Opinion

TUESDAY, OCTOBER 8, 2019

FREE FALL

PDP leader, Mehbooba Mufti

Glad that activists were able to stop the felling of trees at Aarey. One wonders why Kashmiris have been deprived of the very same right to free speech & expression.

RationalExpectations

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States may agree to fix GST now

With the compensation cess falling short, states may now have no option but to agree to raise GST rates at the lower end

DESPITE HIS CREDENTIALS as an economist and a former secretary general of Ficci, most tend to dismiss West Bengal finance minister Amit Mitra's warning on the stagnant GST revenues as pure politics. At an Express Group event, Mitra spoke of India's federal polity being at risk if the Centre didn't extend the guarantee of a 14% growth in the states' revenue from GST; right now, if the state GST revenues don't rise by 14%, they are to be compensated for the shortfall. The states would fall off a cliff, Mitra said, if this guarantee wasn't extended for another five years after 2022. While the situation may be more serious, in one critical aspect, than Mitra pointed out, the good news is that this may also result in much-needed GST reform.

Many reasons are given for GST revenues not being as buoyant as originally envisaged, ranging from the fact that important sectors have been kept outside the GST net to large-scale tax-theft, or even the fact that, as many say, the system was never robust enough to deliver... Whatever the reason, from ₹92,581 crore in FY18, monthly GST revenues rose to just ₹101,049 crore in April-September FY20 (*see graphic*).

As a result, compensation-cess collections have averaged around ₹7,500-8,000 crore per month while, thanks to sluggish overall GST revenues—revenues need to grow at 14% every year for the states' share to grow at the same rate—the amount that needed to be paid as compensation has skyrocketed; from ₹6,000 crore per month in FY18 to ₹11,500 crore so far in FY20. This means the compensation cess will fall short by November or December.

Choking on compensation

₹ crore, per month

As GST revenues stagnate...

	FY18 (8 months)	FY19 (12 months)	FY20 (6 months)
GST revenues	92,581	98,114	1,01,049

...compensation cess falls short...

	FY18	FY19	FY20
Cess collected	7,750	8,083	8,166*
Paid to states	6,000	6,750	11,500**

*Avg of 6 months **Avg of 4 months

...so fixing GST rates critical

Tax rate (%)	Tax collected (₹ crore p.a.)	
5	1,20,000	Raising these GST rates will boost revenues
12	70,000	
18	6,50,000	
28	4,00,000	

While Mitra and many others are hoping that the Centre will dip into its tax kitty to make good the shortfall, the GST law doesn't say the compensation has to be paid by the Centre if cess collections fall short. So, even if the Centre guarantees a 14% growth in state GST revenues for another five years, in case the compensation cess falls short, the states get nothing.

In which case, while the states can blame the central government for not implementing a perfect GST—since GST is a joint responsibility of the GST Council in which all states are members, of course, a blame game may not even fly—this won't really help. In all probability, the GST Council will have to agree to raise tax rates on items that are either taxed at very low rates or not taxed at all. The 5% tax slab, for instance, fetches the government ₹120,000 crore (*see graphic*); doubling this rate will give a big boost to GST revenues and, at a time when inflation is so low, the consumer impact of a tax hike may not be as high as imagined. Similarly, the 12% bracket fetches ₹70,000 crore, and an increase in this rate will add to GST revenues.

There are additional benefits of such rate-rationalisation. One, as GST rates are raised, and the gaps between tax slabs narrow, the incentive to cheat by using fake invoices falls. Two, as rates rise, the government will lose less from input tax credits. Mobile phones, for instance, are taxed at 12%, but their inputs at 18%, so the government ends up giving GST refunds to the industry. In textiles, the fact that the final cloth is taxed at 5% while inputs are taxed at 18% means an input-credit loss of ₹30,000 crore a year; this loss is ₹7,000 crore in the case of fertilisers where the final product has a 5% tax rate versus 18% for the inputs. Once GST rates are raised for the final product, such input-credit losses will reduce.

Faced with the need to hike rates on items of so-called mass consumption, most states will argue a rate-hike wouldn't be needed if tax theft was less rampant. Junior finance minister Anurag Thakur spoke of a ₹45,600 crore tax loss due to fraud, but this was the figure for all indirect taxes; the government caught input tax fraud of around ₹11,500 crore last year, so it is possible GST evasion levels could even be over ₹100,000 crore a year.

