

Machine learning, AI & drug development

It seems research could soon be largely taken over by machines



QUANTUM LEAP
DEVANGSHU DATTA

Organic life depends on proteins, complex molecules, which perform many functions. Proteins are made up of amino acids combinations. Amino acids are simple molecules paired and wrapped around each other in three-dimensional configurations. Mis-folded proteins can cause horrible conditions like Alzheimer, Parkinson's Disease, Huntington's Disease, etc.

Developing new drugs, and tackling such conditions would receive a huge boost if we understood protein-folding processes. This is among the biggest

research challenges. Protein folding seems to have simple rules, and we can list the amino acids sequences in a given protein. But the number of folding possibilities are very large, making it impossible to list all 3D configurations, even with super-computers. There are about 20,000 genes which can malfunction in multiple ways, and therefore, huge numbers of possible interactions between resultant proteins.

Researchers use algorithms to compute the likely 3D structure of proteins, inputting amino acids sequence data. They also use methods like X-ray crystallography and nuclear magnetic resonance to image protein structures. But this is an expensive hit or miss process and we still don't know what the structure of a new sequence could be.

In many ways, protein-folding resembles chess, Shogi (a Japanese version of chess) and Go. These games have simple rules, which a child can learn in a few minutes. Each game has complete information. Yet, chess contains more possibilities than atoms in the universe; Shogi has even more possibilities than chess; and Go has orders of magnitude

more possibilities than Shogi. Programs have to find heuristics (strategic rules of thumb) to play these games well.

A program that's good at such games can be adapted for protein-folding. We're seeing demonstrations of this, with DeepMind's AlphaFold. The UK-based artificial intelligence company, DeepMind created a sensation when its "Alpha" algorithms learnt chess, Go and Shogi. In 2016, the first iteration, AlphaGo beat Go world champion, Lee Seedol. A second iteration, AlphaZero was given the basic rules and played millions of games with itself to develop its heuristics. It beat AlphaGo, and thrashed other top chess-playing and Shogi programs.

The self-learning methods DeepMind developed work for other systems of complete information. In December 2018, its program, AlphaFold, was the top performer at a very prestigious competition — the 13th edition of the Critical Assessment of Structure Prediction (CASP).

CASP is a biennial competition that aims to predict 3D protein structures. Competing teams were given the linear

sequence of amino acids for 90 proteins, where the 3D shape is known, but has not yet been published. The physical properties of protein molecules include the linked pairs of amino acids, the distances between linked pairs, and the angles of the chemical bonds connecting the pairs. If you know these, you can work out 3-D shapes.

The CASP competitors compute how those 90 sequences "should" fold and match those against known structures. The debutant, AlphaFold, far outperformed the other 97 entrants. In 43 sequences where nothing beyond linear sequences was known, AlphaFold made the most accurate predictions 25 times. Second place finisher, Zhang Group, succeeded three out of 43 times.

Dr John Moult, CASP's lead organiser, a computational biologist at the University of Maryland in Rockville, says AlphaFold was on average, 15 per cent more accurate than the others. DeepMind's team refined two algorithms pioneered by others.

DeepMind uses "deep neural networks" to learn correlations between the shape of a protein molecule and its amino acid sequence. The AlphaFold model uses two algorithms. It computes a score

that estimates the accuracy of a proposed structure. Then it uses "gradient descent" — an algorithm to find the minimum value of a function — to optimise that score.

AlphaFold compared genomic data on other proteins to derive probabilities for which pairs would end up folding close to each other. "Fold" also worked out probable distances between neighbouring pairs and likely angles at which they joined. This approach combines clever engineering design and vast computer resources to make a contribution to fundamental science.

While DeepMind CEO, Demis Hassabis, says this demonstration is just a beginning, it does marks a shift in research into this key area. Instead of academics with biochemistry backgrounds, or conventional pharma companies, there could be more IT companies moving into studying protein-folding, using artificial intelligence (AI). Facebook has also started up research in this area, publishing a recent paper from its R&D group. That hasn't yet been peer-reviewed.

Academics who were tracking CASP seemed to be stunned by AlphaFold's results, as it seems research into protein folding could be taken over by AI. Machine learning and AI could make a big contribution to accelerating drug development methods and research into many diseases.

CHINESE WHISPERS

Angry BSP

After closely watching the recent developments in Karnataka and Goa, Madhya Pradesh Chief Minister Kamal Nath has asked all Congress MLAs and those supporting his government to stay in the state capital. Nath addressed an MLA meet late on Wednesday and directed them not to travel outside Bhopal. Bahujan Samaj Party (BSP) MLA Sanjeev Kushwaha missed the meeting although he was in the city that day. It is no secret that BSP MLAs Kushwaha and Rambai are unhappy with the state government and do not get along with some of its ministers. Rambai had publicly stated she wanted a ministry. On Thursday, Kushwaha said that some Congress ministers had an "attitude problem" and that he planned to talk to the chief minister about "the behaviour issues".

