge well:

No one has demonstrated convincingly that the drawbacks of fragmentation have outweighed the contributions to knowledge made possible by specialization. Nor has any general theory or universal methods emerged to knit the separate disciplines together. The unity of knowledge remains an elusive ideal.\(^{15}\)

One attempt to reach that ‘elusive ideal’ was formulated in the concept of ‘consilience’ by E.O. Wilson. ‘The greatest enterprise of the mind’, he wrote, ‘has always been and always will be the attempted linkage of the sciences and humanities. The ongoing fragmentation of knowledge and resulting chaos in philosophy are not reflections of the real world but artefacts of scholarship’.\(^ {16}\) He proposes consilience as ‘the key to unification’.\(^ {17}\) Wilson acknowledges that consilience is a minority view ‘shared by only a few scientists and philosophers’.\(^ {18}\) And yet he argues that ‘we are approaching a new age of synthesis, when the testing of consilience is the greatest of all intellectual challenges’.\(^ {19}\)

What does this mean for higher education in India? Integrating fields of knowledge is not new to India. Nalanda University, operating from the fifth to twelfth centuries in ancient Magadha, is said to have been ‘uniquely attractive for all seekers of pure knowledge’ because of its ‘ability

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17 Wilson, *Consilience. The Unity of Knowledge*, p. 8.
18 Wilson, *Consilience. The Unity of Knowledge*, p. 9.
19 Wilson, *Consilience. The Unity of Knowledge*, p. 12.
to meld multiple discourses and to embrace knowledge in its entirety. While those involved in re-establishing Nalanda University declare ‘[t]here is now a perfect opportunity to recreate the hallowed universalism of Nalanda as a centre of knowledge’, most Indian universities today have adapted the British or American systems of higher educational. They are thus confronted with the challenge of inter-disciplinarity in similar ways to universities elsewhere in the English-speaking world.

Professional advancement is in large part determined by identifying with and contributing to specialized disciplines and students expect to find a wide range of departments and concentrations in the humanities and philosophy, the natural sciences, and policy and social sciences, including law and management. The need to advance interdisciplinarity notwithstanding the pull toward fragmentation is addressed in the chapter by Yugank Goyal in this volume. The breadth of disciplines covered is further complicated by the challenge of levels of degree programmes.

The temptation for a university concerned with its reputation in knowledge production is to focus on those areas of research where innovation is measurable and applications are needed in the industrial sector, such as the bio-sciences rather than the arts, humanities, and social sciences. There is a strong trend in this direction in India today. For example, chemical biologist Krishna Ganesh, director of Indian Institute of Science Education and Research (IISER), Pune, declared ‘[w]e need to find ways to attract intelligent students into science’. A report on the future of scientific research in India stated that ‘[t]he future of scientific research in India is very promising’ given the pool of professionals in such areas as genetic modification, bio-energy sources, biochemistry, atomic energy, organ donation, biomedical science, among others. The research in these areas ‘will determine much of the way these issues are viewed by the world in the near future.’

22 See Chapter 14 in this volume.
As such, ‘[h]ow India handles many of the ethical dilemmas that scientific research presents will be an education for many other countries, including developed countries’. The Minister for the Ministries of Science and Technology and of Earth Sciences, Shri Sudini Jaipal Reddy, takes pride in the fact that ‘India is one of the top-ranking countries in the field of basic research. Indian Science has come to be regarded as one of the most powerful instruments of growth and development, especially in the emerging scenario and competitive economy.’

Indeed, it is also noteworthy that the Indian Department of Science and Technology (DST) acknowledged ‘the present situation of a large number of well-qualified women scientists who due to various circumstances have been left out of the S&T activities needs to be addressed.’ In order to address the problem, the DST has created a ‘Women Scientists Scheme (WOS)’. A positive development is the agreement, announced by Alice Prochaska, Principal, Somerville College, University of Oxford, at the March 2013 Conference to set up of the Indira Gandhi Centre for Sustainable Development at Somerville College, Oxford, as a tribute to the former Prime Minister, Indira Gandhi, who was a student of Somerville College. It will provide ‘graduate/PhD scholarships … specifically to Indian students at Oxford, with a cohort of Indian graduate students participating directly in research of relevance to India.’ This initiative is consistent with WOS and will no doubt be followed by other efforts to remove the barriers to women in science and other fields of research.

The push for science education is understandable and is likely to succeed in light of resources made available for education and research in these areas.

