



Figure 3. USPTO patents per million population for India and comparator countries where the chronological time runs from 2003 to 2016.

Figure 2 plots S&E papers per million population for India and comparator countries and regions (including the world taken as a whole and the rest of the world). The chronological time now runs from 2003 to 2016. There is a point during this development time window

where India (2012–2016) is nearly where China (2003–04) was at the same level of GDP per capita. China is headed to where Japan, the European Union (EU) and USA are at present.

Figure 3 plots USPTO patents per million population for India and comparator

countries and regions (including the world taken as a whole and the rest of the world). The chronological time runs from 2003 to 2016. Unlike the findings in figure 5 of the Economic Survey¹, India (2010–2016) was noticeably ahead of China (2003–2011) at lower levels of GDP per capita. Since then, China has accelerated and is headed to where Japan, the EU and USA are at present. India is also on a promising trajectory as far as USPTO patents are concerned.

1. <http://mofapp.nic.in:8080/economicsurvey/> (accessed on 31 January 2018).
2. <https://www.nsf.gov/statistics/2018/nsb20-181/assets/nsb20181.pdf> (accessed on 19 January 2018).

GANGAN PRATHAP

*Vidya Academy of Science and Technology,
Thrissur 680 501, India, and
A. P. J. Abdul Kalam Technological
University,
Thiruvananthapuram 695 016, India
e-mail: gangan@vidyaacademy.ac.in*

Water management

The commentary by Shantha Mohan *et al.*¹ begins with a description of the complex water challenges faced by India. These challenges such as population explosion, urbanization, rising demand for water from agriculture, energy, industry; water pollution, inefficient use of water, poor management and poor institutional scenario exist all around the country, including the eight regional zones identified by the study conducted by National Institute of Advanced Studies (NIAS), Bengaluru¹. However, it is observed that the challenges identified for these zones and zonal water partnerships (ZWPs) get narrowed down conveniently into isolated water issues bereft of the complexities mentioned at the beginning. For example: (1) Designing policies, programmes and action plans to stop the destruction of water bodies in Hyderabad and identifying strategies to rehabilitate water urban bodies. (2) Identification of problems of frozen pipes that supply

drinking water at sub-zero temperatures in Jammu and Kashmir. (3) Preparation of framework for integrated drinking water plan through participatory approach in the districts of Madhya Pradesh, Maharashtra and Andhra Pradesh. In fact, the real challenge for integrated approach lies in managing complex water problems and not selective or isolated water issues chosen conveniently.

Shantha Mohan *et al.*¹ state, ‘Striving for inclusiveness, transparency, accountability and gender sensitivity are the core values of zonal partners’. However, the note is not transparent with respect to ZWPs and therefore contrary to the core values stated. Nowhere do the authors mention about the participants/actors/stakeholders/gender representation in the ZWPs to show that they are truly integrated. The information regarding the type and composition of the communities involved in ZWPs is absent. The note informs that 20% of dalits do not have

access to safe drinking water and 48.4% of dalit villages do not have access to water sources. However, it does not mention whether weaker sections of the society are part of ZWPs and other decision-making venues of such partnerships and, if so, up to what percentage they are represented. While the authors state in the beginning that water resources need to be managed at numerous levels, with the involvement of several stakeholders and professionals from diverse disciplines, it is unclear in the note, the levels, stakeholders and professionals from diverse disciplines represented in ZWPs. It is also unclear whether the Department of Science and Technology (DST) or NIAS has partnered with the Ministry of Water Resources, River Development and Ganga Rejuvenation or the Central Water Commission or the Ministry of Drinking Water Supply or the Ministry of Urban Development in the true spirit of integrated approach. Neither the NIAS

website nor DST website has any information that befits the core values adopted by these ZWPs. The note could have added value, had it disclosed the above information true to its declared core values.