While a part of this will get fixed once rates are rationalised, a basic level of invoice-matching—the heart of the GST system—takes place even today. Everyone has to file their invoice-level returns as part of GSTR-1, so when firms pay their GST dues and file the GSTR-3B summary return while doing so, a basic check takes place automatically. If firm A gives invoice-level details of ₹100 crore of supplies to firm X, and firm B shows it is supplying ₹350 crore to firm X, but X shows a turnover of only ₹300 crore, this problem gets caught even now. A more detailed level of automatic checks is being designed as the earlier one didn't work. The new system, where all invoices are uploaded without filing an actual return, is supposed to take off by next April; a huge delay from the original schedule.

And, once every business files its detailed annual returns, this will also help catch tax-theft since all supplier invoices have to be accounted for, but this requires considerable speeding up. Annual returns for FY18 were to be filed by December 2018, but this has been extended to November 2019; no dates have been fixed so far for FY19 and FY20; similarly, it is to be hoped that the new system's invoice-matching will be more rigorous to catch tax theft. But, catching tax evasion takes time, and the government can't wait for this to succeed if it needs higher revenues fast; catching evaders and tax-rate hikes will need to happen side by side, and both will reinforce one another.

HitWICKET?

A sports university seems like a good idea, but the Delhi govt should mull over if its degrees will really help

THE DELHI GOVERNMENT has cleared the setting up of a sports university, to encourage people to choose sports as a career. The university will offer undergraduate, post-graduate and doctorate degrees in different sports. This, the government believes, will give children who wish to choose sports as a career, but are often forced to give up this option. At present, it is hard to earn a regular undergraduate degree while focussing on a professional sports career. Given many jobs—including government ones—require a graduate degree as the basic qualification, this will help those for whom a career in sports doesn't work out or those who retire.

However, while a degree in sports may help with eligibility, it is difficult to see it going beyond that. A degree in cricket may allow a sports university graduate to sit for a competitive exam, but doesn't equip her to qualify that exam. In fact, a general graduate is more likely to have an edge, given how most competitive exams test graduate-level competence in mainline subjects. Even if the sports university were also to offer degrees in allied disciplines, such as sports management, sports paramedical courses, etc, there will always be specialists from regular courses to compete with. The government would do better to upgrade its existing infrastructure or support the private sector in creating better infrastructure while concentrating on catching potential sportspersons young, and focus exclusively on their training.

CORP TAX RATE CUT

GIVEN HOW, IN INDIA, THERE SEEMS TO BE LITTLE IMPACT OF THE CORPORATION TAX ON WAGES, THE CUT MAY NOT MEAN MUCH FOR LABOUR

What impact will the tax rate cut have?

LEKHA CHAKRABORTY
Professor, NIPFP
Views are personal

INDIA HAD REDUCED the corporation tax rate from the peak of 30% to 25% for small firms in FY17, and to 22% for all firms in FY20. However, the new rate of 22% is applicable only to those corporate firms, which "will not avail any exemption/incentive". This tax cut is a bold step, given that India has one of the highest "statutory" corporation tax rates in the world, which, in turn, adversely affected its competitiveness.

In an open economy, who bears the brunt of corporation taxation—capital or labour? Why should a tax on capital affect labour? Economists often debate about the macro-economic channels of corporation tax incidence—whether higher corporate taxes lead to lower capital formation and, in turn, lower labour productivity and wages, thereby shifting the tax burden to workers. However, empirical evidence is "inconclusive" about how corporation tax burden is shared between capital and labour.

The macro-criticality of the corporation tax incidence was highlighted in a paper published by the International Monetary Fund earlier this year, Corporate Taxation in the Global Economy. The shifting of corporation tax burden through its cross-country spillovers and the vulnerability due to base erosion and profit shifting activities (BEPS) were discussed in the report. The design of empirical research on corporation tax incidence are of two types. One set of analysis based on cross-country models examines the effects of capital and labour mobility from high-tax countries to low-tax countries, to know whether there is any "voting with feet". The corporate capital moves from high-tax countries to low-tax ones, reducing the capital-labour ratio in the former and leading to a lower marginal product of labour and lower wages. At the same time, low-tax countries experience higher capital-labour ratios, a higher marginal product of labour, and hence higher wages. The second set of studies are based on single-country design, where the effects of corporation taxation "over time" on capital and labour are analysed. The latter set of studies are also carried out either at corporate/firm level or at subnational government levels.