A nudge from NITI Aayog

So you thought government ads were composed by and aimed at the fuddy-duddies, right? Wrong. A recent NITI Aayog ad caught attention because it was not. The ad, placed on Twitter and saying the government think tank was looking for senior specialists and specialists in behavioural economics, seemed to be inspired by a popular dialogue from Hindi movie *Rang De Basanti*. The NITI Aayog ad started off with *Koi bhi desh perfect nahin hota, usse perfect banana padta hai*; the 2006 sleeper hit had a dialogue, *Koi bhi desh perfect nahin hota... usse behtar banana padta hai*. Now if you said using snappy phrases and taglines was par for the course on Twitter and that NITI Aayog needed something relatable to "nudge" young people into action, you probably wouldn't be far off the mark.

To name or not to name

During the discussion on the Finance Bill in the Lok Sabha on Thursday, Trinamool Congress MP Saugata Roy said the Union Budget's relief to the corporates was intended to help two leading industrial houses. Roy named the two houses, which bear the surnames of their founders. The Bharatiya Janata Party's Nishikant Dubey said Roy, under Rule 352 of the Lok Sabha, had defamed two individuals as also those who had these two surnames. Roy argued that he did not take any first names, but had referred to the two corporate groups. Meenakshi Lekhi, who was at that juncture chairing the proceedings, seemed to agree with Dubey that Roy had taken names of two individuals. However, the Biju Janata Dal's Bhartruhari Mahtab intervened to say that there had been several instances in the past when members referred to two other industrial houses, the Tata and the Birla groups, in their speeches. He said the Lok Sabha secretariat should go through the records to find out if those references were also defamatory and come to a conclusion on the issue. Roy then continued with the rest of his speech as no one countered Mahtab's interjection.

Missing links in India's defence readiness

Since the bulk of the military resources is consumed by revenue expenditure, modernisation will remain a distant dream



PREMVR DAS

We will fight with what we have" is a statement attributed to the then Army Chief when some units of the Pakistan Army surreptitiously captured and then sat astride mountain positions dominating our Kargil lifeline. Twenty years down the line, it will not be surprising if the present Army Chief has to say much the same thing. After all, we did have to field outdated MIG-21s against superior planes of the adversary and lost one of them. Yet, in these same two decades, both the BJP-led NDA and the Congress-led UPA have governed the country for ten years each. Is there something fundamentally missing in our ability to recognise the kind of military power that India needs is the question that needs to be answered.

Only a few days ago, reputed journalist Shekhar Gupta wrote in this paper

that something was seriously wrong in our military planning process. He argued that to constantly decry resources allocated to defence in terms of a less than 2 per cent share of GDP was flawed logic as the government did not have control of that entity. What it did manage was Central Government Expenditure or CGE. This, at 15.5 per cent for FY 2019-20 outmatched the 15.1 per cent that it would spend on health, education and welfare combined. Therefore, to expect the allocation to be increased is clearly far-fetched. Since the bulk of this resource is spent on revenue expenditure, including pay and pensions, modernisation will continue to be a distant dream.

Mr Gupta laid out some other postulations which merit examination. Given their intrinsic strengths, India's Army and Air force could worst those of Pakistan in a long war which he argues we would not be allowed to fight by the international community. In short wars of two or three weeks, the scales would be more or less even except at sea where our Navy could inflict decisive punishment but risk global outrage as freedom of movement was involved. In support of his argument, it may be mentioned that the "surgical strike" across the border was responded to by sponsored terrorist attacks on our military installations at Uri and Pathankot. Even more, the attacks on Balakot camps were met within a few hours, and in broad day-



light, by the Pakistan Air Force which led to the downing of our MIG 21 and capture of its pilot. In sum, short-term confrontations are unlikely to lead either side to a position of dominance. If long and short conflicts are both unlikely to yield great political dividend, what is the option? We have not yet considered what might face us across the border with China where the end result could be no different.

Finally, Mr Gupta talks of the futility of planning for a two-front war for which resources can never be found. This brings us to the fundamentals of national security planning. Broadly, there can be two approaches. One, to formulate plans based on Threat Assessments. Things like two-front war capability, punishing Pakistan, et al fall under this category. There is the Raksha Mantri's Directive which is issued periodically and tells the armed forces what threats are visualised and for which they should be prepared. More recently, a committee has been constituted under the National Security Advisor and comprising the three Service Chiefs and some others presumably to formulate some kind of

a national security strategy. It is very unlikely that it wears away from the Threat Assessment methodology.

