Innovation in India: deciphering environmental, socio-economic and technological issues

Webinar 3 – February, 3, 2021 - Session 2: 10 h 45 to 12 h

Roundtable: Innovation, Research and Territories, Session coordinated by Eric Denis (Directeur du Laboratoire de Géographie Cités du CNRS) ;

The general aim of this session is to examine the localization of innovation throughout Indian territory.

1) Roland Lardinois (CNRS, Centre for Indian and South Asian Studies, EHESS, Paris): « *The role of engineers in innovation in India* » Innovation in India depends mainly on two kinds of professionals: scientists on the one hand, and engineers on the other hand.

a*) Production of engineers*: they come from Colleges of Engineering, leading to Bachelor of engineering (BoE) or of technology (4 years of studies), and from Polytechnics delivering Engineering Diplomas (in 3 years). In 1980: deregulation of economy - opening to private investors. But there is an unequal distribution across states and level of graduation. The vast majority of Colleges deliver only BA and few lead also to MA or PhD. The number of Colleges has grown from 240 in 1985 to more than 3,300 in 2015. None other countries have seen such a growth. Enrolment in Engineering colleges has risen from 3% to 16% of the total number of students
In 2010, 50% of Engineering Colleges were located in 4 states: Tamil Nadu, Andhra Pradesh, Maharashtra, Karnataka. They represent 2/3 of the total number of Engineering Colleges at undergraduate level (but only 1/3 of the total population of India); the selection of candidates is organized at national or regional level. Due to the fast economic growth of India, government institutions are not enough to answer to the business needs. Therefore, since 1980, there is an opening to private sector to train engineers. So, from 2015, 90% of Engineering Colleges are private institutions, which are under contract with the State, i e they must respect quota policy in favour of disadvantaged people

b) *Their international circulation*: USA are the main destination since 1920's. MIT (Boston) is the model for the creation of IITs at the independence of India. 2 groups of migrants in the US which are very different in their purposes and composition. The larger group are BoE graduates who were recruited in India and serve as a workforce in ITC sector in the US. Between 1990 and 2000 the number of Indians living in the US doubled to reach 1 million, and more than doubled again until 2.7 million in 2019 (not all engineers…). A second group are postgraduate students who got their Bachelor degree in India and continue to a Master and/or a PhD in the US, or to a MBA in a Business School; most of them come from the prestigious IIT or NIT ; it is estimated that 1/ 3 of IIT graduates emigrate to the US. It remains the question of their future and return to India. Names of most famous Indian engineers or scientists who succeeded in the US, are quoted. These two types of migrations are called « brain drain » but also « brain gain ». Some form the IIT Alumni Association and work for the reputation of their « alma mater », for the creation of Start-ups in India, etc…

c) *Employability of Indian engineers* and quality of their training. Many studies have been carried out on this issue. A test called AMCAT was developed, adapted for job applicants, and was used by many employers in ITC. The situation is alarming: an assessment made in 2019 shows that 80% of Indian engineers with a BA do not fit for any job. Less than 5% can be

called « correctly », slightly higher than for Chinese engineers (2%). Among the 3,000 Colleges of Engineering, only 10 to 15% provide a satisfactory training.

QA: *Distribution of casts quotas in the engineering education in India?* It is a complex question. 3 major cast groups including OBC (Other Backward Classes) could benefit of « affirmative action » and quotas from the government for admission in the Engineering Colleges: the total of these groups makes 49.5%. The remaining 50.5% is open to all categories. Quotas of « scheduled casts and tribes » for entering in IIT were introduced in 1973, but due to the special status of IIT, a quota for OBC was only set up in 2008, and their admission changes the social landscape in these prestigious institutions. The number of IITs was increased from 6 in 2000 to 23 today. But the selection remains tough: there are only 10,000 seats for one million applicants.

2) Marion Maisonobe (CNRS – UMR Géographie Cités): « *The geography of scientific research in India, from 1999 to 2015* » http://geoscimo.univ-tlse2.fr/

This presentation is based on a project supported by ANR, covering the "deconcentration" of scientific production in India and the world (URL: https://geoscimo.univ-tlse2.fr).
Between 2000 and 2013, more than 10,000 scientific journals and about 1.5 M publications per year are indexed in the Web of Science (WoS). Since researchers indicate their address on their paper, it is possible to geocode them. The research team succeeded in geocoding almost 98% of them at the global level. The publication data were then clustered by urban areas. Collaborations (co-publications) from different areas were taken into account as well as each city contribution. Therefore, the scientific production of different areas can be compared. And also, collaborations between them, derived from co-publications. A comprehensive normalized counting was applied to avoid double counts.
A comparison between urban areas of two close cities of Maharashtra, Mumbai and Pune, is given as an example. And it is extended to Indian continent as a whole, which shows the production growth from 2000 to 2013. In the ranking of the 30 most publishing urban areas (WoS): Delhi, Chennai (Madras), Kolkata, Mumbai and Bangalore are on the top. A chart giving the specialization ratio of Delhi and Chennai compared to India and the rest of world shows a lack of production in Social sciences, Humanities and Maths but a better level in Physics, Chemistry, Biomedicine (Delhi), Engineering (Chennai).
A world map of the evolution of scientific production 2000-2013 shows the decline of the traditional US hegemony and a re-balancing of the global scientific output with a decrease of the biggest spots. A similar trend is noticed for the total share of global citations

From 1999 to 2015 Indian domestic collaboration have grown at a higher pace than Indian international collaboration.

A preliminary analysis suggests that collaborations between India and other countries about Covid are well developed.

3) Rémi de Bercegol (Cnrs – Savoirs et Mondes Indiens): « *Bottom up innovation in poor urban settlements : an ambiguous panacea* »

A motto in India is Jugaad Innovation, a frugal and flexible approach to innovation for the 21st century. Some of the local arrangements developed in the margins of the city, can be seen as innovative. Example: the traditional system of « kabariwala » (scrap dealer) gives an

inspiration for innovative mobile based application, launched by an Indian start up in the waste collection sector.

In urban areas non-connected to infrastructure networks, local solutions shows inventivity to provide water services (in a slum of Mumbai or in a small town of Haryana where a private network delivers water, or thanks to private lorries in Bangalore or Chennai) or to provide sewerage and sanitation (by emptying septic tanks in an urban village of south Delhi not connected to the sewerage network). BUT there is an ambiguity of labelling as « innovative » some of these local arrangements set up to access basic services, which are essential to the living standards of slums population (water, sewerage, electricity). To provide a basic service is a societal choice, and not only a technical question, since basic urban services are of utmost importance for economic growth, social cohesion and environmental sustainability of human settlements.

The bottom up system of innovations in poor urban settlements, which remains a mediocre service, tends to formalise socio-spatial exclusion and heterogeneity: providing "2nd class services" to "2nd class citizens". It reflects a failure of the government policy: you acknowledge that the conventional network model does not function and that local solutions can only help to solve the problem. Of course it is better than nothing!