An internet search by the present author showed a document by Routray *et al.*² from NIAS dating back to 2008 (about 10 years ago) under the support of Global Water Partnerships that outlines similar policies, strategies and methods compared to Shantha Mohan *et al.*¹. The objectives *inter alia* include mobilization of global water partnership membership, facilitate experience sharing, evolve mechanisms, capacity building, etc., but they do not outline seeking solutions to complex water challenges mentioned by Shantha Mohan *et al.*¹. But, again, ZWPs that were conceived in 2008 for every zone do not consist of any key government agencies at federal, state or local level involved in drinking water supply and sanitation, water resources departments of the respective states, minor irrigation departments, groundwater agencies, pollution control boards of Central and State Governments, and the apex policy and planning body in water resources like Central Water Commission relevant to the objectives of each zone and in line with the integrated approach articulated in the note. Barring a few NGOs, there is hardly any representation from citizens such as farmers, resident welfare associations, etc. in each of these ZWPs. Further, neither the document by NIAS² nor the note by Shantha Mohan *et al.*¹ discloses the disciplines considered in each of the zones to support the claim of the multi-disciplinary approach. Whereas it is stated that DST is part of this initiative of integrated approach in seeking solutions to water challenges, DST itself has ignored, in a disintegrated manner, the key central ministries involved in water resources. In view of the above, the overall approach elaborated in the note¹ as well as the document² is nothing short of being just a rhetoric or an extension of the objectives of global water partnership in India, than finding any credible solutions to the complex water challenges broadly elaborated in the note. In fact, it does not provide any results due to the work of these ZWPs in the last 10 years.

Successive national water policies in India have recognized river basins/watersheds as the units of water man-

agement. Examining the method outlined in the note, the approach of dividing the country into zones with political boundaries (states) is flawed; in fact, it is a disintegrated approach because it fails to recognize the integrity of water resources within a river basin or watershed. Certainly, boundaries of the eight ZWPs do not coincide with those of river basins or watersheds within a river basin. The eight zones (and areas within these zones), which the study has identified criss-cross the watershed boundaries, thereby effectively splitting or disintegrating the hydrological unit of water management. Therefore, the challenges get split and so do the solutions. For example, the water bodies of Hyderabad receive rainfall and run-off in Krishna river basin from several directions. Increased diversions in upstream lead to reduced flow and increased toxicity in the water bodies elsewhere in the Krishna river basin, including the water bodies of Hyderabad. However, the note does not mention consideration of the integrated approach within hydrological units called 'watershed' or 'river basin'.

Further, the note advocates state-specific water policy. The statement 'each state requires its own state-specific water policy' dilutes the very integrated approach that NIAS wants to seek solutions to all the complex water challenges in India. By advocating 30 water policies for 30 states in India besides the national water policy and policies for Union Territories, the entire water management in the country gets split and pulled in multiple directions. This is because a river, e.g. Krishna does not recognize the boundaries between Maharashtra, Karnataka, Telangana and Andhra Pradesh. Similarly, River Mahanadi in case of Chhattisgarh and Odisha, and River Cauvery flowing between Karnataka and Tamil Nadu. In fact, eight states in India already possess their own water policies, and these are more state-centric than basin-centric or national-centric with very little in common between two or more states³. Therefore, Shantha Mohan *et al.*¹ should adopt decentralization of policies at watershed or basin level, rather than wrongly advocating policies based on political boundaries that will only worsen the already complex water challenges in the country.

India's mounting water challenges are primarily caused due to (1) archaic water institutions and (2) poor governance. The

note ignores these fundamental causes despite mentioning about the institutional problem at the beginning. It does not provide clarity on how to overcome the problem of India's archaic institutions established 5–6 decades ago (some like Central Water Commission/State Water Resource Departments (WRDs) were set up in 1940s and 1950s, when the concept of 'integrated approach' was non-existent). Or whether NGOs and academic institutions are sufficient to find solutions to all the water challenges that India is facing? According to World Governance Index, India was ranked 152 as on 2011 in contrast to 49 in case of Israel⁴. The note is silent on the role of poor governance in India, which is the root cause of the maladies afflicting complex water crisis in the country⁵. Transparency, accountability, equity, integrated approach, participation of all groups of society, ability to adjust to changing demands and accountability are vital components of effective governance⁶. These are largely missing in India's governance and hence it is unclear how the methodology suggested by the authors could overcome India's governance crisis while seeking solutions to India's water challenges that criss-cross these zones.