27 Available at http://www.dst.gov.in/.
The challenges for Indian universities shift, therefore, to finding the resources and resolve to sustain and increase knowledge creation in the humanities and social sciences. Three additional challenges further complicate the role of Indian higher education in contributing to knowledge creation.

**Challenges Due to Levels of Education**

Knowledge creation faces challenges that vary according to the level of education. At the undergraduate level, students need to learn methods of research and writing at a qualitatively different level than they were exposed to in secondary education. Further, the ethics of research, principally ensuring that the student produces original work and does not plagiarize in any way ideas, data, and wording of others, is a significant feature of undergraduate education. The issue of academic integrity is addressed in more detail in the next section.

At the graduate level, students are exposed to the highest level of research in their field and are expected to begin creating their own original research, by applying the most advanced methods and translating their research into publishable scholarship. At the same time, they begin teaching undergraduates, which should offer them the opportunity to appreciate how knowledge is transmitted and how to assist younger students acquire the research skills at the undergraduate level.

At the postgraduate level, students are expected to publish in peer-reviewed journals and established networks of collaboration among professionals in their field as they prepare for a career devoted to knowledge creation.

Finally, once a qualified researcher has attained faculty status, knowledge creation, reproduction, and translation becomes the core function. As mentioned above, the task of the university is to ensure the highest possible access to research funds, time away from teaching, and access to documentation through a well-stocked library and online sources.

In sum, universities need to be aware of the evolving conditions of knowledge creation across these four levels of education. They intersect and overlap but special attention must be paid to each.

**Challenges Due to the Propensity towards Academic Dishonesty**

Knowledge creation is clearly hampered by the blatant infringement of academic honesty in the form of deliberate or inadvertent plagiarism.
A related issue is that of academic freedom and freedom of scientific research. Each of these dimensions will be addressed briefly.

Old, well-established universities like Jawaharlal Nehru University (JNU) and Delhi University (DU) and new ones like O.P. Jindal Global University have a special responsibility to ensure that knowledge created under their auspices respects the highest standards of academic integrity, meaning that all ideas, data, findings, reasoning, conclusions, and recommendations that are not original creations of the author are properly attributed. This seems self-evident but it is easy for students and even the most celebrated senior faculty to let their hope for results or time constraints lower the rigor with which they treat their scholarship. Dishonesty and inadvertence must at all times be held in check and it is the university’s responsibility to communicate to all concerned clear and imperative rules of academic integrity and institute disciplinary procedures so that there are serious consequences for misconduct. Scholars and their research assistants need to be trained properly in being meticulous about avoiding that their cut-and-pasted notes from the Internet become confused with their own prose and in avoiding other forms of academic dishonesty that fall short of blatant plagiarism.

These issues seriously affect knowledge creation in China and India. In 2010, *Nature* reported that since October 2008, ‘a staggering 31% of papers submitted to the Journal of Zhejiang University–Science (692 of 2,233 submissions)’ were found to have contained unoriginal material. India comes second to China in the ‘shame sweepstakes’ of questionable research practices. In a study published in the US *Proceedings of the National Academy of Sciences*, the authors used English-language articles indexed by PubMED and found that ‘China and India collectively accounted for more cases of plagiarism than the United States, and duplicate publication exhibited a pattern similar to that of plagiarism’. According to an assessment of this study in the *Telegraph*, G.S. Mudur reported that ‘India accounted for 3.4 per cent (30 papers) of the 889 papers retracted for fraud or suspected fraud, 10 per cent (20 papers) of the 200 retracted for plagiarism, and

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9 per cent (26 papers) of the 290 retracted because of duplication, noting that ‘the analysis was not designed for country-to-country comparisons’ (see Figure 9.3). While Mudur stipulated that ‘the analysis was not designed for country-to-country comparisons’, he identifies a real problem, which will only increase as the pressure on Indian researchers to compete in the global knowledge creation field escalates.

Similarly, an empirical study of academic integrity in law schools and colleges across India by Jonathan Gingerich and Aditya Singh concluded that ‘plagiarism is a pervasive problem in Indian legal education’.


35 Gingerich, Jonathan and Aditya Singh, ‘Writing Requirements, Student Assessment and Plagiarism in Indian Law Schools’. India Law News (Fall 2010);
In July 2011, in an attempt to stem the rising tide of dishonesty in research, Indian scientists convened by the Institute of Mathematical Sciences and the Forum for Global Knowledge Sharing proposed the creation of ‘an office of research integrity that could detect, investigate, and punish proven scientific misconduct in the country’ and would ‘ensure authentic scientific output from the rapidly expanding scientific community’.