The second approach is to evolve national security based on national interests. These are more long term and will provide a stable platform for defence planning over a period of time. For example, if these require us to be the third largest global economy in fifteen years, after the USA and China, with military stature commensurate with that goal, then we must figure out what needs to be done to get there; similarly, our interests in the Indo-Pacific and how they might contribute towards the larger objectives and the capabilities needed to safeguard them. Surely, putting 3,00,000 boots on the ground against Pakistan cannot be the desired end result. Or, for that matter, "readiness" to defeat invading Chinese troops across the foothills. To be the third or fourth ranking global power something different is needed in which, technology, space, sea and air power, informatics and artificial intelligence must merit priority. Only then can limited resources for military modernisation be allocated optimally.

Unfortunately, the approach our planners are following today continues to be threat based in which manpower holds sway as even China, one of our two "threatening powers", is converting its military strength from one based on manpower to one better suited to its longer-term interests.

But how is such a drastic change in mindsets to come? It cannot come from Defence Planning Committees and such like. In the first tenure of the NDA, a high powered Group of Ministers (GoM) was constituted post Kargil to review every aspect of national security. Led by no less a person than the then deputy prime minister, it made a series of recommendations of which the more routine ones have been implemented but the weighty ones remain in orbit. Service Headquarters have been notionally renamed Integrated Headquarters of the Ministry of Defence but with little integration. A Chief of Defence Staff is nowhere in sight. If that GOM could not take us towards the interests based approach, what will? Trying to satisfy several vested lobbies will simply not get anywhere. We now have a Prime Minister who has the chutzpah to do what has not been done before. Only his personal clout will enable us to get away from the status quo just as demonetisation did, in the face of huge criticism. It is time he himself took charge of the national security ethos of the country and put it on lines which will meet our needs commensurate with our aspirations.

The writer has been a member of the National Security Advisory Board

INSIGHT

Rules in cricket and economics are fallible



AMOL AGRAWAL

What a match is an understatement. In times to come, all matches will be measured by this one match which fittingly was played for the World Cup final. Earlier, matches were measured by the World Cup semi-final match in 1999 between South Africa and Australia which ended in a tie as well. The final of 2019 upped the level by a few notches.

In One Day International (ODI) cricket, a team wins by scoring more runs. But what if both teams score equal runs? ICC rule book defines such a match as a tie: "The result of a match shall be a tie when all innings have been completed and the scores are equal. If the scores are equal, the result shall be a tie and no account shall be taken of the number of wickets that have fallen". Though, there were two tied matches where the teams won on account of lesser number of wickets: India vs Pakistan in 1987 and Australia vs Pakistan in 1988. In the first one, India won and the second was won by Pakistan.

In World Cup type tournaments we have stages where you need a winner to move ahead. This requires a result and we have tie-breakers like those seen in football and hockey where we have penalty shootouts (no matter how unfair).

In cricket, ICC has experimented with tie-breakers. For instance, in the

above mentioned semi-final between Australia and South Africa, the former won as it had better performance than latter in the league stage which in turn was based on net run rate. The result drew similar ire as seen now and one felt a tie-breaker should be based on the current match and not past performances.

This led to another type of tie-breaker where the bowlers from the two teams were asked to bowl and strike the stumps. We saw a tied match between India and Pakistan decided in this manner in favour of the former. But again this was not seen as a good way to decide the outcome as there was no role for batsmen and it was really random.

We then had the idea of a Super Over where each team played an additional over and whoever scored the highest runs won the match. Call it a micro-match between the two sides. But what if there is a tie here too? It is here that the rule book gets really dicey and tilts completely towards the batters.

Appendix F of the *ICC Cricket World Cup Qualifier 2018 Playing Conditions* explains the working of a Super Over. In case of a tie in the Super Over, the team which the most number of boundaries combined in both the main match and the Super Over shall be the winner. If this is equal as well, then only boundaries of the main match shall be counted.

If this is equal as well, then we go back to Super Over and figure out from the last ball onwards, and declare the highest scoring ball team as the winner. To explain this last bit, let us see scores a fictional tied match where both scored 14 runs in the Super Over: 3, 2, 4, 2, 2, 1 and 2, 6, 2, 2, 1, 1.

We start with the last ball and compare the scores of the two teams. Sixth ball scores are 1 and 1 which means tie, fifth ball scores are 2 and 1 which means Team 1 is the winner. If the



boundary count rule has created fury, imagine match being settled on this basis. I mean both teams ever so evenly matched that they could have scored equal runs with the same distribution in the super-over. In that scenario, ICC would have actually run out of its rules and awarded the cup to both the teams, a result most deem as fair.

There have been flurry of articles written on the Super Over rules being unfair and unjust. Experts have suggested league performance, net run rate and so on as alternate rules. But England would have won based on all such rules as it did better than New Zealand. This does not imply we should not make better cricket rules but to highlight that all well-intended rules show limitations when tested, showing that randomness of life overpowers everything else.