In India, as corporation tax rates do not vary across states, it will be interesting to analyse the effects of corporation taxation across time and across heterogeneous labour categories. A recent study in the context of Germany—by Clemens Fuest of CESifo in Munich and his team—found that the average "pass-through" of corporation taxation on wages was to the extent 51%. They found that labour bears a substantial share of the corporation tax burden. Their results showed that higher corporation taxes reduce wages most for the low-skilled, for women, and for young workers.

More analysis on corporation tax incidence can be found in Alan Auerbach's paper on "what we know from economic theory and evidence about corporate tax incidence". One of the few papers in the Indian context is by Parthasarathi Shome in Oxford Economic Papers, in 1978, which explores the effect of a marginal change in the corporation tax on wages in the economy. In a general equilibrium setting, his findings suggest that a part of the burden of corporation taxes are shifted to labour.

Using the Prowess IQ database provided by the Centre for Monitoring Indian Economy (CMIE), we can examine the corporation tax incidence in India. "Preliminary" evidence from a recent paper by Samiksha Agarwal and this author showed that corporation tax incidence is more on capital than labour in India. If so, the budgetary announcement in Union Budget FY19—the first announcement on corporate tax cut by the Modi government—to reduce the corporation tax rate to 25% for those firms with turnover up to ₹250 crore was the right step forward. Any tax reforms for the corporate sector will, therefore, have redistributive effect on small firms. However, we flagged in our paper that the lack of significant impact of corporation tax on labour needs to be interpreted with caution in the context of India. With perfect mobility of labour, business taxation may not affect wages. However, the channels of corporation taxation on wage determination may be relatively weaker in India. This prima facie lack of "pass-through" of business tax on wages in India needs further research. It may depend on other wage determination mechanisms, not alone on taxation policies. If there is lack of a significant link between corporate taxation and wages, it may also be due to "profit shifting" arrangements. However, this demands further research on whether the incidence of corporate taxes on wages is lesser due to "income shifting" to avoid taxes or other wage "bargaining" mechanisms. Clemens Fuest and his team highlight in their study that gigantic and, in particular, foreign-owned firms can avoid taxes by "shifting profits" across jurisdictions or even abroad, and if this is relevant for a country, one should observe smaller effects of corporation tax changes for these firms on wages.

Now, let us unpack and differentiate between the "statutory" tax rate and the "effective" corporate tax rates. The analysis shows that the corporate firms with profits before taxes (PBT) above ₹500 crore contribute to 60.63% of corporate tax revenue (see graphic). However, it is also evident that the effective corporate tax rate is only 22.88% for these big corporate firms with PBT greater than ₹500 crore, as compared to 29.37% effective tax borne by the small companies with profit before tax (PBT) up to ₹1 crore.

It is interesting to recall here that Pinaki Chakraborty, in his ex-post Union Budget analysis in 2016 in *EPW*, had highlighted that any tax reform in corporate sector to rationalise the tax structure without tax exemptions would also mean effective tax rate going up for those paying lower than the intended statutory rate. In that sense, the corporate tax cut "effective" is only 2.7% and not 8%. The estimated revenue impact of ₹1.5 lakh crore, if that comes to pass, can reduce the tax-transfer share to the states—as highlighted by Kerala finance minister, Thomas Isaac—and, in turn, affect the state's fiscal space.

It is important to wait and watch if the fiscal stimulus through tax policies have relatively better multiplier effect on the economy than expenditure stimulus. As fiscal rules—maintaining the threshold fiscal deficit-to-GDP ratio at 3%—are often attached to fiscal discipline and economic growth, it is highly unlikely that the government will announce a stimulus package through boosting public expenditure. However, it is imperative to explore the path of public expenditure stimulus, given the corporation "effective tax rate" reduction on the economy is only to an extent of around 2%, and the "structural reforms"—including corporation tax rate reduction—can take a long time for the intended results on the macro economy to show.

Effective tax rates of corporate sector in India

Profit before taxes	Share in total: Profits before	Share in total: income taxes (in %)	Share in total: Corporate income Tax (in %)	Ratio of total income to profit before taxes (%)	Effective tax rate (%) (profit to tax ratio)
Less than Zero	0	0.58	0.47	—	—
Zero	0	6.54	2.81		
0-1 Crore	2.73	3.38	3.25	95.39	29.37
1-10 Crore	6.76	7.54	7.4	85.44	26.99
10-50 Crore	9.17	9.08	9.48	76.26	25.52
50-100 Crore	5.16	5.01	5.26	74.83	25.14
100-500 Crore	15.55	14.56	15.12	72.00	23.97
Greater than ₹ 500 cr	60.63	53.31	56.21	67.66	22.88
All Companies	**100**	**100**	**100**	**76.94**	**24.67**

Source: (Basic data) Budget Documents, Ministry of Finance, Budget Division, Government of India

Investors caught in a global tug of war

Given the increasing uncertainties, investors should consider, at the minimum, adding an element of "regret minimisation" to their portfolios

MOHAMED A EL-ERIAN
Bloomberg

MORE THAN ANYTHING else, last week's market gyrations illustrated the tug of war that has dominated the US stocks in recent months, and confined them in a range despite significant developments in the underlying dynamics. The intensifying tension between the two macro forces could lead to greater volatility, and pose increasing challenges for investors.