In the interim, an NGO called the Society for Scientific Values (SSV), established in 1986 with no legal or administrative powers, monitors cases of misconduct and speaks out. One of its members, Kasturi Lal Chopra, referring to recent cases involving researchers in high-profile institutions bemoaned the fact that ‘[t]here’s little done about this.’

The pressure to publish is so intense that even the brightest succumb. The responsibility of the university to reverse this trend and to ensure academic integrity cannot be overemphasized.

A related dimension of ethical conduct of research is academic freedom and freedom of scientific research. Shiv Visvanathan referenced the ecology of dissent and the ecology of debate during the March Conference. For that environment to be conducive to unfettered knowledge creation requires strict respect for academic freedom, a global concept supporting freedom of inquiry by faculty members, without which the learning and research functions of a university are and should be suspect. Accordingly, scholars have freedom to teach and disseminate ideas and information, however, inconvenient to the authorities, without fear of being fired or worse, subject to repression by the state. There is a delicate balance to be struck between negative consequences in terms of promotion and renewal of contract for academics whose research is sloppy, politically motivated, or offensive, on the one hand, and pressure being placed on the academic for espousing unpopular causes or expressing unconventional research findings. At the level of policy, universities must be explicit and public,
while also providing legal safeguards for faculty. It is an essential feature of a knowledge creating university to maintain this highest standard of academic freedom.

**Challenges Due to the Politics of Knowledge**

Knowledge is power. That oft-repeated bromide is open to a variety of interpretations. The sense in which it is used here is that knowledge can be distorted through the subtle abandonment of critical analysis of underlying political and financial interests and power relations in the process of knowledge creation. Barbara Harriss-White in her chapter ‘Science-Policy Interfaces in an Era of Global Commodification’ draws our attention to ‘abandoning the crucial critical and self-critical process through which science, and ultimately society, make progress’ in the de-politicised culture where natural scientists communicate with policymakers, contrasted with that of social scientists. 39 This is part of what she calls the ‘fourth culture’, that is, ‘an expert culture in which science, social science, and policymaking are tightly linked, and re-politicized through their joint de-politicization’. 40 She finds that the presumed de-politicization is based on the ‘assumption that if the current socio-economic model cannot be changed it is not the fault of science but of political leadership’. 41 Among the politically significant results is the masking of ‘relations of authority in the allocation of public resources towards the application of scientific advances to society’, and of the processes of privatization and commodification. 42 In sum, Harriss-White argues, ‘it makes political critique impossible’ of the ways in which commodification of the knowledge society places the private interests ahead of the public interest. 43

The challenge of the re-politicization of knowledge is part of a broader issue of the politics of knowledge. Hans N. Weiler identified four relationships between knowledge and power, namely, ‘… hierarchies in the existing knowledge order, … reciprocal legitimation between knowledge and power, the transnational division of labor in the contemporary knowledge order, and the political economy of the commercialization of

39 See Chapter 10 in this volume.
40 See Chapter 10 in this volume.
41 See Chapter 10 in this volume.
42 See Chapter 10 in this volume.
43 See Chapter 10 in this volume.
knowledge’. The ramifications of these four relationships are extensive. The privileged status of ‘hard’ sciences, of elite institutions, and of senior faculty sustains hierarchies as ‘a pervasive structural characteristic’. Knowledge is used to legitimate power (qualifications for careers, conditions for public funding) and political decisions are made with reference to certain forms of knowledge. Regarding the international division of labour, Weiler notes that the ‘international hierarchies of economic influence and political power’ are reflected in a sort of ‘orthodoxy of knowledge,’ exemplified by the World Bank. He cites Indian political psychologist and social theorist Shamans Ashis Nandy, who called for ‘a new, plural, political ecology of knowledge’ to challenge this hierarchy. Finally, he bemoans the fact that ‘creation of knowledge has come to be regarded and treated so pervasively in economic and commercial terms’.

All these concerns have implications for knowledge creation in the context of the future development of Indian universities.