Take the case of economics where rules are tested all the time. The BIS (Bank of International Settlements) has come up with all kinds of bank capital rules (Basel I, II and III) only to be tested severely in 2008 crisis. Taylor Rule, which helps central banks set interest rates, suggested that Federal Reserve kept policy rates too low before the crisis thus fuelling the housing bubble. This was questioned by Ben Bernanke, then head of Federal Reserve, saying that housing price

bubble cannot be explained by Taylor rule alone. Central banks' own models which rely on some or the other macroeconomic rule book, underestimated financial risks before 2008 crisis and have overestimated inflation risks lately. India and China are often seen as countries which have managed to grow without strictly following the rule book of growth.

To sum up, we have to understand that the rules are made by humans and prone to fallibility. One common rule behind all the rules is that they need to be changed with time, be it cricket or traffic or taxes. Ideally, we should be changing rules periodically but mostly do when rules are either challenged by events or we have some new information. To make solace with the result of the final, one can say it went to a team which has transformed itself beyond anyone's imagination. After poor performance in 2015 World Cup, English sought lessons ironically from New Zealand cricket and repositioned their ODI cricket (see my previous piece English comeback). England captain Eoin Morgan said "rub of the green" did go the English way, perhaps gods deciding to reward them for the sweating of all these years.

The author teaches at Ahmedabad University and blogs at Mostly Economics

LETTERS

Well done, Sebi

This refers to "Sebi chief questions Budget plan for transfer of surplus funds to govt" (July 18). Securities and Exchange Board of India (Sebi) Chairman Ajay Tyagi must be praised for seeking a review of the proposal that mandates transferring 75 per cent of the market regulator's surplus funds to the central government. Tyagi has claimed that the proposed move would affect the functioning of Sebi as well as the securities market while over-emphasising the rationale behind the market regulator keeping a reserve fund for mandatorily protecting the interests of the investors.

As stated in this report, two provisions — one related to the surplus transfer and the other related to seeking prior approval from the finance ministry for raising expenses — haven't gone down well with the markets regulator which considers those as an additional tax. The Department of Economic Affairs' idea behind the proposed move to "address the issue of accumulation of huge surplus funds" with the Sebi could be similar to the government's earlier game plan to corner the so-called surplus funds of the Reserve Bank of India.

S Kumar New Delhi

SC erred on Karnataka

The Supreme Court's interim order that the dissident MLAs cannot be compelled to attend the Karnataka Assembly session convened for the sole purpose of floor test goes to defeat the

very object of the anti-defection law. Obviously, the exemption to the rebel MLAs from participating in the session gives the Bharatiya Janata Party (BJP) an undue numerical advantage in the House. The spirit of the anti-defection law does not permeate the ruling that a party whip cannot be issued to the dissident MLAs to be present in the House and vote reposing their trust in the government. The rationale behind allowing the dissident MLAs to skip the trust vote without attracting the provisions of the anti-defection law is elusive to find out if it is convincing. By granting the dissident lawmakers the freedom to attend or not to attend the session, the apex court has fettered the Speaker.

G David Milton Maruthancode

Correction

A Chinese Whispers item published on July 18 said former vice-president M Hamid Ansari was designated to be the keynote speaker at a lecture (Furthering India's Promise) on Thursday. Mr Ansari has clarified that he was never asked to be a speaker at the function and that he has only received an invitation to the lecture to be delivered by former President Pranab Mukherjee. The error is corrected.

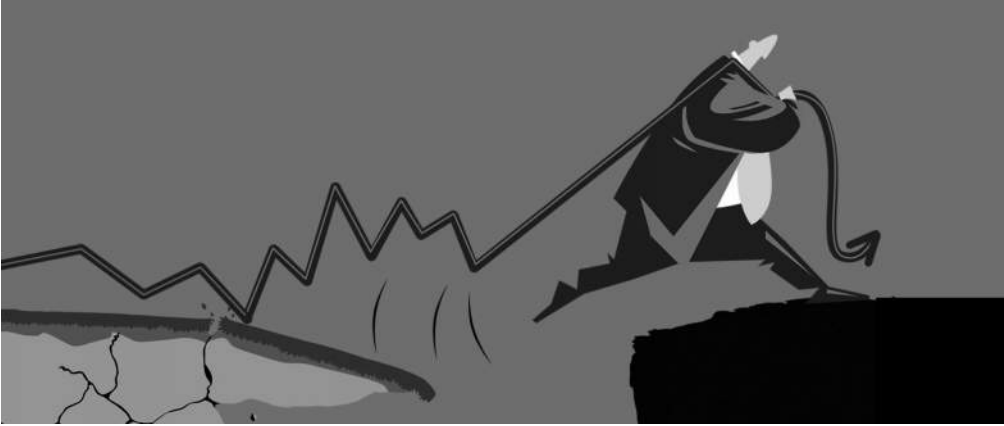
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HAMBONE



