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5. INDIA's HIGHER EDUCATION SECTOR: CHALLENGES AND OPPORTUNITIES

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ABSTRACT

For both developed and emerging economies, knowledge and innovation will increasingly drive competitive advantage, according to a great deal of analysis conducted by the OECD and other Institutions. Higher Education is a key component of future competitive advantage in the knowledge and innovation spheres. This paper will examine the challenges and opportunities for the Indian Higher Education Sector, as it grapples with meeting the needs of a changing economy, and providing access and opportunity for millions of its population. Drawing on a variety of data sources and benchmarking India against a number of nations around the world, this paper contends that India needs to further significantly reform its Higher Education sector in areas of quality, efficiency, accessibility, internationalisation and in meeting labour force needs. This paper will also recommend further policy initiatives.

KEYWORDS: Higher Education, Knowledge Economy, Knowledge Traits, Knowledge Transfer, Knowledge Transformation, Knowledge Translation.

INTRODUCTION

The Indian Higher Education scene is, and continues to be, in need of a dramatic overhaul. This paper explores the challenges facing the Indian Higher Education scene and puts forward some solutions going forward. Where feasible and appropriate it benchmarks India's performance against other nations.

Education and training, including in Higher Education, has many benefits and roles: as a supplier of labour to meet industrial, economic and societal needs; as research inputs into the knowledge economy; to enhance participation in civil society; address significant inequality of income and opportunity, promote empowerment including of women and minorities; and especially in earlier years of education, promote health outcomes. Various studies point to positive impacts of investment in Human Capital on economic growth and that social and economic returns from investment in human capital are at least as important as physical capital. In addition, raising skill levels give rise to better quality jobs and higher salaries. Quality of education matters (Khare 2016).

A current day and future University and Institute of Higher Education, is in many senses a knowledge manager which incorporates all aspects of knowledge from its creation through to its diffusion and deployment, aimed at solving commercial and societal challenges.

In our view, this is encompassed in four different domains: Traits; Transfer; Transformation and Translation

At its minimum Universities and Higher Education Institutions need to have the traits of efficiency, access, accountability and effectiveness, and provide a high quality of education.

Knowledge Management also encompasses the idea of knowledge transfer-taking existing knowledge sets and diffusing them to the wider economy and society. Universities need to be adept in being able to disseminate knowledge on a wider scale.

Knowledge transformation is the capacity and potential to shape in a meaningful, and often radical way, the contours of economy and society, through, for example developing new industries, improving competitiveness of existing industries, fostering new and improved technologies and business models and meeting economic and social challenges. In this way universities become important problem solvers of complex challenges. It is fundamentally about innovation in all its guises and forms.

Knowledge translation, to our way of thinking, means an open, inquiring, and accepting mindset in which knowledge garnered from elsewhere, is melded with existing internal knowledge for the betterment of economy and society. It is about the ability of Institutions to incorporate and absorb, and further develop knowledge that is garnered externally. In this way Universities can act as a critical information filter deploying capabilities that link with other sources of knowledge.

In all domains, Universities are vital conduits for flows of knowledge in economy and society, both as drivers and as conduits. They also play a vital role as suppliers of labour, purchasers of goods and services, as centres for excellence and as cultural and economic hubs. The role of Universities as anchors for economic development is underscored by institutions such as Stanford, and MIT, which drive and shape economic development through research, technology transfer, new business development and spinoff's and the like.

Section one of this paper considers traits, section two transfer, section three transformation and section four translation. Section five provides some broad policy recommendations.

SECTION ONE TRAITS

In terms of the traits referred to earlier, India performs quite poorly.

A plethora of reports and studies have found serious issues with governance, accountability and efficiency. The key issues include: over burdensome regulations and standards concerned more about inputs around what can be taught, how, much investment in assets and facilities is to be undertaken and various rules and regulations about staffing, promotions and the like; poor and variable quality standards across the system including the proliferation of sub-standard institutions; pedagogy which emphasises rote learning rather than innovation; corruption in appointments, maladministration and government interference; significant weaknesses associated with the college affiliation system in terms of lack of autonomy for colleges; equity and access issues; and lack of co-ordination and appropriate planning in capacity and capacity utilisation; and funding anomalies between Central and State Governments (Agarwal 2009, Altbach 2014, British Council 2014, Government of India (a) 2013, Government of India (b) 2016).

This paper focuses on some of these key factors. At the outset it needs to be stated that the current, modern day Indian Higher Education scene is a reflection of twin legacies. The British rule imposed a system of rote learning and affiliated colleges, over- turning in many ways India's traditional system of learning based among other things on the oral tradition and embodying close knit learning and teaching about life and philosophy between pupil and guru attuned to India's traditions, culture, values and philosophy. According to Tharoor and others the British rule was designed to subjugate Indian Higher Education (and indeed the innovation system as a whole) to British interests, including through English as a medium of instruction (Altbach 2014 and Tharoor 2016). Indeed Tharoor, goes on to say in reference to the teaching of English and quoting Lord Mcaculey that " this was designed also to teach a minority of Indians to form a class who may be interpreters between us and the millions whom we govern" (Tharoor 2016 page 219).

The second legacy that the current Indian Higher Education scene faced and faces is that of the post-independence era in which authorities, through the five year plans and other initiatives, centrally determined the patterns of economic and social development entirely including establishing elite public institutions to meet national needs in research and technology, thus rendering Universities largely as teaching rather than research bodies, with notable exceptions among the Indian Institutes of Technology (Altbach 2014 and Krishna V and Patra 2015). It also meant that research bodies in the public domain were guided by central parameters about national development rather than market forces and needs of entrepreneurs.

The affiliated system of Universities and Colleges which continues today is a particular source of angst. Under this system the University awards a degree and sets curriculum and examinations, among other things and Colleges merely implement these dictates. According to many this "dead hand" approach has led to lack of autonomy, creativity and innovation at the College level, and in a manner which does not accommodate local needs and circumstances. For Universities, there is the problem of burdensome administrative oversight of Colleges which deflects resources from research and other academic initiatives, and the affiliation fees that Colleges provide sets up rent seeking activities on the part of Universities (Government of India (a) 2013, Kapur and Mehta 2017).

GROWTH IN THE SYSTEM

The system has seen a rapid proliferation of these institutional arrangements, especially Colleges. At the aggregate level, enrolment in Higher Education has grown by 18.5% between 2011-2012 and 2015-2016, compared to overall institutional growth of 15.8.%. This however, is masking some significant key facets.

Table 1: Institutional and Enrolment Growth 2011-2012 to 2015-2016

	Enrolment Growth	*Institutional Growth*
Public Universities (National and State Universities)	17.6%	14.8%
Private Universities	39.1%	37.3%
Public Colleges	37.2%	29%
Private Colleges	70.4%	62.7%

Source AISHE various reports, author calculations

From the system is that the system is in a rapid growth phase (and is one of the very largest in the world with 35 million enrolments), as it has been over the last decade and beyond (Ernst and Young 2012, Price Waterhouse Coopers 2012). Another feature of this is the massive shift in the composition of enrolment and institutional growth, towards much greater privatisation. To the figures in the table can be added growth in stand alone institutions (diploma granting ones) of 7%, between 2011-2012 and 2015-2016 where more than 75% of these institutions are privately run.

Yet there are serious implications of this development. Much has been written about the proliferation of private Institutions and Colleges, including in professional and technical areas, often either unregulated, of very poor quality, established rapidly merely as money making devices and through excessive patronage by Government backers (Kapur and Mehta 2017, Government of India (b) 2016). The rapid proliferation of institutions has also created issues such as the inability to hire teachers with faculty shortages running at 40% (Government of India (b) 2016). This is also associated with red tape and restrictions on hiring, poor standards in teacher training, and the lure of higher paid salaries in other industries. It has also meant spreading resources thinly across the entire system, therefore lacking critical mass.The proliferation of institutions has clear implications for capacity utilisation, availability of suitably qualified, and rates of return on investment.

If we take college enrolment as a guide, which is the mainstay of the system, dominating enrolments, enrolment per College has over the period 2011-2012 to 2015-2016, increased only from 721 to 723 while average number of colleges per lakh of population (ages 18-23) has gone from 25-28. Thus it would appear that in the face of the need to cater to an expanding tertiary education population, the focus has been on creating more and more Institutions rather than on better capacity utilisation. The preference has been on “ribbon cutting” exercises in opening new institutions.