The first part of the week was dominated by investor concern that international weakness in manufacturing had spread to the US and, more importantly, to the services sector, which dominates the domestic economy. The result was a harrowing two-day drop in stocks that erased the gains of the previous five months.

The second part was much different. Hopes for support from Washington, fuelled by constructive comments from the White House about the coming trade negotiations with China, were accompanied by the release on Friday of the September jobs report, which kept the door open for another Federal Reserve rate cut this month. Stocks rebounded, significantly cutting into the losses for the week.

This roller coaster is not new and exemplifies the interaction between two big macro themes, or what economists call "global factors." The intensifying tug of war, however, raises questions about the stability of this "unstable equilibrium" for markets, and the consequences for investment strategies.

As the week demonstrated, the long-standing risk of downward pressure on stocks from weaker fundamentals has been amplified recently by mounting evidence that US manufacturing is now part of a global contraction caused by a deepening slowdown in international trade. Adding to the gloom, data on sentiment suggests that this is already spilling over to the much larger services sector. And, while solid readings from more comprehensive hard data releases, such as the jobs report, didn't ring additional alarm bells, it wasn't strong enough to establish that the US economy is immune to pressure from the rest of the world.

On the other side of the tug of war, the policy hopes that have pulled stocks higher have shifted from central bank action to trade and other measures. This is not because investors have concluded that the Fed is unlikely to cut interest rates this year—it most likely will—but because they realise the cuts probably won't materially improve the economic outlook. Recognition is spreading among market participants that there is an important difference between a friendly central bank and an effective one. Moreover, in the case of the European Central Bank, such prolonged friendliness risks being counter-productive beyond a certain point.

Consequently, the optimists now centre their hopes on the possibility of a US-China trade deal, and fiscal stimulus in Europe led by Germany.

Some feel that with president Donald Trump now facing possible impeachment, his administration will be more inclined to reach agreement with China—a partial deal—even if it falls short of the comprehensive and durable outcome for which many are hoping. The coming visit of a Chinese trade delegation offers optimists a timeline for their hopes. Meanwhile, weakness in German economic data is seen by these optimists as the catalyst for significant fiscal stimulus.

> In the current scenario, traditional approaches to diversifying holdings and mitigating risk could prove insufficient

The growing tension between these two global factors increases the uncertainty for the worldwide economy and markets, and threatens the "unstable equilibrium" that has persisted until now.

For investors, the situation challenges the sufficiency of the traditional approaches to diversifying holdings and mitigating risk. It increases the risk of unsettling volatility, multiple equilibria, and the threats of mistakes that come with that.

In such a world, investors should consider, at the minimum, adding an element of "regret minimisation" to their portfolios. This means strongly emphasising balance-sheet strength and other quality considerations in selecting stocks, building a bigger-than-usual cash buffer in their asset allocation, and shortening maturities on their corporate and government bonds.

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LETTERS TO THE EDITOR

Growth over environment debate

Glad to read that the SC stayed the cutting of any further trees at Mumbai's Aarey Colony, which is the biggest slap on the face of those who wants to destroy the environment. Innocent people were arrested for protesting and were later released on bail.The matter of whether Aarey is an eco-sensitive zone or not pending before the National Green Tribunal and the authorities should have not gone ahead with the felling of trees.Resolved to save the trees, many protestors gathered at the site to raise their voice against the felling of trees where the Mumbai Police imposed Section 144, banning unlawful assembly. The police arrested more than 100 protestors for allegedly disturbing public order and obstructing government officials from performing their duties.
— Bhagwan Thadani, Mumbai

Repo rate cuts

Amidst continued weakness in economic activity, the Monetary Policy Committee has cut the basic repo rate by 25 bps. Its accommodative monetary stance, given the economic slowdown is understandable. Apprehensions over poor transmission by financial institutions cannot be allowed to persist.As the efficacy of monetary policy depends upon transmission, the government needs to take steps like aligning interest rate on savings with market rates. Stimulus measures to arrest the slow down of economy are imperative, but the government needs to ensure adherence to fiscal deficit targets.
— M Jeyaram, Sholavandan