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Budget 2019 marks a paradigm shift

It quells all doubts about the private sector being the dominant agent for wealth creation in the economy

Finance Minister Nirmala Sitharaman's first Budget will in times to come be seen as marking a paradigm shift in both the pace and nature of economic activity. Her Budget speech included a strong pro-private investment stance and an unequivocal admission of the critical role to be played by private enterprise in the country's march towards a \$5 trillion economy. The Budget itself contains a number of measures for spurring private investment, with the government playing a supportive role and displaying a willingness to share risks in order to make private investment more attractive and feasible.

Before detailing some of these measures, I should point to two pre-conditions for the success of a private sector-led growth strategy, implicit in the Budget. First, it is critical that the bureaucracy wholeheartedly accepts this approach and pro-actively implements the initiatives included in the Budget. For example, it must ensure the higher targets for dis-investment are actually achieved; public-private partnership in the Railways is actualised; and MSMEs have better access to formal credit and are able to avail the 2 per cent interest rate subvention announced in the Budget etc. This calls for further improvement in governance and widely establishing an incentive structure based on output-outcome-based performance evaluation, for which a strong start has been made in the Budget. Budget documents include for the first time, a full-fledged output-outcome performance evaluation framework for all government schemes where allocations are above ₹500 crore, covering more than 90 per cent of

the total public expenditure.

The second pre-condition is to successfully build a trust-based relationship between the government and all other stakeholders who have a role in accelerating economic activity in the country. Such trust existed during the period leading up to—and immediately after— independence. It broke down during the 1970s and '80s in the face of strong government-led promotion of public sector enterprise and the rampant licence inspector raj that converted the interaction between the government and business from a collaborative one to a patron-client relationship. This has to change. A trust-based relationship is an essential condition for India to expand its share in global markets and, indeed, even for the success of the Make in India initiative.

The Budget explicitly recognises that private investment-led growth requires the government to share some of the risks associated with long-gestation infrastructure projects. This can be achieved by encouraging private investors for taking over brownfield public sector assets such as airports, highways and even some gas pipelines and telecom sector infrastructure. This will help attract private investment in infrastructure, which requires additional investment of ₹20 trillion (nearly \$300 billion) each year for the next five years to overcome the infrastructure deficit that currently hobbles the country's global competitiveness.

The Budget also announced that private investment will be invited in the sectors hitherto considered as exclusively public sector monopoly such as the railways and defence production. The Budget esti-



PAHLE INDIA

RAJIV KUMAR

Protecting India's river basins

Inter-state conflicts over sharing of river waters have become endemic in India. Despite decades of effort at resolving them, no solution appears in sight. At the same time, more and more sites for the spiritually significant holy dips have either dried up or been reduced to garbage dumps. This sorry state of India's most hallowed rivers is a matter of grave national shame. It is also a symptom of precisely where we have gone wrong in our approach to water management.

At the root of it is the way we have ignored the basics of water science. As children, we all learnt of the water cycle in school. But policy-makers in India have forgotten this lesson. They have overlooked the integral interconnectedness between the health of catchment areas and the rivers they feed. The healthier their catchments, the better will be the state of rivers. The unique medicinal properties of the Ganga can only be preserved if we protect the pristine Himalayan catchments from where it originates.

This is why the residents of New York pay those in the city's watersheds for the eco-system services they provide by protecting catchment areas, keeping the river basin healthy and green. This is what ensures clean water supply to the city. Such examples have multiplied all over the world, including in China, Brazil, Mexico, Costa Rica and Ethiopia. But if we encroach upon, damage, block or pollute the channels through which water flows into rivers, naturally river flows suffer in quantity and quality. The natural morphology of rivers has taken hundreds of thousands years to develop. Large structural changes to river channels can lead to unforeseen and dangerous hydrological, social and ecological consequences. For example, it has been estimated that in the United Kingdom soil erosion has caused a loss to fisheries of as much as 5 million pounds.

My organisation, Samaj Pragati Sahayog, has implemented watershed programmes in central tribal India for the last 30 years. This has taught us the need to view the economy as inextricably interlinked with the

larger eco-system. Not seeing these inter-connections and not building them into our development plans can lead to a serious aggravation of the water problem. A 2018 study of 55 catchment areas, published in the prestigious international journal *Scientific Reports*, shows that there has been a decline in the annual runoff generated by India's major river basins, including Baitarni, Brahmani, Godavari, Krishna, Mahi, Narmada, Sabarmati and Tapi, and this is not due to a fall in rainfall but because of economic activities destructive of their catchment areas. The fear is that if this trend continues, most of these rivers will almost completely dry up.