The 12th Plan noted this issue clearly when it claimed that “With the growth rate of Institutions matching that of enrolment, the problem of low enrolment per institution evident at the start of the Eleventh Plan remains and that “ this should be realised ….through “ increasing capacity within existing institutions rather than creating new institutions” (Government of India (c) 2012 page 94).

The Planning Commission also speaks of a poor geographical spread of institutions with large concentrations in big cities and towns. It finds that there were a large number of areas with populations between 10,000 and less than 100,000 without proximity to institutions (Government of India (c) 2012). From other perspectives, some states such as Maharashtra and Karnataka have average enrolments of colleges of less than 500 while other States such as Bihar and Jharkand have 1716 and 1427 respectively, while the average across India is 721. Similar discrepancies are found when considering colleges per lakh of population. Indeed, according to the All India Survey on Higher Education (AISHE), overall some 62.7% of Colleges have less than 500 enrolments (AISHE 2015-2016).

What is missing is a more nuanced careful planning of the system linking more carefully student growth with facilities, potential consolidation of existing institutions to build scale and critical mass, obtaining a balance between online (which is not capital intensive) and physical infrastructure and delivery and providing access on a co-ordinated, balanced spatial approach.

BUREAUCRACY

Another key feature that we note is the growing bureaucratisation of the system.

Table 2: Growing Bureaucracy

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Professional staff/teacher ratio	0.64	0.69	0.72	0.74	0.74
Pupil/teacher	23.4	23.0	23.6	23.2	22.8

Source AISHE various surveys, Author Calculations

While the pupil/teacher ratio has remained broadly stable over the last five years or improved slightly (although worsened in 2013-2014), the professional staff/teacher ratio has increased steadily, suggesting that the "bureaucratisation" of the system has increased. Scarce resources have been steadily deployed towards administration rather than to teaching and research, the raison d'etre of education.

PUBLIC AND PRIVATE ROLES

While growth in institutions and enrolment has been fuelled by private sector growth, this paper takes the view that the private provision and consumption has a definite role to play, in concert and conjunction with a carefully articulated and implemented public role however. Higher Education contains features of mixed goods. On the one hand, externalities associated with research, information gaps for students, risk and uncertainty in terms of unknown future returns from investment in education and training, capital market imperfections, and equity and access issues, all warrant a strong public role (Chowdry 2009). On the other hand, it is the case that individual graduates derive considerable private benefit in the form of salaries and other remuneration, stemming from higher education, while private provision can provide much needed capital, management experience and innovation into the system. Thus, what we argue for is a balanced system of public and private participation, in which both sectors co-exist, complement each other and even at times collaborate. The role of the public sector can be manifold and varied to suit needs and circumstances, including provision of education through public institutions, subsidised support for institutions and students, appropriate regulatory oversight, and information provision to students about choices of study.

Yet what we have seen in India is a diminished role for the public sector in expenditure on Higher Education.

The first observation to make is that over the 5 year period, India has gone backwards in terms of government funding per student, a trait shared only with Pakistan, and to a lesser extent Germany, of the 16 countries that we benchmark against. The second point to note is that India is considerably lower in both years than nearly all of the benchmark countries. Third that India is behind its natural counterparts in BRIC countries (minus China for whom we don't have data) and worryingly behind Sri Lanka in 2015 and other emerging countries in Malaysia and Thailand although Bangladesh lags far behind. Indeed in 2015, India was behind Pakistan on this measure. India is faring worse on this criteria, than some nations which have GDP levels many times lower than it. It appears that it is less about capacity to pay in the case of India but more about willingness, capabilities and planning.

More broadly, is the question of overall deployment of resources to Higher Education. According to Universitas 21 India ranks 38th out of 50 nations on overall resources dedicated to Higher Education, although noting that India performs better when allowance is made for level of economic development (Universitas 21 2017).

Table 3: Initial Government funding tertiary per student (U.S $)

	2010 or nearest year	2015 or nearest year
India	788.4	711.4
Australia	11101.1	13838.3
Bangladesh	151.4	202.4
Brazil	3122.5	3561.5
Chile	2056.5	2499.7
China	-	-
Germany	17641.3	17515.6
Japan	9968.6	9951.2
Malaysia	4111.2	4918.8
Pakistan	941.5	788.5
Republic of Korea	2232.1	4472.6
Russian Federation	1666.9	2202.9
Sri Lanka	522.0	1054.9
Thailand	814.2	1120.99
U.K	9092.8	16127.3
U.S	9813.96	14842.5

Source : UNESCO

Much of the slack has been increasingly taken up by the private sector, including in all tiers of education. By our calculations in the tertiary sector, total private expenditure in tertiary education has grown almost 3 times in 6 years from 1430923621.9 U.S dollars to 3573435471.3 U.S dollars between 2007-2008 and 2014 . India's growth of privatisation of its education system is mostly unmatched by other countries.

DIVERSITY AND QUALITY

Diversity in Higher Education is in our view an essential trait of a modern system. It allows for greater student choice, fosters synergies and complementarities across disciplines necessary for leading edge research, and provides a breadth of skills that a complex knowledge economy would require. In fact, we propose that India should aspire to diverse specialisations, which integrate deep learning and knowledge with breadth across the system.

Yet India suffers from an "Illusion of diversity". Despite grandiose named institutions of national importance and the proliferation of technical colleges, the fact remains that 71% of graduates are from just three fields: arts, science and commerce with general arts degrees representing more than 36% of graduates (University Grants Commission 2015-2016). As the University Grants Commission (UGC) comments despite the importance of agriculture and veterinary sciences to the Indian economy, very few are enrolled in this area, while the system needs to focus on more vocationalisation of education (University Grants Commission 2015-2016).

On quality, some 32% of accredited institutions have been rated A grade or above, and out of colleges only 9% of accredited institutions are rated A. 68% of Universities and 91% of Colleges are rated average or below. (Government of India (b) 2016.) Many colleges and universities are still not accredited with the National Assessment and Accreditation Council (NAAC). Raising quality is a major challenge for the Indian higher education sector, a task extremely important but complicated in an era of mass education.

Moreover, the system has very limited practical application. According to a recent survey of what matters to Indian students, a common refrain is that one of the reasons for seeking to go abroad is the absence of practical applications in Indian courses, and that many specialist areas of learning are not available in India (QS (a) 2016).

To be fair there are a number of high performing, well managed and reputable institutions. For example, the Indian Higher Education scene has been described as a “ Islands of excellence in a sea of mediocrity” (Altbach 2014 page 503). For example, Indian Institutes of Technology and Indian Institutes of Management are of good quality, while many non profit colleges and some private post graduate professional colleges and newer universities exhibit favourable traits (Altbach 2014).

THE LEAKY PIPELINE AND ACCESS

Table 4: Gross Enrolment Ratio Tertiary 2016

India	26.9%
Australia	90.3%
Bangladesh	13.4%
Brazil	50.6%
China	43.4%
Chile	88.6%
Germany	68.3%
Japan	63.4%
Malaysia	26.1%
Pakistan	9.9%
Republic of Korea	93.2%
Russia	80.4%
Sri Lanka	19.8%
Thailand	48.9%
U.K	56.5%
U.S	85.8%

Source : UNESCO

Access and Opportunity is a key trait of a modern economy. Despite improvements in recent years, for a variety of economic and social factors, India has one of the lowest rates of Tertiary Gross Enrolment of the benchmark set. Gross enrolment ratios vary widely on a state by state basis and across various socioeconomic groups in society. It should be noted that the difference in gender is not as pronounced as it was once was. It is open to question whether the system of reservations and affirmative action for various socio-economic groups has achieved its intentions.

India has a significant problem of "leaky pipes". Pre-tertiary level enrolments are at the lower end of the international comparator set, meaning that the flow through of potential entrants into tertiary education is not occurring. This is counter to the notion of an inclusive education and training system.

As the following table shows, with about 74% Gross Enrolment Ratio in Secondary and Gross Enrolment Ratio of 63.6% in upper secondary, India has among the lowest out of the benchmark set of countries even accounting for improvement over time, while the share of population (above 25 years of age) with at least some secondary education, 48.7%, means that India is relatively poorly placed when considering other nations, especially BRIC and developing nations (Table 6).