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OVER THE BARREL

A buffer called Saudi Arabia

Pakistan is heavily in debt to Saudi Arabia and it depends hugely on the Kingdom's largesse to avoid economic collapse. Saudi Arabia, consequently, has considerable leverage over Pakistan and the latter, in turn, cannot afford to ignore Saudi economic interests when war-gaming an offensive strategy against India

TWO UNCONNECTED 'DEVELOPMENTS' and one 'fact' lead me to suggest India should deepen its economic linkages with Saudi Arabia through interlocking cross-country investments. The first development is the recent attacks on Saudi Arabia's oil and gas infrastructure. The second is the muscular, albeit irresponsible, anti-Indian diatribe by the Pakistani leadership. They have introduced the nuclear option in their language. The 'fact' is the location of a substantial part of our petroleum assets on- or offshore our western coastline. In my view, when seen through a common lens, these three matters reveal a heightened security risk scenario for India, but also offer a non-military option for mitigating the consequential outcome. Saudi Arabian investments in India's petroleum infrastructure and vice versa lie at the core of this option.

Saudi Arabia's oil and gas infrastructure has been attacked several times over the past several months. On May 12, four oil tankers, two of which belonged to Saudi Arabia, were damaged by limpet mines. On May 14, the East-West oil pipeline that runs for 1,200-km across the Arabian peninsula was bombed. On August 17, its super giant Shaybah oil field was sabotaged. And on September 14, unmanned aerial vehicles (drones) knocked out the Abqaiq oil processing facilities and the giant Khurais oil field. This latter attack took out 5.7 million barrels per day (mmbd), or 60% of Saudi Arabia's production of 9.8 mmbd. It was the largest disruption to oil supplies, ever.

The Abqaiq attack compelled India to contemplate drawing on its strategic reserves and also look for alternative supplies. Fortunately, the supply shortfall was made up quickly and prices, which had shot up by 12% in the immediate aftermath, returned to pre-attack levels within days. India did not suffer greatly from this disruption.

The attack also compelled India to ask questions related to Middle East geopolitics. Was the regional status quo now sustainable? How might the US react? Would they limit their response to non-violent options of sanctions (and cyber)? Or would they support a (covert or overt) retaliatory attack on Iranian assets. (The Kharg Island facilities would be a proportionate target). India has admitted they have no clarity on the answers. In fact, it appears no one does. Trump is talking of "maximum pressure," but he has refrained from a military response. Iran has said "no war, no negotiation," but it has signalled it may be amenable to the resumption of talks.

The attack has also compelled reflection on the state of the security of India's oil and gas infrastructure. The Saudi assets were ringed by sophisticated US Patriot anti-missile defence systems. Yet 17 facilities in Abqaiq and Khurais were hit by 25 low-flying cruise missiles. What does this say about the strength of defence systems when pitted against the forces of weaponised artificial intelligence? How vulnerable are our oil and gas assets on the western coast? Specifically, the Mumbai High oil and gas fields; the Jamnagar refinery complex; the LNG regasification terminals in Dahej, Hazira, Dabhol and Cochin. What, if any, steps should India take to tighten the security systems protecting these assets, especially in light of the heightened anti-India rhetoric by Pakistan. And, perhaps most important, what can India do to lengthen the odds of an attack against these assets?

> The drone attacks compelled India to ask questions related to Middle East geopolitics. Was the regional status quo now sustainable? How might the US react?

It is in the context of this last question that I suggest that India promote cross-country investments with Saudi Arabia.

Pakistan is heavily in debt to Saudi Arabia and it depends hugely on the Kingdom's largess to avoid economic collapse. Saudi Arabia, consequently, has considerable leverage over Pakistan and Pakistan, in turn, cannot afford to ignore Saudi economic interests when war-gaming an offensive strategy against India. Were Saudi invested in Indian oil and gas assets, it might deter Pakistan from bringing these assets into their strategic calculus.