So how do we reconcile the imperative of economic development with its negative impacts on water availability and river flows? By adopting a completely different approach to development, one where we weave our interventions into the contours of nature, rather than trying to dominate it. Most of India gets its annual rain within intense spells in a short period of 40-50 days. We need to reduce the speed of rain water as it rushes over the ground by carefully regenerating the health of catchment areas, treating each part in a location-specific manner, as per variations in slope, soil, rock and vegetation.

Such watershed management helps recharge groundwater and increase flows into ponds, dams and rivers downstream. And helps us score multiple win-wins: Reduce soil erosion, regenerate forests, raise water tables, rejuvenate rivers, create employment, raise farmer incomes, reduce indebtedness, and gradually eliminate bonded labour and distress migration. The most important success factor is building capacities among the local people so that they can take charge of the watershed programme from planning, design, and implementation, right up to social audit. We must recast MGNREGA on a watershed basis and use its enormous resources for watershed and river rejuvenation, as also for the restoration of traditional water harvesting systems that still exist in so many parts of India, even if in a state of decay and disrepair.



WATER: REFORM OR PERISH

MIHIR SHAH

the Hindus" and embarked on a social experiment, learning Tamil and Telugu and taking on all aspects of a Brahminical life. Most of us will balk at his casteism, but it is hard not to admire his unorthodox strategy.

A few pages later, you will come across the extraordinary story of "A Muslim Deity in a Hindu Temple". The story dates back to the "fourteenth century and features a Muslim woman revered to this day as Tulukka Nachiyar (literally, 'Tughlaq Princess' or 'Turkish Princess'), who is said to have fallen in love with a Hindu god."

According to the temple chronicles, armies of the Tughlaq sultan in Delhi raid a Vaishnava temple in south India and took back the deity. The temple authorities follow the marauder to Delhi and convince the sultan to return it.

The story is not without a twist: While the deity was in the sultan's palace, his daughter fell in love with it. When the god returns to his temple, he commands his followers to recognise his Muslim consort. Now, she is commemorated in Srirangam as a painting on the temple wall. The conclusion Mr Pillai arrives at: "It tells us once again that while there were moments of tension between India's principal faiths, legend and myth allowed them to see eye to eye and engage on a fresh ground, even while competing in the realm of ideas — a lesson we would be wise to remember in our own contentious times,

when revenge is sought from people long dead and gone, and violence justified in the name of so many gods."

A couple of months back, a historian friend wondered why there was suddenly

mates that the railways requires nearly ₹50 trillion over the next 10 years, to upgrade its infrastructure and modernise its rolling stock. Such infrastructure upgrades alone will allow the Indian Railways to recover its share in freight and passenger movement, which it has consistently lost over the past decades. The Budget clearly postulates that such massive investment can be achieved only by encouraging public-private partnership in modernising track infrastructure; manufacturing railway rolling stock and indeed in the running of freight and passenger train services. Increasing the share of domestically produced strategic equipment will similarly also require an increased role of the private sector.

Further, as part of its push to private enterprise, the Budget announced that all firms with a turnover of less than ₹400 crore (compared to ₹250 crore so far) will henceforth pay a corporate tax of only 25 per cent. This measure will apply to 99.3 per cent of all corporate entities in the country, leaving only 0.7 per cent that will still pay the higher tax rate of 34 per cent. Similarly, MSMEs, which are registered under the Goods and Services Tax, have been given a 2 per cent interest rate subvention for all fresh and incremental loans. Shares issued by start-ups to both Category I and Category II Alternative Investment Funds have also been put beyond the scope of income tax scrutiny. The issues relating to angel tax have been addressed as well.

The government's objective of expanding the scope of private enterprise is visible in the higher target of ₹1.05 trillion for disinvestment in fiscal 2019-20. At the same time, the government has announced its preparedness to reduce its equity stake below 51 per cent for successfully completing the strategic disinvestment of particular central public sector undertakings (CPSUs). The Budget reiterated the government's commitment for not only the strategic privatisation of Air India but also other CPSUs, which may benefit from strategic take-over by the private sector.

Even for the NRIs, the Budget has announced an easing of the KYC norms and permitted them to invest in India through the foreign portfolio investment route, thereby reducing compliance requirements. Foreign direct investment (FDI) inflows are sought to be further liberalised in sectors such as single-brand retail, civil aviation, media and insurance, while 100 per cent FDI for insurance intermediaries was explicitly allowed.