Table 5: Gross Enrolment Ratios: Secondary and Upper Secondary

2000		2005		2010		2015		
	Secondary	Upper secondary	Secondary	Upper Secondary	Secondary	Upper Secondary	Secondary	Upper Secondary
India	45.1	32.9	54.2	40.5	63.2	50.3	73.97	63.6
China	61	38.96	68.5	48.9	84.9	69.9	94.3	89.7
Brazil	109.99	90.6	101.3	90.6	95.3	89.2	99.65	91.4
Russia	91.5	96.7	82.9	92.7	92.1	90.3	104.5	113.6
Australia	162.6	249.6	148.4	220.6	132.5	168.5	137.6	186.4
Bangladesh	48.1	34.9	45.5	30.9	50.1	39.4	63.5	48.4
Chile	87.1	83.3	97.7	91.8	94.6	91.4	100.7	99.6
Germany	101.6	99.3	102.5	101.6	103.98	106.8	102.7	104.9
Japan	101.8	100.5	101.0	102.2	101.6	101.4	101.8	101.2
Malaysia	66.2	45.8	68.7	51.6	66.9	48.6	77.6	69.4
Pakistan	22.9	13.1	26.5	15.9	35.9	27.4	44.5	35.5
Republic of Korea	98.4	95.9	93.2	82.9	96.1	93.8	98.9	95.3
Sri Lanka	-	-	71.6	55.99	83.6	68.9	129.0	130.4
Thailand	62.8	54.5	71.6	55.99	83.6	68.9	129.0	130.4
U.K	101.9	103.6	105.4	108.4	101.9	96.5	127.8	138.24
U.S	93.95	84.9	95.4	88.3	94.3	89.5	97.6	93.3

Source: UNESCO

Table 6: Population with at least some secondary education 2010-2015 (% ages 25 and above)

India	48.7%
China	75%
Brazil	57.5%
Russia	94.6%
Bangladesh	43.1%
Pakistan	35.4%
Australia	91.5%
Germany	96.7%
U.S	95.3%
U.K	82.9%
Japan	91.8%
Republic of Korea	91.4%
Chile	76.5%
Malaysia	77.1%
Sri Lanka	80.5%
Thailand	43.3%

Source : UN

Of concern is the discontinuation (and drop out rates) which indicates clearly that the transition from one level to another level is highly problematic.

Table 7: % of dropped out/discontinued persons among ever enrolled by level of last enrolment (ages 5-29)

	Completed level of last enrolment (Discontinuance)		**Did not complete last level of enrolment (Drop out)**	
	2014	2007-2008	2014	2007-2008
primary	12.9%	13%	10.1%	12.0%
Upper Primary	25.9%	17.3%	16.2%	26.5%
Secondary	30%	27.3%	20.7%	30.2%
High Secondary	34.7%	32.5%	10.8%	19.2%
Diploma	35%	25.3%	4.4%	2.3%
Graduate	41.3%	45.2%	4.7%	8.4%
Post Graduate and above	51.8%	60%	2.9%	4.0%
All	25.2%	20.4%	12.7%	19.4%

Source : National Sample Surveys Office (NSS0)

Overall, while drop out rates have declined across the board, discontinuance has increased between 2007-2008 and 2014 and continue to be significant, especially in the secondary and higher secondary levels. These are the levels that feed into Higher Education. Also discontinuance at higher levels of Graduate and Post Graduate continue to be significant although have declined.

What are the reasons for this? Surveys around discontinuance and dropping out point out that for both males and females, across various ages , four key and inter-related features stand out: financial constraints on households; economic activities e.g working in home business especially for males who may have to assume the breadwinner role ; domestic activities, particularly for females across all age groups, and more so for the age group of 6-15 for females; and "not interested in education" which also shows up among among males and females among the lower age groups (NSSO 2014).

These figures reiterate and reflect the broader features of Indian society and economy. They boil down to income insecurity in households, including vulnerable employment among family members, potential costs of education and social conditioning and tradition which still places priority on females getting married at early ages, and providing the domestic support in running households. Finally, and also of concern is the lack of interest in education among people. This raises questions and perceptions about its value and reputation. It can be inferred that the Indian mode of pedagogy with its emphasis on rote learning, examination and outdated curriculum may not be stimulating younger people enough, nor drawing out their innate capabilities of creativity and innovation. Modernisation of modes of teaching and income support to allow for more engagement with education may be the key to greater participation.

Table 8: % dropping out/Discontinuing by main reason (Male)

Ages	**Financial constraint**	**Economic activities**	**Domestic activities**	**Not interested in Education**
5	67.6	2.2	3.6	25.5
6-10	26.8	16.2	4.3	43.3
11-13	29.3	23.8	5.8	33.2
14-15	25.4	29.7	4.9	27.4
16-17	24.2	33.9	5.1	21.5
18-24	16.6	41.1	4.0	8.3
25-29	3.2	42.4	1.4	3.2

Source National Sample Surveys Office (NSSO)

Table 9: % dropping out/Discontinuing by main reason (Female)

Ages	Financial constraint	Economic activities	Domestic activities	Not interested in Education
5	33.2	0	14.2	23.1
6-10	16.9	3.6	32.4	33.0
11-13	18.7	3.6	37.3	22.5
14-15	17.3	33.9	33.9	16.1
16-17	15.6	26.3	26.3	11.7
18-24	9.5	21	21.0	4.6
25-29	2.9	19.6	19.6	2.1

Source National Sample Surveys Office (NSSO)

SECTION TWO: KNOWLEDGE TRANSFER

One of the most important roles of a Higher Education system is to transfer knowledge to the wider community. One manifestation of this which we focus on is through highly skilled labour. High skill, high wage, high value jobs are a hallmark of a knowledge intensive economy. Yet this does not appear to be occurring in any meaningful way.

Table 10: Employment (000's)

	High Skilled Employment 2011	High Skilled Employment 2015	Medium Skilled Employment 2011	Medium Skilled Employment 2015	Low Skilled 2011	Low Skilled 2015	Total 2011	Total 2015
India	61698	72040	264485	283649	130749	128418	456932	484106
China	80404	91463	615324	616127	61463	62989	757192	770579
World								
India Share of employment by skill category	13.5%	14.9%	57.9%	58.6%	28.6%	26.5%		
China share of employment by skill category	10.6%	18.9%	81.3%	79.95%	8.1%	8.2%		

Source ILO, Author Calculations

Table 11: Growth in Employment 2011-2015

	High Skilled Employment	Medium Skilled	Low Skilled	Total
India	16.8%	7.2%	-1.8%	5.9%
China	13.8%	.13%	2.5%	1.8%

Source ILO, Author Calculations

Overall, in raw number terms, India has significantly lower numbers employed in all categories across both years despite having a comparable population to China. India has a higher share of its economy in higher skilled employment compared to China in 2011. However, India has considerably more employed locked up in low skill jobs in that year. This in large part would reflect the large informal, unorganised sector in India, as well as vulnerable and own account workers, and those working in agriculture. China has a much larger share of workers in medium skill employment compared to India, and less in low skill jobs as shares of total employment, suggesting that China is making a better fist of the transition out of low skill jobs than India, necessary for a knowledge economy. Undoubtedly the industrial composition is at play here. China's large manufacturing sector is working towards its advantage in this respect, while India lacks the depth and breadth of manufacturing as a large scale employer of various types of skilled labour. India's dominant services sector in terms of output (some 75% of GDP) is not necessarily a large employer and tends to employ smaller numbers of elite graduates.

Table 12: Forward projections of employment

	2021 High Skilled employment	**2021 medium skilled employment**	**2021 low skilled employment**	**2021 total employment**
India	90554	304761	143307	538622
China	102860	602337	63459	768656
India share	16.8	56.6%	26.6%	
China share	13.4%	78.4%	8.3%	
India growth 2011-2021	46.8%	15.2%	9.6%	17.9%
China growth 2011-2021	27.9%	-2.1	3.2%	1.5%
India growth 2015-2021	25.7	7.2	-1.8	5.9
China growth 2015-2021	12.5	-2.2	0.7	-.2
2015-2021				

Source: ILO and Author calculations

Looking ahead and based on ILO forecasts we see in the years 2015-20201 that India is anticipated to make a significant gain in higher skilled employment growth, more so than China (but not higher in raw numbers), with growth over the period 2015-2021 expected to be 25.7% and close to 47% over the period 2011-2021. In fact, total employment is expected to grow in India compared to projected decline in China, with undoubtedly India's demographic dividend playing a key role. By contrast with the exception of the high skilled category China's employment is flat. However, India will still have a very significant share of the population, more so than China, locked in low skill employment, and a smaller share in medium skill employment.