A related challenge is that of preventing conflicts of interest from artificially determining the focus and the findings of research. What direct and indirect factors determine what is researched and what gets published? Can a researcher in a university understand the social engineering behind

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her options for research and be critical, where appropriate, of the role of the university in knowledge creation? Are those options limited to research that will not challenge prevailing structures? Part of the integrity of research requires disclosure of sources of funding and financial interests in entities affected by the research.

A typical definition of a conflict of interest is ‘a divergence between an individual’s private interests (competing interests) and his or her responsibilities to scientific and publishing activities such that a reasonable observer might wonder if the individual’s behaviour or judgement was motivated by considerations of his or her competing interests’.\(^{49}\) Conflict of interest disclosure is a commonly required and essential feature of research integrity in health and medical research.\(^{50}\) In other fields it is voluntary and a matter of individual ethics. The Guidelines on Good Publication Practice of the Committee on Publication Ethics (COPE) stated in 2003, ‘Conflicts of interest arise when authors, reviewers, or editors have interests that are not fully apparent and that may influence their judgments on what is published. They have been described as those which, when revealed later, would make a reasonable reader feel misled or deceived.’

Academic journals often require a conflict of interest statement or conflict of interest disclosure from authors, especially in medicine and public health. Similar policies would benefit Indian universities as they define their role in knowledge creation. There are other challenges to their emerging role, most of which are determined by the evolving field of Information and Communication Technology (ICT), addressed in the next section.

**FUTURE OF KNOWLEDGE CREATION IN THE UNIVERSITY**

Traditional modes of knowledge creation applied across the globe for centuries tend to focus on passive learning in the classroom, research in


\(^{50}\) See, for example, BMJ transparency policy: http://resources.bmj.com/bmj/authors/editorial-policies/transparency-policy, ICMJE (International Committee of Medical Journal Editors) uniform requirements for manuscripts submitted to biomedical journals: http://www.icmje.org/urm_main.html;
libraries, labs, and field settings. The future is clearly wound up with the development of ICT. As a result, Indian universities will have to change their priorities to adapt to new technologies. Profound changes have occurred in human history with the shift from oral to written modes of recording and transmitting knowledge, to the proliferation of print media and eventually to the technology of hypermedia made possible by the web today, all of which has affected not only the classes of people who can access knowledge but the very functioning of our brain. The ‘plasticity of our neural pathways,’ explains Carr, is such that ‘the more we use the Web, the more we train our brain to be distracted. … As our use of the Web makes it harder for us to lock information into our biological memory, we’re forced to rely more and more on the Net’s capacious and easily searchable artificial memory, even if it makes us shallower thinkers.’ The challenge for knowledge creation in higher education in the first half of the twenty-first century is to anticipate the impact of ICT and especially the web on both the classroom and the use of books as well as on the very neural circuits of our brain.

Disappearance of the Classroom

Devesh Kapur, Director, Institute of the Advanced Study of India, told the March Conference that it is impossible for India to build enough brick and mortar universities to meet demand. Hence, the future of research clearly calls for the imaginative use of distance learning and other ICT advances insofar as education and knowledge creation cannot be fully accommodated in the physical plant of the universities.

Alternatives are emerging to the traditional classroom experience of the university. The appeal of massive open online courses (MOOCs) is undeniable in order to reach thousands of students with well-structured courses but without faculty or classrooms. The online courses are offered through open access, typically without academic credit or charging tuition fees. Since their launch in 2008, about 10 per cent of the tens of thousands of students enrolled in MOOCs actually completed their courses. Several

52 Carr, The Shallows, p. 194.
53 Remarks made during the first thematic session at the March conference.
variants emerged around 2012 inside and outside universities. Students can follow courses individually at their own pace through the Khan Academy, Peer-to-Peer University (P2PU), and Udemy outside of the university system. Several major universities offer other online teaching. Among the better known is EdX, which was founded in 2012 by Harvard University and the Massachusetts Institute of Technology (MIT) and now involves some 108 members in a growing list of the major universities in the world,\textsuperscript{55} including one in India, the Indian Institute of Technology Bombay, although it had not offered any courses by fall 2013.\textsuperscript{56} EdX is an open online course platform through which people anywhere in the world can follow online university-level courses in a wide range of disciplines. Harvard and MIT contributed $30 million each to this non-profit project. The president of Harvard, Drew Faust met, with alumni and business leaders in Hong Kong to discuss Harvard’s online learning initiative, HarvardX, and its role in EdX. ‘This is a moment of transformation for education, and we want to be able to lead in a way that allows us to enhance our outreach to the world, even as it helps us understand new ways to teach our students on campus,’ said Faust.\textsuperscript{57} By 2017, EdX had reached over 11 million learners in every country in the world.\textsuperscript{58} Faust explains,