The Budget thus provides the clearest statement of the government's intention of accelerating economic growth, based principally on private investment and enterprise. There cannot be any lingering doubt on the government's recognition of private enterprise as the dominant agent for value and wealth creation in the economy. The government will, of course, continue to play its role in improving both the social and physical infrastructure and take steps for ensuring sustainability and inclusion. This is in line with experience from across the world that the success of a private sector-led accelerated growth strategy is contingent on ensuring greater inclusion of those at the bottom of the pyramid and innovatively addressing any trade-off between growth and environment protection.

The writer is vice chairman NITI Aayog. Views are personal

This regenerative work must be integrated with groundwater-related demand management initiatives, outlined in the previous article in this column. It is groundwater base-flows that keep rivers flowing after the monsoon. So river catchments and aquifers must be always managed together within a river basin protection programme. And for this, the structure of crop incentives has to change so that farmers can shift to less water-intensive choices (as explained in the first article). Urban planners also need to understand that if destructive land use and land encroachment continue in catchment areas, the sustainability and quality of their water sources will be negatively impacted. They should, therefore, like New York, aim to leverage this link to solve their own water problems. They must also recognise that the increased frequency of urban flooding in recent years has much to do with our encroaching upon traditional lakes and destroying the natural channels through which excess water flows into the river or the sea. Again, those responsible for cultural events like the Kumbh Mela must protect the catchments of holy rivers. Otherwise, we will continue to repeat the bizarre spectacle of artificially filling up the holy *kunds* with water drawn from completely external sources!

Fundamentally, what all of this demands, is bottom-up participatory management in every river basin in India. The only solution to the Kaveri conflict, for example, is for stakeholders on either side to come together in a joint exercise to restore the health of their shared river basin, through both catchment area treatment and gradually reducing area under water-intensive crops. Each river basin is a shared resource, whose health will determine the future of people throughout the basin and beyond. Any cavalier short-termism by any state, based on the desire to grab as much water as possible, will be against the enlightened self-interest even of those attempting something so thoughtless.

If our river basins survive, we also will. Otherwise, like many great river valley civilisations of the past, we too will perish!

The writer is co-founder Samaj Pragati Sahayog, working for the last 30 years in tribal heartlands of central India on water and livelihood security. Every fortnight, he outlines multiple dimensions of long overdue reforms in the water sector

50 years of nationalisation

Status quo on banks will increase the burden on the exchequer

The Indira Gandhi government's decision to nationalise 14 commercial banks 50 years ago on this day is said to be the most significant economic event after India's independence. Though the decision was given an economic rationale, the underlying reason was more political. In 1980, the government took control of another six banks.

The idea of bank nationalisation, however, was not new. An internal committee of the All-India Congress Committee (AICC) recommended nationalising banking and insurance in 1948, which was endorsed by the AICC later in the year. After independence, the banking system had its problems and there were issues related to the reach and flow of credit to important sectors. For instance, the fragmentation was addressed through consolidation. The number of banks was brought down from 566 in 1951 to 91 in 1967, which made the sector more viable. Before nationalisation, the government tried addressing some of the issues through "social control". The idea was to attain a wider spread of credit and increase the flow to priority sectors.

Although the issue of nationalisation kept surfacing from time to time, rising economic difficulties in the 1960s and the need to retain control in the party after some electoral setbacks prompted Indira Gandhi to nationalise commercial banks. Bank nationalisation resulted in a significant increase in bank deposits and financial savings, and the rising fiscal deficit made the banking sector a captive source of financing. With continued political intervention, profitability suffered. Over the years, this affected operations and a large part of the population remained outside the banking net until the launch of the Pradhan Mantri Jan Dhan Yojana in 2014.

Most public sector banks (PSBs) today are not in the desired position. The government has pumped in over ₹2.5 trillion in the last few years — that includes ₹70,000 crore in the current year— and it still may not be enough. PSBs continue to struggle with a higher level of non-performing assets.

There are multiple issues that need attention. First, the government does not have the fiscal space to continuously pump capital into PSBs. The idea of using recapitalisation bonds has its limits as it is increasing the government's liability. Second, the role of technology in banking and finance is rising rapidly, and PSBs with their weak balance sheets are not in the best position to adapt and compete on this front. Naturally, the business will increasingly shift towards private sector banks. Third, it would be hard to implement the required reforms in PSBs in the present set-up. These banks, which account for 66 per cent of outstanding credit and 65.7 per cent of deposits, need functional and operational independence, which will always be difficult to attain with the government being the majority shareholder. Therefore, it should actively consider bringing down its shareholding in a systematic manner. It can perhaps revisit the recommendation of the Narasimham Committee on banking sector reforms in this context. Bringing down government equity to 33 per cent will not only give banks more functional autonomy but will also enable them to raise capital and compete in the market.

The 50th anniversary is a good opportunity to objectively review the performance of PSBs and take corrective measures. Maintaining the status quo will keep increasing the burden on the exchequer, impede financial intermediation and an efficient allocation of resources, and hamper growth.