India still faces a number of challenges in employment. Despite having some growth between 2011 and 2015

" High Skill are Manager, professional and technical jobs, Medium Skills are clerical, service, sales worker. Skilled agriculture, trades workers and plant and machine operators and assemblers and low skilled are elementary occupations" in high skilled employment it is not enough to absorb the numbers of graduates that India is producing, where most would expect to reside in the high skill category. For example, according to our calculations, there has been a growth in high skilled employment of some 16.8% between 2011 and 2015 while graduates from higher education has grown approximately by 18.9% in the same period. Projecting forward we estimate that between 2011 and 2021, total high skilled employment will grow by 46.8% while graduates from higher education are expected to grow over this period from 2011-2021 by 67.7%. Thus, on the basis of our estimates, growth in high skill employment is not and will not keep up with growth of graduates.

There are some key demand and supply side implications. Firstly, India is not producing enough high skilled knowledge intensive jobs.Our analysis also shows that India's share of knowledge intensive industry employment on a sectoral basis, using OECD data and classifications, is only about 13% of total employment.

This also goes to the heart of the sort of industries that are being generated. There are insufficient knowledge intensive industries in play. India needs a knowledge plan which will identify key sectors and capabilities of the future and make faster transitions out of low skilled employment where employment still dominates. The Make in India needs to have a focus on higher value sectors, technologies and capabilities. It is not enough to Make in India. It should be Make Advanced in India if India's demographic dividend is to secure access to prosperity enhancing higher value, higher paying, more stable jobs. Various data indicate as proxy that salaried jobs have more settled job contracts and access to social security benefits (Government of India (d) 2015-2016). The narrowness of India's employment base is reflected in the problem of insufficient jobs for graduates.

Table 13: Distribution of persons aged 15 and above 2015-2016

	Employed	Unemployed	Not in Labour Force
Not Literate	46.3	0.9	52.7%
Below Primary	51.9%	0.9%	47.1%
Primary	54.7%	1.3%	44%
Middle	51.8%	1.6%	46.6%
Secondary	42.8%	1.9%	55.3%
Higher Secondary	39.2%	3.1%	57.7%
Under graduate certificate	46.4%	5.9%	47.7%
Diploma/Certificate	51.5%	6.4%	42.2%
Graduate	51.6%	10	38.4%
Post graduate and above	59.2%	9.8%	31.0%

Source: Government of India (e) Data based on field work from April to December 2015.

Unemployment is highest for graduates among the various levels of education, with also significant proportions of people not in the labour force (even allowing for the fact that some will not be in the labour force due to undertaking further study).

Table 14: Percentage distribution of unemployment by graduate and post graduate level by reason

	Non Availability of jobs matching with education/ skills/experience	Non availability of adequate remuneration	Family/ personal problems	other
Undergraduate				
Rural + Urban Persons	58.3%	22.8%	5.3%	13.5%
Rural Persons	55.9%	25.1%	5.5%	13.5%
Urban Persons	64.0%	17.5%	5.0%	13.5%
Rural + Urban Male	57.8%	24.1%	3.7%	14.4%
Rural + Urban Female	59.1%	20.8%	7.9%	12.2%
POSTGRADUATE				
Rural + Urban persons	62.4%	21.5%	3.8%	12.4%
Rural persons	58.5%	24.8%	3.7%	13.0%
Urban Persons	68.7%	16.0%	4.0%	11.3%
Rural +Urban Male	61.4%	24.6%	2.4%	11.6%
Rural+Urban Female	63.4%	18.0%	5.4%	13.2%

Source: Government of India (d) Data based on field work from April to December 2015.

Table 15: Number on job seekers on the live register

	Male	Female	Total	%	% Total
10th passed	126387	6120.9	1875.9		46.9
10th plus 2	7712.4	4400.9	12113.3		30.3
GRADUATE/POST GRADUATE					22.8
Arts	1952.7	1749.5	3702.2	40.5%	
Science	901.6	807.7	1709.4	18.7%	
Commerce	708.8	635	13434.8	14.7%	
Engineering	197.7	177.1	374.8	4.1%	
Medicine	43.4	38.9	82.3	0.9	
Veterinary	4.8	4.3	9.1	0.1	
Agriculture	33.7	30.2	64	0.7	
Law	19.3	17.3	36.6	0.4	
Education	728.2	652.3	1380.5	15.1	
Others	231.5	207.3	438.8	4.8	
Total	4821.9	4319.6	9141.5	100	
Grand Total	25173.2	14841.3	40014.5		100

Source: Employment Exchange, Data as at December 2013

That India is not doing enough to create high value, higher paying jobs is reflected in the reasons for unemployment amongst graduates. The stand out reasons for unemployment among graduates is the absence of suitable jobs matching education, skills and experience. This is particularly pronounced in the urban areas where one would expect that greater skilled jobs would be available.

Tables 15 and 16 show that graduates account for a fifth of those seeking jobs on the live register (persons seeking jobs on the employment exchanges), with arts graduates dominating the job seekers, while table 16 confirms unemployment across a range of fields of education. It is claimed that only a smallish fraction of those on the live register end up being placed in jobs (Khare 2016).

Table 16: Distribution of persons aged 15 and above with Graduate and above in Different Fields

	Employed	Unemployed	Not in Labour Force
Arts/Humanities	50.6%	10.5%	38.9%
Natural Science/Maths	51.9%	10.6%	37.5%
Engineering/Technology	55	11.6%	33.4%
Accounting/Law	61.4%	6.6%	32%
Medical Science	67.7%	4.0%	28.3%
Agriculture/Forestry/Animal Husbandry	61.6%	9.3%	29.7%
Not known or unspecified	61.7%	5.9%	32.2%

Source: Government of India (e)

The other side of the equation is that of employability of graduates. A plethora of studies finds that Indian graduates lack employability skills. A study of 40,000 Indian technical graduates covers skills of English communication, quantitative skills, problem solving and programming skills, found that only 38% were employable (Mehrotra 2015). 21st Century skills of communication, problem solving and analytical skills among others are lacking. Other studies show that only one quarter of engineering graduates are employable, and that only 10% of other graduates are. There are considerable gaps in employability between leading institutions and the rest and between cities (Khare 2016). Yet more studies find that less than 20% of graduates from Higher Education Institutions are rated as immediately employable and that it is time to consider Graduate Employability ratio (Government of India (b) 2016.

Various studies point to emerging skills gaps and shortages. This sits alongside unemployment among graduates as we have seen. For example, there could be a shortfall of 350 million people by 2022 in 20 high growth sectors of the economy (Kumar 2016, Majumdar 2016).

More broadly, is that India will add a million new entrants to the labour force every year (Majumdar 2016). Only 2% of people receive formal vocational training and 3.4% receive informal training, with 95% of people receiving no training at all (Government of India (e) 2015-2016). Thus India needs a massive skilling agenda, a fact recognised and being acted upon by policy makers, in order to provide employment and address economic needs (Mehrotra 2016).

This goes to the heart of the need for the Higher education (and vocational) curriculum and capabilities to be more aligned with industry and economic needs, supported by policy towards knowledge intensive capabilities and that exposure to industry among academics and students could be especially valuable, especially in the earlier years of tertiary education. It also means integrating Vocational Training with Higher Education. This also suggests a need to shift from rote based learning to more applied and problem solving skills in courses relevant to economic need.

SECTION THREE: KNOWLEDGE TRANSFORMATION

A critical part of Higher Education institutions is their ability to drive change- be it economically, socially, environmentally and culturally. In this context research and development is a strongly transformative capability, through development of new technologies, industries, commercialising of ideas and knowhow. To what extent does India perform in Higher Education, and more generally in research?