\textit{[t]he hunger for knowledge is so strong around the world ... I feel [HarvardX] is a magnificent opportunity, but it is also a big responsibility for us to set a standard for online learning that upholds the most important aspects of higher education and its values, and allows Harvard to play a leadership role in shaping how education changes in the years to come.}\textsuperscript{59}

One source predicted that MOOCs ‘may change the university and college system forever.’\textsuperscript{60} As a tool for learning that offers the

\textsuperscript{55} EdX, available at: https://www.edx.org/schools.
\textsuperscript{56} https://www.edx.org/school/iitbombayx/allcourses.
\textsuperscript{57} http://news.harvard.edu/gazette/story/2013/03/harvards-hand-in-shaping-education/.
\textsuperscript{58} Available at https://www.edx.org/schools-partners.’
\textsuperscript{59} http://news.harvard.edu/gazette/story/2013/03/harvards-hand-in-shaping-education/.
advantage of reaching hundreds of thousands without requiring the expenditure on classrooms and faculty, MOOCs and EdX present a tempting trend for Indian universities. Some predict that, as established universities offer degree credits for those students who complete MOOCs, ‘this will drive a dramatic reduction in the price of a traditional higher education’. However, if this occurs, the students may access quality teaching but their university loses the incentive to offer its own courses in critical areas and hire faculty, thus diminishing their capacity to contribute to knowledge. On the positive side it reflects two trends in knowledge creation.

The first is based on connectivist theory, according to which learning and knowledge are not transmitted from repositories of knowledge in libraries or didactic teachings but emerge from a network of connections. The second innovative feature is the ‘classroom reversal’, meaning that, in place of students listening to lectures and doing assignments outside the classroom, the lectures are watched online in private at a pace than ensures the students absorb the material, and then the exercises are performed in groups, in a collaborative, problem-solving way, closer to how people use knowledge in their professional life. This way of learning is growing rapidly and Indian universities will face difficulty in deciding whether and to what extent they should participate.

The Digital Gap

But ICT is not just for teaching: perhaps more important is how dependent research is on computer technology and the Internet for access to journals; publishing online; collecting, storing, and analysing data. One of the most visible advances in the ICT field is broadband, which is transforming societies through use of the Internet in developed countries. The failure to realize the right to benefit from advances in technology is reflected in the persistent broadband divide. In developed, as well as in many middle-income countries, the cost of access to the Internet is on the decline, yet

it remains unaffordable to the majority of low-income developing countries.\textsuperscript{62} In 2011, fixed broadband penetration was 26 per cent in developed countries and only 4.8 per cent on average in developing countries.\textsuperscript{63} As the MDG Gap report noted,

\begin{quote}
[a]lthough the cost of ICT services has been decreasing, they remain much higher in developing than in developed countries. Costs are still prohibitive for the majority of people in some regions, especially Africa. Mobile cellular services cost, on average, about 10 per cent of per capita income in developing countries, but their cost is as high as 25 per cent of per capita income in Africa. The average cost of a fixed broadband subscription in Africa is almost three times the per capita income. In developed countries, however, the average cost per user is less than 2 per cent of per capita income.\textsuperscript{64}
\end{quote}

The worst off are Oceania, South Asia and sub-Saharan Africa, where fewer than one in nine people have Internet access.\textsuperscript{65} Compared to the international average of 5.6 mbps, India provides only 256 kbps and only 260,000 broadband connections are available in rural India, in spite of 2007 being the Year of Broadband for India. Of the 100 million Internet users in India only 12.5 million have broadband compared to 450 million in China.\textsuperscript{66}

The Economist Intelligence Unit calculates that India ranks near the bottom in broadband penetration, as show in Figure 9.4.

The importance of broadband for India’s development was recognized at a Broadband Summit, organized by KPMG International, a Swiss entity,


and the Confederation of Indian Industry (CII) in New Delhi in September 2012. According to the summit report, ‘[i]n India, the drive to facilitate widespread broadband access has been high on the national agenda since several years now.’\(^{68}\) However, as their data show, ‘[c]urrently, broadband penetration in India is just around 10 per cent of the Internet user base and approximately 1 percent of India’s population—one of the lowest in the world as compared to other economies such as Russia (11 per cent), Brazil (7.5 per cent) and China (9.5 per cent).’\(^{69}\)


\(^{68}\) KPMG International Cooperative (‘KPMG International’) and Confederation of Indian Industry (CII), Broadband ecosystem for inclusive growth, Broadband Summit (28 September 2012), New Delhi, KPMG, 2012.