Mr Jadhav's reprieve

ICJ ruling demands skilful diplomatic responses from India

The verdict of the International Court of Justice (ICJ) on Kulbhushan Jadhav is a huge relief to India. Former External Affairs Minister Sushma Swaraj is right in congratulating Prime Minister Narendra Modi on his decisiveness in referring the case to the ICJ and praising the defence put up by the legal team, led by Harish Salve, to win Mr Jadhav a reprieve from the kangaroo-court style death sentence by a military court in Pakistan. But the widespread euphoria over the ruling should not overshadow the hard fact that the challenges for the Indian government in securing his release have just begun. In that context, External Affairs Minister S Jaishankar's remarks in Parliament that Pakistan should immediately release Mr Jadhav may sound too optimistic.

The 15:1 ICJ ruling — the Pakistani judge being the only dissenter — concerns violating Article 36 of the Vienna Convention on diplomatic relations, under which Mr Jadhav should have been informed of his consular rights, and consular officials have the right to visit him in prison, custody, or detention, and to arrange for his legal representation. The Indian legal team's principal contention was that Pakistan denied Mr Jadhav 13 requests for consular access between March 2016 (when he was arrested) and March 2017 (when his death sentence was pronounced). It is important to note that in ordering Pakistan to give Mr Jadhav consular access, the ICJ has not overturned the death penalty. It has merely ordered a stay on it till the Pakistan government provides "by the means of its own choosing, effective review and reconsideration of the conviction and sentence of Jadhav, so as to ensure that full weight was given to the effect of the violation of the rights set forth in Article 36 of the Convention". Nor did the ICJ accede to India's demands for Mr Jadhav's release or trial by a civil court since that is outside its remit. That said, the ICJ ruling has admittedly made it difficult for Pakistan to re-impose the death sentence on Mr Jadhav.

If anything, the path to Mr Jadhav's reprieve is more likely to lie in back-channel diplomacy between New Delhi and Islamabad rather than in Pakistan's judicial system. To be sure, the details of the case are murky. The Pakistani authorities claim that Mr Jadhav, a former naval officer, was an Indian spy who had illegally entered Balochistan on a false passport. India contends that Mr Jadhav was arrested by Pakistani security agencies from Iran, where he was working after he retired. Between these contending positions is a gulf of mistrust and opacity implicit in spy cases the world over. But encouraging signs of an easing of India-Pakistan relations have emerged in the past few weeks: The successful talks on the Kartarpur Corridor, the reopening of Pakistan's airspace, and the re-arrest of 26/11 mastermind and Jamat-ud-Dawah chief Hafiz Saeed. Having won the first round, Mr Modi's government must now display similar diplomatic nous in building on this thaw to bring Mr Jadhav home.

Small bites of history



BOOK REVIEW

UTTARAN DAS GUPTA

In this book's afterword, simply titled "An Essay for Our Times", young historian Manu S Pillai quotes a wide range of freedom fighters and intellectuals of pre-Independence India and the debates on nationalism, and arrives at the following conclusion: "Whether or not India's diversity was an asset or a peril, might have read these essays earlier dangerous weakness depended on which when they first appeared in his weekly of these visions was allowed to prevail column, 'Medium Rare' in *Mint Lounge*.

and gain moral influence over the vast majority of the country's people." He warns that any attempt to "reengineer" the unity-in-diversity narrative, which has been official policy since Independence, is likely to result in significant challenges and even disaster.

This conclusion is not plucked out of thin air; to arrive at the final essay in the book, a conscientious reader has to go through 60 essay, neatly divided into two unequal parts — "Before the Raj" (25 essays) and "Stories from the Raj" (35 essays). Those who have followed Mr Pillai's career since the publication of his extraordinary debut *The Ivory Throne* the following conclusion: "Whether or not India's diversity was an asset or a peril, might have read these essays earlier dangerous weakness depended on which when they first appeared in his weekly of these visions was allowed to prevail column, 'Medium Rare' in *Mint Lounge*.

Transforming one's columns into a book might not be the best idea, because, devoid of their immediate contemporary context, the writing can seem dull. Mr Pillai's book, however, does not suffer from this, primarily because each essay is a nugget of well-written history, easily absorbable.

Both parts of the book have some extraordinary stories and characters. For instance, the Italian Brahmin of the title Roberto de Nobili, who set sail from Naples in 1604 and arrived at Madurai two years later. He soon realised that to spread Christianity in India, he would have to convert the upper caste Hindus, who till then rejected European missionaries as unclean, as they ate beef and kept no caste distinctions. Nobili decided very soon, "I will become a Hindu to save

THE COURTESAN, THE MAHATMA & THE ITALIAN BRAHMIN

Manu S Pillai

Context

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