We first examine this at a system wide level, then consider Higher Education. At the overall system with a compound annual growth rate of almost 10% over a 20 year period, India now produces the fifth highest number of papers in the world. This compares with 13th place 20 years ago. Thus in volume terms India has been progressing rapidly. (Sci Mago 2017)

A further issue relates to the composition of the research. In disaggregating the SciMago data base we found that in both India and China, papers were almost entirely dominated by Science, Technology, Engineering and Mathematics (STEM). While it is the case that papers and citations tend to be dominated by scientific endeavours in both countries we found that outputs in arts and humanities, social sciences and multidisciplinary studies tend to be limited. Moreover, within STEM, computer science, engineering and medicine dominate accounting for close to 70% of papers in India (and similarly in China). While one can argue that these disciplines drive the growth of knowledge economy two points can be made: other scientific disciplines also relevant to the knowledge economy are underdone, while the perspectives, insights, critical thinking that arts and social sciences bring are not at all capitalised on. There is a growing recognition around the world of the importance of Science, Technology, Engineering, Arts and Mathematics (STEAM) in driving economic prosperity.

QUALITY

However, quality is a key issue to consider. Citations for India is at the “middle of the pack” behind a number of countries, including some in the developing world such as Thailand and even surprisingly Bangladesh. Earlier data also revealed quality issues as measured by the proportion of a country’s publications in the top 10% most cited publications and top 25% of most cited journals, where India is at the lower end of the spectrum. Thus publications in volume are not necessarily translating into quality.

Table 17: Publications

	1996	2001	2006	2011	2016	CAGR
U.S	339770	347212	511026	607071	601990	2.9
China	28823	60982	189238	387798	471472	15.0
UK	86756	95325	140499	174107	182849	3.80
Germany	73941	88080	125120	153858	164242	4.1
India	20736	25527	46673	96999	138986	9.98
Japan	85720	96134	123377	129281	121262	1.8
Australia	24078	29392	48955	73506	89767	6.8
South Korea	10178	20509	43153	66175	78660	10.8
Russia	31728	34773	35125	43381	73207	4.3
Brazil	8814	15308	33816	54518	68908	10.8
Malaysia	980	1416	4446	20751	28546	18.4
Thailand	1212	2292	5957	10715	14176	13.1
Chile	1735	2331	4954	7800	12448	10.4
Bangladesh	518	606	1123	2530	3995	10.8
Sri Lanka	196	261	598	951	1673	11.3

Source: Sci Mago and Author calculations

Table 18: Citations per document

	2011	2016
U.S	16.24	1.23
China	7.71	0.93
U.K	15.82	1.36
Germany	15.55	1.32
India	7.83	0.65
Japan	10.78	0.9
Australia	15.80	1.37
South Korea	11.61	0.97
Russia	5.91	0.54
Brazil	8.8	0.81
Malaysia	7.21	0.67
Thailand	10	0.80
Bangladesh	7.97	0.81
Sri Lanka	8.05	0.78
Chile	12.38	1.12

Source : Sci Mago

Table 19 :Top 10 % cited documents by country, as a % of all country documents

	2004-2008	2008-2012
UK	16.74	15.85
US	17.44	15.65
Australia	16.12	15.22
Germany	14.10	14.4
South Korea	10.67	9.70
Chile	9.52	9.12
Japan	9.12	8.56
China	6.75	6.92
India	7.76	6.42
Brazil	7.46	6.29
Russia	4.09	4.16

Source: OECD and Sci Mago Research Group

Table 20: Papers in most cited journals 2003-2012

	Share of country's publications in top 25% most cited journals
US	51.63
UK	50.97
Australia	47.80
Germany	43.65
Chile	37.99
Japan	36.49
Korea	36.10
Brazil	28.19
India	24.50
China	20.01
Russian Federation	17.64

Source OECD and Sci Mago Research Group

PRODUCTIVITY AND RESOURCES

The other aspect of the system that we consider is productivity and resourcing. We use two metrics: papers per researcher or what we could describe as labour productivity, while we use papers per PPP dollars expended as a de-facto capital productivity measure.

Table 21: Papers per researcher

	2005	2010	2015
Australia	.51	.74	.91
Brazil	.24	.36	-
Chile	.72	1.30	1.38
China	.14	.28	.28
Germany	.44	.45	.46
Japan	.18	.19	.18
Malaysia	.35	.38	.38
South Korea	.21	.23	.22
Russia	.08	.09	.15
Sri Lanka	.32	.41	.60
Thailand	.23	.28	.21
India	.26	.41	.48
U.K	.53	.66	.65
U.S	.45	.49	.47

Source: UNESCO, Sci Mago, Author Calculations

What is noteworthy here is that for most countries (with some exceptions), papers per researcher has grown over the 10 year period, reflecting greater productivity. India is no exception to this although it stands broadly in the middle of the pack, but exceeds the U.S and has consistently exceeded China. Thus India has a productive research labour force when compared to a number of other countries and over time. As table 22 shows, on the metric of thousand papers per PPP dollar expenditure on research we find that for available data India has grown on this metric.

A key issue is the level of resourcing that is directed towards research. When we look at GERD per thousand researchers as a measure of resource availability, using purchasing power parity dollars, we find that in most cases countries have gone backwards, including India. This reflects growing austerity in research budgets around the world, although China, Japan and Thailand particularly buck the trend. India in particular has shrunk dramatically on this measure. China is the interesting case in point- it is increasing its resources per researcher but this is not reflected on its return on investment ie papers per researcher. However, that India has shrunk dramatically is a cause for concern, given that this calls into question the sustainability in the long run of its commitment and funding of research. In terms of raw expenditure on research as measured by GERD India has improved only moderately over 5 years, whereas China has grown significantly (table 24).

Table 22: Thousand Papers per PPP dollar (constant price 2005)

	2010	2015
Australia	3.75	4.98
Brazil	1.69	2.06
Chile	8.62	9.78
China	1.74	1.31
Germany	1.94	1.90
Japan	.98	.87
Malaysia	2.90	3.01
South Korea	1.23	1.14
Russia	1.75	2.70
Sri Lanka	4.13	7.19
Thailand	3.41	2.19
India	2.01	3.21
U.K	5.07	5.06
U.S	1.57	1.51

Source: UNESCO, Sci Mago, Author Calculations

Table 23 GERD per thousand researcher FTE (GERD in ppp $ constant price 2005)

	2010	2015
Australia	196.7	181.7
Brazil	213.1	-
Chile	150.7	141.3
China	160.2	211.6
Germany	231.9	243.8
Japan	194.4	211.9
Malaysia	132.7	127.3
South Korea	187.2	195.95
Russia	51.6	53.9
Sri Lanka	98.1	83.1
Thailand	80.9	97.8
India	205.8	148.5
U.K	129.7	129
U.S	310.9	311.1

Source: UNESCO, Author Calculations

Table 24: GERD (000 ppp constant 2005 prices)

	2015 or nearest year	2010 or nearest year
India	42038378.0	39690630.53
Australia	18241431.62	18221962.74
Bangladesh	-	-
Brazil	32498467.4	29550361.26
China	342513404.22	194010587.35
Chile	1155359.08	819835.67
Germany	87179229.31	76069811.93
Japan	140316886.86	127539462.51
Malaysia	8895835.53	5473974.96
Pakistan	1944365.05	2200236.0
South Korea	69848079.14	49432690.87
Russia	24225092.38	22822069.66
Sri Lanka	189186.08	209952.76
Thailand	5809929.34	2941730.13
UK	37327531.23	33289134.03
US	420550104.15	372682565.52

Source : UNESCO

What is even more stark is when we consider Higher Education Research and Development expenditure (HERD) per Higher Education Researcher (Table 25). What we find is a complete collapse of India's performance. Its researchers in Higher Education are operating on a "declining shoe string". The resources available to its Higher Education researchers is far less than available in other countries and has declined significantly. That this is so is reflected in the fact that HERD is only worth 4% of total Gross Expenditure on Research, well short of other countries (Table 26). Simply put there is not enough commitment and effort and resourcing put into Higher Education Research in India.

This is the result of the legacies of the past. The great bulk of research in India is done in Government laboratories and public - sector research institutions. This is a legacy of the planning system post -independence in which research was undertaken to fulfil societal objectives and economic needs as espoused by the Government and its central planners. Universities were left largely as teaching bodies, which as we described earlier, suffers from low and variable quality. Thus in Universities the critical nexus between research and teaching in driving new pedagogy, new capabilities and understandings, and enriched course material is missing.