The future of knowledge creation in Indian universities will be disappointing until researchers and students have much better Internet access. The need to participate in online courses and access electronic journals is obvious. Conducting research also requires the need to access big data. In his inaugural lecture at the March Conference, John Wood explained how the tools of E-science are generating a tsunami wave of data. The data deluge will be used for research in countries that can handle all the petabytes he talked about. If India’s universities do not achieve the sort of progress achieved, for example, by universities in South Africa, it will not reach its full potential in terms of competitiveness as it might in those research fields that need such data. India for now is at a disadvantage in this dimension of knowledge creation through massive data analysis. It is likely to catch up through think tanks and advanced research institutes. However, if universities are to be able to contribute to knowledge creation of this type, a radical transformation of their ICT capacity is necessary.

Disappearance of the Book

Traditional knowledge creation involves consigning new knowledge not only to specialized journals, but also to learned tomes that line the shelves of university libraries. Hard print books have been with us since Gutenberg. The great Alfred North Whitehead wrote in 1925—and he was no doubt correct—that the ‘chief tool [of education] is the printed book.’ But that was before computers and the Internet. We are living in a time of great change.

Indian universities need to address the issue of the purported disappearance of the book as they determine whether and how to increase availability of books for research and teaching or to shift to digital sources.

The Wall Street Journal reported in early 2013:

[P]undits have assumed that the future of book publishing is digital. Opinions about the speed of the shift from page to screen have varied. But the consensus has been that digitization, having had its way with music and photographs and maps, would in due course have its way with books as well. By 2015, one media maven predicted a few years back, traditional books would be gone.

70 John Wood’s inaugural lecture in the March conference.
Half a decade into the e-book revolution, though, the prognosis for traditional books is suddenly looking brighter. Hardcover books are displaying surprising resiliency. The growth in e-book sales is slowing markedly. And purchases of e-readers are actually shrinking, as consumers opt instead for multipurpose tablets. It may be that e-books, rather than replacing printed books, will ultimately serve a role more like that of audio books—a complement to traditional reading, not a substitute. ... Having survived 500 years of technological upheaval, Gutenberg’s invention may withstand the digital onslaught as well. There’s something about a crisply printed, tightly bound book that we don’t seem eager to let go of.  

Books continue to be printed, of course. The number of new titles per year, per country, as of the latest year available:

- United States (2010) 328,259 (new titles and editions)
- United Kingdom (2005) 206,000
- China (2010) 189,295 (328,387 total)
- Germany (2009) 93,124
- Spain (2008) 86,300
- India (2004) 82,537 (21,370 in Hindi and 18,752 in English)
- Japan (2009) 78,555
- Iran (2010) 65,000
- France (2010) 63,690 (67,278 total)
- South Korea (2011) 44,036
- Taiwan (2010) 43,309
- Turkey (2011) 43,100

TOTAL: approximately 2,200,000

This resilience should not cloud the reality of internet-based research, where printed materials are not as important as immediate access to millions of journals and articles and books and petabytes of data. And yet

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73 Available at http://www.worldometers.info/books/.
some libraries are entirely electronic. The challenge for the university is to have the bandwidth, stable grid, infrastructure, and trained staff as well as affordable data plans so that ICT will become an instrument of rather than an obstacle to knowledge creation.

* * *

Higher education has been described as evolving ‘far more as a market, with university and colleges competing to supply the service of education.’

In March 2013, on the first day of a weeklong visit to Asia, Harvard President Drew Faust called knowledge ‘the most important currency of the 21st century,’ highlighting faculty research, student engagement, and online learning as central to Harvard’s global strategy. During that visit, ‘[t]he local leaders told Faust that the continued evolution of Hong Kong’s economy from manufacturing-based to knowledge-based was creating a need for new thinking in higher education, including curriculum reform shifting from three-year to four-year undergraduate degrees, along with a greater emphasis on international issues, service-oriented learning, and the liberal arts.’ This shift is exactly what has been proposed for India. If change is called for, it is appropriate to reflect here on what model best fits India’s needs.