Finally, integrated approach in water management is not a new concept. It was introduced in the World water conference held in Mar-de-Plata as early as 1977, and was formalized in the World Summit for Sustainable Development in Rio in 1992 (ref. 7). The integrated, co-ordinated and multidisciplinary approach in water resources development and management has been recognized in our country almost three decades ago in the national water policy of 1987 (NWP-1987) and then in 2002 and 2012. Some of the extracts of NWP-1987 (ref. 8) are as follows:

Clause 4.4: There should be an integrated and multi-disciplinary approach to the planning, formulation, clearance and implementation of projects, including catchment treatment and management, environmental and ecological aspects, the rehabilitation of affected people and command area development.

Clause 7.3: Integrated and co-ordinated development of surface water and groundwater and their conjunctive use, should be envisaged right from the

CORRESPONDENCE

project planning stage and should form an essential part of the project.

Several studies in India have already adopted such integrated approach in resolving specific and isolated water issues similar to the initiative of NIAS, but without considering basin/watershed approach. For example: (i) Integrated approach to address endemic fluorosis in Jharkhand. The approach integrated water treatment technology, health monitoring, community-based water management and locally synthesized hydroxyapatite⁹. (ii) A study conducted in 2008 on pilot project on decentralized treatment and recycling of domestic wastewater – in Tamil Nadu¹⁰. The mission includes providing holistic and innovative solutions to varied problems of the Sangamam community, such as water supply, sanitation, inadequate housing, planning, etc. with the help of decentralization and rural development¹.

So, the NIAS study seeking solutions to water challenges through integrated approach does not contribute any new knowledge to complex water challenges of India.

Complex water challenges in India cannot be managed by cosmetic integrated approach suggested by NIAS. Mere sweeping generalizations based on experiences of isolated water problems within a political boundary, cannot solve the complex water problems mentioned by Shantha Mohan *et al.*¹. Therefore, the

methodology identified by them needs re-evaluation and correction, given the flaws pointed out in this letter. The study should look into delinking the isolated water issues from the water challenges of India at a larger scale and curtail the ambitions of seeking solutions to every water challenge of the country by extrapolation of this flawed methodology. However, if no corrective measures are incorporated in the approach and the *status quo* is continued, then the prospects of finding the ever-elusive water solutions through replication of this methodology to complex water challenges of the country would be misleading.

Views expressed in this letter are the author's own.

1. Shantha Mohan, N., Parween, M. and Raj, B., *Curr. Sci.*, 2017, **113**(11), 2074–2076.
2. Routray, S., Sreeja, K. G., Shantha Mohan, N. and Sashikumar, N., Report, National Institute of Advanced Studies, Bengaluru, 2008; http://www.cwp-india.org/Publication/pdf/ESTABLISHING_AND_STRENGTHENING_ZWPs_IN_INDIA-JUNE_2008.pdf
3. Harsha, J., *Curr. Sci.*, 2012, **102**(7), 987–989.
4. World Governance Index, Why should world governance be evaluated, and for what purpose? Proposal Papers Series, Version 2.0, Forum for a New World Governance, Paris, France, 2010, p. 15.
5. Ménard, C. and Saleth, R. M., Mike Young et Christine Esau. Investing in

Water for a Green Economy. Services, Infrastructure/Policies and Management, United Nations Environment Programme, 2012, pp. 152–174.

6. EUWI Water Initiative, Directing the flow, a new approach to integrated water resources management. Directorate-General for Research, European Commission, Brussels, 2006, p. 3.
7. Hassing, J., Ipsen, N., Clausen, T. J., Larsen, H. and Jorgensen, P. L., Integrated water resources management in action. Dialogue Paper, The United Nations World Water Assessment Programme, UNESCO, Paris, France, 2009, pp. 3–4.
8. Indian National Water Policy – 1987; http://cgwb.gov.in/documents/nwp_1987.pdf
9. MacDonald, L., Pathak, G., Singer, B. and Jaffé, P., *J. Water Resour. Protection*, 2011, **3**(7), 457–472; doi:10.4236/jwarp.2011.37056.
10. CPCB, A study of pilot project on decentralized treatment and recycling of domestic wastewater – an integrated approach to water management at Sangamam community – a village model. Auroville Universal Township, Tamil Nadu, Central Pollution Control Board, Auroville Universal Township, Auroville, Tamil Nadu, 2008.

J. HARSHA

*Central Water Commission,
Jalasoudha, HMT Post,
Bengaluru 560 013, India
e-mail: infoharsha@yahoo.com*