According to the Yashpal Committee some years ago, "Over the years there has been a tendency to treat teaching and research as separate activities.....It should be necessary for all research bodies to connect with Universities in their vicinity and create opportunities for their researchers and for all universities to be teaching and research universities" (Krishna and Patra 2015 page 210). Thus challenges identified previously remain.

Table 25: HERD per 1000 Higher Education Researchers FTE; HERD in ppp constant 2005 prices

	2010	2015
Australia	79	79.6
Brazil	-	-
Chile	96.5	111.2
China	68.6	80.8
Germany	153.0	148.0
Japan	131.1	125.7
India	73.7	14.7
Malaysia	47.5	46.5
South Korea	136.2	155.4
Russia	22.6	25.1
Sri Lanka	41.7	70.8
Thailand	44.7	51.4
UK	56.3	56.7
U.S	-	-

Source: UNESCO and Author Calculations

Table 26: GERD performed by Higher Education Institutions 000's ppp $ Constant Dollars 2005 and % of GERD in Brackets

	2015 or nearest year	2010 or nearest year
India	1658106.26 (3.94)	1629386.77 (4.11)
Australia	5451848.6 (29.6)	4810209.15 (26.4)
Bangladesh	-	-
Brazil	-	-
China	24137806.0 (7.1)	16407911.14 (8.5)
Chile	445124.68 (38.5)	315869.09 (38.5)
Germany	15128478.0 (17.35)	13822638.27 (18.18)
Japan	17228192.15 (12.3)	16417344.57 (12.87)
Malaysia	2533665.90 (28.5)	1585071.02 (28.96)
Pakistan	1154648.12 (59.38)	556620.64 (25.30)
South Korea	6352542.61 (9.1)	5349029.28(10.8)
Russia	2323558.03 (9.6)	1906166.25 (8.4)
Sri Lanka	37781.07 (19.97)	24117.10 (11.5)
Thailand	1097321.31 (18.9)	886569.38 (30.1)
UK	9561613.77 (25.6)	9003146.18 (27.0)
US	55623103.98 (13.2)	54866425.94 (14.7)

Source: UNESCO and Author calculations

In spite of this Indian Higher Education Institutions,have been productive, as measured by the share of total Indian papers produced by the Higher Education sector, which is more than 70% and growing over time (Krishna and Patra 2015). By our calculations, Higher Education papers per Higher Education Researcher have risen over the decade from 2005 to 2015, and more than holds its own with overall papers per researcher (the system wide papers per researcher).

However, it should be noted that Indian Higher Education system is nowhere near as prolific as China's as shown in the following table. In fact, the best Chinese institution produces 5 times as many papers as the best Indian institution.

Table 27: Indian top ten papers vs china top ten by Institution 2012-2015

	India	China	
Indian Institute of Science	6381	Shanghai Jio Tong	29121
IIT Kharagpur	4902	Zheziang University	28828
University of Delhi	4269	Peking University	25867
IIT Bombay	4063	Tsinghua University	25236
Banaras Hindu University	4012	Fudan University	20362
IIT Madras	3823	Sun Yat Sen University	18684
IIT Delhi	3797	Sichuan University	17138
Jadavpur University	3100	Shandong University	17060
IIT Roorkee	3055	Huazhong University of Science	17019
IIT Kanpur	2902	Nanjing university	16911

Source: Leiden Institute

Table 28: Impact of Research

	% of papers in top 1% cited	% of papers in top 10% cited	% of papers in top 50% cited
India	0.4%	6.7%	43.9%
China	0.6%	8.1%	47.2%

Source: Leiden Institute

Note Fractional Basis Count

China has an edge in the percentage of papers that are cited among the top 1%, top 10% and top 50 % most frequently cited papers. As is to be expected in both cases, there is a large gap between the top 10% and top 50% share suggesting that most cited are in the moderate end rather than the very elite end.

INDIAN CITATION INDEX

Recent performance on the Indian Citation index which includes more than 950 papers published in Indian journals over the period 2004-2014, over 49 subject areas and across institutions, also provides some important insights (Confederation of Indian Industry 2016)

There is a narrow research base. Out of 49 subject areas in the data base, 5 subject areas: health sciences (23.3%), Biology (11.4%); Pharmacology and Pharmaceuticals (10.4%), Agriculture (9.2%) and Chemistry (8,4%) account for 62.7% or close to two thirds of papers in the Indian citation index (Confederation of Indian Industry 2016). Many other areas such as arts and humanities and the social sciences do not get a look in The other interesting feature is the narrowness of the publications by State.

Table 29 Share of publications by State Indian Citation Index

Tamil Nadu	11.9%
Maharashtra	11.5%
Uttar Pradesh	9.5%
Karnataka	9.3%
Delhi	7.7%
West Bengal	5.3%
Telengana	4.4%
Gujurat	3.9%
Andhra Pradesh	3.7%
Rajasthan	3.7%

Source: Confederation of Indian Industry 2016

The top 10 states thus account for 71% of all publications, while the top 5 account for just on 50%. The capacity for knowledge transformation via publications is thus spatially constrained. The database also reveals that average citations across the sector are low, particularly in the private universities. The latter is to be expected given the young age of these institutions (Confederation of Indian Industry 2016).

There is also a disconnect between volume and quality among foreign authors publishing in Indian journals. For example, China produces the most articles, close to 15,000 in Indian journals yet is ranked 113th on citations per paper out of 176 countries, the U.S is second on articles but 30th on ciitations. By contrast some of the lesser known and lower research output countries such as Peru and Krygyzstan have produced only 41 and 7 articles respectively yet have citations per paper at the top end of 1.9 and 1.7 respectively (Confederation of Indian Industry 2016). In some senses India may be considered a “dumping ground” for papers of not necessarily high worth,while in other ways India is arguably not capitalising on the niche capabilities in terms of volume that some less established research nations could offer.

INTELLECTUAL INPUTS

Part of the issue of India’s Higher Education research performance is linked to its capacity for producing post graduate researchers. India lacks the depth of Ph.D’s amongst its ranks. Student enrolment is shown in the following manner.

Table 30: Ph.D Enrolments and Out-Turn (pass)

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Ph.D Number enrolled	81,430	95,425	107,890	117,301	126,451
Ph.D share of total enrolment	0.27%	0.32%	0.33%	0.34%	0.37%
Out turn(pass)/enrolment ph.D	26.4%	24.8%	22.1%	18.6%	19.1%

Source: AISHE various years

As can be seen in the following table, Ph.D share of total enrolment is extremely small meaning that India lacks the depth of researchers need to transform itself into a knowledge economy in the future even though the numbers in raw terms seem significant. India's higher education system is very strongly under-graduate driven lacking the specialist capabilities that Ph.D's bring. However, it should be noted that given the system is heavily oriented towards teaching rather than research, Ph.D's in large proportion may not necessarily be required. Although this highlights our concern that by and large Indian Higher Education lacks cutting edge research. Further, and noting that it is not strictly comparable in the absence of specific cohort tracking, we look at the ratio of passes to enrolments in Ph.D's and find that this has declined over time , and is now only around one-fifth.

PATENTS

Of course publications are not the only outputs of a national innovation system, including its Higher Education Institutions. Patents reflect the industrial application of knowledge and propensity for commercialisation of knowledge and research.

As the following table shows, India's patent performance, although improving over time is dwarfed by China. Moreover, its patents are dominated by non- resident patent applications and patent applications abroad are almost on a par in 2015 with resident patents.

	Resident			Non Resident			Abroad		
	2005	2010	2015	2005	2010	2015	2005	2010	2015
India	4721	8853	12579	19661	30909	33079	3307	6016	11367
	2005	2010	2015	2005	2010	2015	2005	2010	2015
China	93485	293066	968252	790842	98111	133612	4463	15620	42196

Source: World Intellectual Property Organisation

That India is heavily reliant on patent applications by overseas corporations and researchers is shown in the fact that non- resident patents are close to treble that of resident patents. Thus the lack of a domestic patenting capability is shown in these figures to some extent. This points to the absence of an indigenous research and commercialisation capabilities, although we note that there is clear value in the latest ideas and knowhow from abroad. As mentioned patents abroad have increased over time to be almost as large as resident patents, although once again that could largely be due to foreign entities in India patenting abroad.