Two Models of Change

Hazelkorn, in her study for UNESCO on the ‘Impact of Global Rankings on Higher Education Research and the Production of Knowledge’ identified two models to achieve excellence in knowledge creation. Before examining her two models, it is important to stipulate a reservation regarding the obsession with rankings. Professor Shiv Visvanathan insightfully told the March Conference that ‘autonomy and playfulness’ are more meaningful than rankings. Nevertheless, although Indian

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77 Shiv Visvanathan, Chapter 2 in this volume.
universities will probably continue to attach importance to rankings,\textsuperscript{78} the value of the models proposed is that they seek to enhance the university’s potential for excellence regardless of the motivation for striving towards excellence.

1. The neo-liberal model aims to create greater reputational (vertical) differentiation using rankings as a free market mechanism to drive the concentration of ‘excellence’ in a small number of research-intensive universities in order to compete globally. China, France, Germany, Japan, Korea, and Russia prefer to create a small number of world-class universities, focusing on research performance via competitions for Centres of Excellence (CE) and Graduate Schools. This model has two main forms: Model A, which jettisons traditional equity values (for example, Germany), and Model B (for example, Japan), which upholds traditional status/hierarchical values. The United Kingdom (UK) attempted another variation of this model by formally distinguishing between teaching and research institutions, but abandoned this by relying on the impact of performance measurement, for example, the UK Research Assessment Exercise (RAE).

2. The social-democratic model aims to build a system of horizontally differentiated high performing, globally-focused institutions, and student experiences. In contrast to an emphasis on competition as a driver of excellence, Australia, Ireland, and Norway, aims to support ‘excellence wherever it occurs’ by supporting ‘good quality universities’ across the country, using institutional compacts to drive clearer mission differentiation.\textsuperscript{79}

Although her examples were based on the experience of advanced economies plus China, the basic options for India are not very different.

\textsuperscript{78} One source commented on the 2012 rankings, ‘Unfortunately, this year too, no Indian university features in the top 200 list.’ Why Indian universities don’t make it to world rankings. Rediff.com (15 November 2012). Available at http://www.rediff.com/getahead/slide-show/slide-show-1-career-times-higher-education-worlds-best-universities/20121005.htm.

What Works for India?

The lessons from the application of the two models challenge India to decide which one fits best with its aspirations. Professor Ved Prakash, Chairperson, University Grants Commission (UGC), gave a partial answer when he told the March Conference about the Government’s commitment to ‘expansion, equity, and excellence’ and its duty to be inclusive and cater to children of diverse backgrounds. 80

The immediate future will be a test for the social-democratic model to bring India up to the level of knowledge creation and quality of research consistent with their extraordinary contribution to global civilization. Political shifts may lead a different government to consider the neo-liberal model. India is diverse enough to pursue both, with government sponsored centres of excellence along with numerous high quality universities, where outstanding contributions to knowledge emerge from intellectual curiosity and perseverance of scholars rather than focused funding of research aimed at competing with world-class research institutions in other parts of the world.

The essential change Indian universities will need to make in order to differentiate the future of knowledge creation from its past is to develop an environment conducive to research such that the finest minds of the nation will prefer to advance knowledge at home rather than abroad. The requirements for such an environment, as described in this chapter, relate to the aims of knowledge creation, the institutional setting, selection among fragmented fields of knowledge and levels of degrees, inculcation, and enforcement of ethical standards, responses to politicization and commodification of knowledge, and adaptation to new technologies. In sum, Indian universities face special challenges in cultivating knowledge as an end in itself through education that should take account of the various forms of knowledge and types of intelligence. They must have an institutional design (human and financial resources, governance, affiliations, networks, etc.) adequate to provide a solid structural foundation for research and learning and apply an instructional design that both educates citizens of the global community and prepares career pathways that draw on a sufficiently wide range of disciplines and opportunities for cross-disciplinary reflection and applications. At the same time, the

80 Remarks made at the inaugural lecture at the March conference.
conditions for research must ensure academic integrity and freedom and remove perverse incentives that result from the politicization of knowledge and conflicts of interest. Finally, given that Indian universities cannot provide classroom and library structures adequate to meet the growing demand, they must be at the forefront of developments in ICT, without succumbing to fashionable trends that in the long run may not be conducive to sustained knowledge creation. Such are the challenges of knowledge creation in Indian universities as they approach an era of unprecedented expansion.