A clue to the latter is found in the utility patents from India originating from India in the US patent office. The top places are occupied by companies such as IBM, GE and Texus. The best performing non- corporate entity is CSIR with 298 patents over a period between 2011-2015.

Table 32: Top twenty utility patents granted in U.S originating from India 2011-2015

	Total 2011-2015
IBM	1138
GE	589
Texus	346
Symantec	344
Individuals	327
HP	301
CSIR	298
Honeywell	298
Oracle	220
Freescale	192
Info Sys	188
Adobe	184
LSI	180
STMIelectronics	176
Qualcon	169
Microsoft	165
cisco	150
Tata Consulting	143
Samsung	138
Citrix	119

Source: USPTO

In examining the US patent office data base, we find that when summing the patents of the Universities and institutes of national importance, there are only 180 patents in the U.S among these or some 1.7% of patents out of the 10,498 patents from india in the U.S between 2011 and 2015. There is very little patenting abroad on the part of Indian Higher Education Institutions. In this sense, Indian Higher Education Institutions lack an international orientation or driver which patenting in the world's leading office would bring.

More broadly, only 4.7% of Universities were granted at least 5 patents In the Indian Patent Office between 1990 and 2013 and there has been a steady decline in patent performance in Indian Higher Education Institutions since 2003 (Krishna and Patra

2015). Nor does India have the particularly well developed infrastructure for incubators in Higher Education Institutions compared to those abroad, although there have been some moves in this direction in recent times (Krishna and Patra 2015)

There are a number of reasons once can advance for this patenting performance. Arguably, the high concentration of non- resident patents in India maybe constraining the domestic patenting effort due to attracting resources, retaining IP closely, and limited transfers of knowledge into the domestic sector reinforcing the siloed nature of innovation in India. Second, is the nature of the innovation system itself in India reliant on jugaad or informal improvised innovation, innovating around resource and other constraints, meaning less role and importance for more formalised forms of innovation such as patents (Rajdou N et al 2012). The third is the weakness in the system in India in which institutions such as public research bodies (with the exception of CSIR) are not inclined to pursue commercial paths for their research nor have the skills, capability and wherewithal to do so, nor have the strong linkages into industry.

SECTION FOUR: KNOWLEDGE TRANSLATION

Knowledge translation refers to the ability of Institutions to garner knowledge from elsewhere, take it on board, adopt it, mould and meld with one's own and then develop and diffuse it. In this context we use a number of critical measures such as University rankings and collaboration. Rankings, although in some senses is a measure of quality, is also a reflection of the extent to which an Institution is in the minds of overseas and local students, how it is regarded on a world scale as a place to work, study and collaborate with, and to what extent therefore an institution can be part of the global flow of ideas and knowhow, and people mobility.

On this score we compare India with China on the international rankings of universities. The following tables are instructive.

Table 33: Times Higher Education Rankings

	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
India	3/400	5/400	4/400	17/800	31/981	42/1102
China	9/400	10/400	11/400	37/800	52/981	63/1102

Source: Times Higher Education Rankings

Table 34: Times Higher Education 2017-2018

	In Top 100	101-200	201-500	501-800	800+
India	-	-	2	15	25
China	2	5	5	32	19

Source: Times Higher Education Rankings

While the number of Indian institutions in the rankings has progressively grown, it is necessary to understand that the number of institutions included in the rankings has also progressively widened. In any case it is true that India's share of institutions ranked has grown from 0.75% in 2012-2013 to 3.8% in 2017-2018. By contrast, China has grown from 2.25% to 5.75% over the same period. What is further instructive is that India has no institution in the top 200 (nor ever has) compared to China which has 2 in the top 100 and 5 in group between 101-200. Institutions in the top 200 certainly would be considered to be among the leading institutions in the world in terms of global standing, as ideas and knowledge hubs, as attractors of students and staff, all critical to the translation factors. Most of the ranked Institutions in India are in the 800+ category, with a reasonably solid presence in the 501-800 group. While China is also well represented in these lower tiers, it has a better spread across the entire spectrum than India. China has consistently over the years had 2 in the top 100 (Peking and Tsinghau). India's current best is IIISC Bangalore, at 251-300.

Table 35: Times Higher Education Scores by Pillar

	Teaching	Research	Citations	Industry Income	International Outlook
India average	27.6	13.6	23.2	39.2	16.96
China average	28.8	24.2	35.1	61.7	25.8
India's best Institution	53.8	48.6	56.1	92.7	47
China's best Institution	83	93.2	76.9	100	54.4
India's weakest Institution	14.5	6.7	2.1	31.8	12.6
China's weakest Institution	15.2	8.1	9.0	32.8	4.8

Source: Times Higher Education

When looking at the scores for the pillars (the higher the score the better, 100 being the best) that comprise the rankings, we find that on average Indian Institutions lag China on all parameters, with the biggest gap on average being on Industry income although India's best scores highly on this criterion. Thus, what we are seeing again is the weakness in linkages between industry and universities. India's best performing institution also lags China's best against all criteria, and there are large differences in the best, most notably on teaching and research, the core fundamentals of high quality, high ranked universities. However, it should be noted that the gap between India and China's weakest is not as significant, suggesting that there are a number of Universities in both countries that are at the lower end of the spectrum. China though has a number of very well represented Institutions in the International outlook pillar with scores above 90.

The extent of knowledge translation is also reflected in the degree to which papers are collaborative. Translation in this sense is a two way exchange of information, knowhow and flows of knowledge and doing things. It is the capacity to meld, mould and augment knowledge for economic and social good which is critical. At the system wide level, we observe that over the decade from 2003 to 2012 India has had the highest share of papers with no collaboration. The lack of any collaboration reinforces the siloed approach to Indian research. This means that Indian researchers miss out on the critical flows of ideas, knowhow and joint discovery based on complementary skills which collaboration brings. There ae two legacy effects of this that can be surmised. First a system of innovation geared to serving British interests alone which led to narrower research, and secondly in the post independence period research singly driven towards social and industrial aims of a planned economy, did not necessarily and arguably did not provide many reasons for sharing of ideas or much room and incentive for partnerships and inter-disciplinary thinking.

It is also observed that international collaboration is higher than domestic collaboration for India (a feature it shares with a number of other countries), and that there is a higher share of foreign leading authors in international collaboration compared to domestic leading authors. However, for a country of India's development, to be more in tune with overseas collaborators rather than domestic, perhaps does suggest that there is a lack of capability domestically and limited opportunity and ability to partner at home. This in turn may make developing truly home grown technological breakthroughs leading to full capture of the returns at home somewhat difficult. It also suggests that India is highly dependent on the know how of other nations (Ramaswami 2016).

Table 36: Collaboration in papers 2003-2012

	No collaboration	International collaboration	Domestic collaboration
Australia	42.88	40.04	17.08
Chile	33.4	52.59	14.02
Brazil	43.6	24.86	31.54
UK	47.5	40.64	11.86
Germany	47.52	41.56	10.93
South Korea	50.73	25.64	23.62
U.S	53.56	25.88	20.57
japan	54.51	21.71	23.77
Russian Federation	60.52	30.9	8.58
China	63.08	15.02	21.90
India	71.46	17.38	11.16

Source: OECD and Sci Mago Research Group

Table 37: International Collaboration in Papers: 2003-2012

	% international collaboration	Foreign leading author in international collaboration	Domestic leading author in international collaboration	No international collaboration
Chile	52.59	31.01	21.58	47.41
Germany	41.56	23.33	18.23	58.44
UK	40.64	22.12	18.52	59.36
Australia	40.04	22.59	17.45	59.96
Russia	30.90	15.13	15.77	69.10
US	25.88	13.72	12.16	74.12
South Korea	25.64	14.55	11.10	74.36
Brazil	24.86	13.77	11.10	75.14
Japan	21.71	10.97	10.74	78.29
India	17.38	9.08	8.30	82.62
China	15.02	9.02	6.00	84.98

Source: OECD and Sci Mago Research Group

LEIDEN INSTITUTE

If we turn to the Leiden rankings database we observe that overall India's rate of collaborative papers from Universities is 53.2% compared to China at 68.7. Overall, Chinese institutions are more likely to collaborate than India reflecting the closed nature of the Indian set up. International collaboration for China at 24.7% is on a par with India at 24.3%. ("Leiden Institute 2017")

China has a slight edge over India in collaboration in terms of industry collaboration, although noting that both countries have some work to do in this area, and of course that there are many types of collaboration beyond papers.

The Leiden rankings provide data for short distance collaboration (less than 100kilometres) and collaboration over longer distances (greater than 5000 kilometres). What is also interesting is that on average collaboration locally ie less than 100 kilometres away is higher in China at 15.4% compared to India at 11.3%. There are a number of factors at play here including the extent of clustering around universities. Overall, Chinese institutions appear to be better integrated with other institutions locally, other institutions of knowledge, and industry through spatial clustering, than India. The role of Chinese technology parks, and the ability to develop and diffuse tacit know through face to face interactions is a key factor here. The benefits of collaboration locally are manifold including development of economic hubs and regions, gains from mobility of researchers, and flows of tacit knowledge.

On the other hand, China is only slightly ahead in longer distance collaborations

(Greater than 5000 kilometres), but less so than when comparing to short distance collaboration. It is hard to be definitive about why India performs relatively better on longer distance collaboration compared to shorter distance collaboration, but this is consistent with the greater propensity generally to collaborate internationally. Possible explanations could be the diasporic effect of researchers, or the rise of virtual collaboration, or simply the greater availability of possible collaborative partners over wider geographical areas. It could also be about the silo mentality and unwillingness of Indian Institutions to share knowledge and intellectual property with potential local rivals. Of course, without being definitive one can suggest that it is also about the spatial planning of universities and the absence of other institutions in the shorter distance.

HIGHER EDUCATION AS A SOURCE OF IDEAS

Of further relevance in the translation of innovation is the extent to which firms relate to higher education as a source of ideas and knowhow. Only 7.9% of manufacturing firms found that higher education was a highly important source of ideas in India, as opposed to 58.5% of firms who claimed that their own enterprise was highly important, and 32.6% who believe that competitors and other enterprises are (UNESCO).

Further, for the innovation active manufacturing firms, some 53.3% of firms claimed that lack of highly qualified personnel was a highly important hampering factor and that in 44.2% of cases this was a fact even for non innovative active manufacturing firms (UNESCO). Thus, the interface between higher education as a source of ideas in India, and in providing the right type of employee at the right time is a constraint in India. (Source : UNESCO 2017)

INTERNATIONAL STUDENTS

As indicated, translation is closely linked to internationalisation of the higher education space. India is increasingly international in the outward domain, with 360,000 students abroad. However, this comprises a relatively small proportion of India's eligible higher education population.

Even more stark is that India's share of total students accounted for by international students is approximately 0.1%. India is in 102nd position on this criteria in the Global Innovation Index (Cornell University et al 2017). Most of the Indian inward student mobility is male, by a ratio of two to one, and dominated by undergraduates some 78.5% (AISHE 2015-2016). Thus, India is missing out on the potential brain gain especially that post graduates bring in, in terms of the intellectual and research abilities, and potential linkages into research networks of the world especially down the track. Recent work has focused on brain circulation and knowledge nomads, or those researchers and scientists who travel the world undertaking projects, developing and deploying knowledge (Day and Stigloe 2009). While there have been some schemes which aim to better link Indian researchers into global networks, students taking on these roles can also be an important investment and future asset, both in terms of inward and outward mobility (Government of India (f) 2015-2016). Of course there is also the issue of brain drain to consider as a number of Indian students studying abroad continue to live and work overseas. The Indian Diaspora is an especially vibrant one, for example, with many success stories in Silicon Valley among other places.

India also performs poorly on the international outlook component of THE rankings, which is made up of both inward students and staff (Times Higher Education Ranking 2017). Thus it is also the case that Indian Higher Education in India does not attract overseas researchers and academic staff due to restrictions on hiring among other things.

A further issue is where these students come from. The following table shows the top ten source countries of India's international higher education.

Table 38 :Top Ten Source Countries of International Students in India 2015-2016

Nepal	9574
Afghanistan	4404
Bhutan	2925
Nigeria	2090
Sudan	2059
Malaysia	1901
UAE	1479
Iran	1459
Yemen	1238
Sri Lanka	1189

Source : AISHE 2015-2016

By and large, India's inward mobility is limited to countries in the nearby region and those from less developed economies. Thus India is not tapping into the core academic and research hubs of the world from the developed nations. This in large measure goes to the heart of the lack of quality of higher education as perceived by students from abroad.

A further clue to this may be found in the surrounding eco-system for students. According to the QS top 100 ranked best student cities in the world, India only has two such cities, and towards the lower end of the rankings: Mumbai and New Delhi ranked at 85th and 86th respectively. By contrast China has four at Shanghai (25th); Beijing (30th); Nanjing (80th) and Wuhan (100th) (QS (b) 2017).

Indian student cities achieve their best ranks on affordability and to a lesser extent employer activity, where employer activity is defined as the number of domestic employers who identified at least one institution in the city as providing excellent graduates, international employer popularity and youth employment.

By contrast, both cities perform relatively poorly on the following criteria: Desirability (liveability, safety, pollution, corruption); rankings (number of ranked Universities in the city) and particularly poorly on student mix (number of students, international students, tolerance and inclusion), and relatively poorly on student view (student experiences and staying after graduation) (QS (b) 2017).

These findings point to weaknesses in the surrounding system for universities.Indian cities are relatively unwelcoming and unattractive for students, although affordable. Yet affordability is just one criterion. India also lags on inclusivity, a particularly important dimension for the knowledge economy. Successful, high prosperity locations are melting pots of inclusion, drawing on and nurturing talent from all around the world with a high emphasis on tolerance and inclusion, allied with technology and talent (Florida 2002). This is not the case in Indian cities. It is also an issue more broadly. The recent Talent Index shows that India ranks badly on tolerance of minorities and migrants at 44th and 112th place respectively (INSEAD 2017). This is in addition to issues of congestion and corruption which bedevil Indian cities.

Therefore, India needs to look more broadly and holistically when considering its internationalisation of higher education. We also argue that fundamentally an immersion program in which India could develop, and nurture and market its history, traditions and culture as a basis for fostering integration of foreigners, including students from around the world, is essential.

SECTION FIVE: TOWARDS A POLICY AGENDA

In this section, we consider the key element of an Indian Higher Education Policy which look to address some of the key weaknesses identified in this paper. Among the key measures are:

- Overhauling India's system of governance and accountability through the removal of the affiliation system, which has severely constrained both Universities and their affiliated colleges.
- Changing incentive arrangements including relaxing the constraints on fee setting. One option is for price variability between floor and ceiling prices (differentiated of course between public and private institutions) and within this allowing market forces and competition to determine where prices land. We would also recommend the greater use of scholarships and stipends to address any distributional impacts of the pricing arrangements.
- An overhaul in Governance of Universities through a new structure to regulate the whole of the sector including Higher Education and Vocational Education in an integrated fashion, with funding linked to quality outcomes and performance.
- Allow institutions, including foreign providers, to operate on a for profit basis, including the establishment of branch campuses. The continues to need an

injection of capital to meet the needs of an ever growing student age population, and targeted increases in Gross Enrolment Ratio by the Government.In addition, an influx of foreign capital potentially brings with it new insights, management techniques, innovation in pedagogy and course offerings and research links and capabilities.

- Reform pedagogy to down- play the rote system of learning with its exam orientation to focus effort on meeting the challenges facing the nation in areas of energy, resource management, urban design, health outcomes, security and the like. This would be underpinned by a comprehensive Knowledge Economy Plan. It would also have a focus on employability of graduates.
- A comprehensive approach to improving the research capability of Indian Higher Education sector through rigorous research training and greater expenditure in Higher Education research, and a program of attracting highly cited researchers from abroad.
- Establish new intermediary bodies which link industry and research organisations and Universities though networks of researchers aimed at undertaking collaborative work, enhancing mobility of researchers, and sharing risk.
- Development of a comprehensive International Higher Education Plan aimed at building India as a hub for international students and staff, linking in and reaching out to researchers and academics from around the world.

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