In this regard, there are two initiatives on the anvil that the government should encourage. One is the $40 billion joint venture refinery project in Ratnagiri. The partners are Aramco, Abu Dhabi National Oil Company (ADNOC) and Indian Oil. This project is currently stalled because of land acquisition and environmental clearance. As matters stand, it will be years before it sees the light of day. All parties remain, however, committed. The second is the proposed investment by Saudi Aramco into Reliance Industries. Mukesh Ambani announced at his AGM in June that Reliance and Aramco were in discussion regards the acquisition of a 20% stake by Aramco in Reliance oil, gas and chemical businesses. The commercial logic for Aramco is compelling. It would secure a captive outlet for 500,000 barrels a day of its crude oil and a foothold in India's downstream market. The logic for India (as distinct from Reliance) is comparably compelling. By giving Saudi Arabia a material stake in its petroleum sector, it would 'strengthen' the security perimeter around its oil and gas facilities.

There is a third initiative, albeit in the opposite direction, which should also be considered. This relates to Saudi Aramco's planned offering thorough an international public offer (IPO) of up to 5% of its shares to the public. The Crown Prince of Saudi Arabia, Mohammed Bin Salman (MBS), is driving this initiative. Its success is a matter of great personal importance to him, especially since his economic vision pivots around the revenues that will be generated through the IPO. The IPO may get delayed because of the attacks and the escalating tensions in the region—but when it is finally announced, India should look at it through a financial and strategic lens. The purchase of even a small stake would please MBS and deepen his commitment to prevent Pakistani adventurism.

No one should assume that such cross-country investments will provide an iron-clad guarantee. There can be no such assurance. Pakistan's behaviour is now so influenced by political emotions, domestic pressures and jingoistic fervour that there is little room for rational logic and dialogue. But as any student of history will know, it does not take much for irresponsible rhetoric to translate into violence. India should consequently pursue any and all ideas that lengthen the odds of such an outcome. A 'Saudi buffer' is one such idea.

RECORD KEEPING

Leveraging the ledger

SUMIT SOOD
The author is MD APAC, GlobalLogic

How distributed ledger technology can revolutionise record keeping

CIVILISATION IS A direct consequence of humans settling down. As Yuval Noah Harari notes in his bestseller '*Sapiens*', what distinguishes us from animals is our ability for large-scale collaborations. The Sumerians of ancient Mesopotamia invented writing around 3,000BC. They kept records (tablets) of the number of sheep, goats, cattle and grain owned/produced. Records meant calculation and collection of taxes. These tablets were arguably the world's first accounts and contracts.

Around 1340AD, Jewish merchants, and traders of northern Italy, devised the 'double-entry system'. Essentially an algorithm, it created two independents, yet correlated, records of the same event. With time, ledgers became tedious paperwork, giving rise to bureaucracy—a time-consuming and costly affair. Bureaucracy made it painful to access records, and even today it is. Here, distributed ledger technology (DLT)—a digital system for recording the transaction of assets in which transactions and their details are recorded in multiple places at the same time—offers the opportunity to tackle problems of record keeping. Underlying DLT is blockchain—the technology that underlies bitcoin as well.

A distributed ledger can be described as a ledger of many transactions or contracts maintained in decentralised form across locations and people. All the information on it is securely stored using cryptography and can be accessed using keys and cryptographic signatures. Any changes or additions made to the ledger are reflected and copied to all participants. Once the information is stored, it becomes an immutable database, which the rules of the network govern, making the records resistant to malicious changes by a single party.

> In India, about 50% of the states are currently involved in DLT-related initiatives. Andhra Pradesh, Telangana lead the pack

Now, imagine a scenario where every transaction (land records, taxes, contracts) gets recorded in a secure, accessible and widely available manner, and does not need multiple rounds of government agencies and offices to ratify, validate and approve transactions.

DLT application is incremental and can reduce bureaucracy on a broad scale. As barriers of implementation subside and the technology matures, DLT's significance through shared ledgers of trust will accelerate current processes and become more efficient. It is the key to architecture vast amounts of secured records and address issues of transparency, accessibility and security in a pragmatic way.

In China, DLT is a national priority—it is looking to harness the power of public-private in healthcare data, supply chain and other applications. In fact, two-thirds of all DLT-related patents are Chinese. In the UK, government agency HM Land Registry is exploring how distributed ledgers and smart contracts could revolutionise land registration and property buy-sell processing. The Baltic state Estonia has been pioneering DLT since 2008. It uses DLT to register businesses and online tax payment—cutting bureaucracy and saving public money. Their blockchain, called KSI, connects all government's services on a single digital platform. It integrates vast amounts of sensitive information from healthcare, judiciary, legislature, security and business registries.

Closer home, in India, about 50% of the states are involved in DLT-related initiatives, driving public sector adoption in the country. Telangana and Andhra Pradesh lead the pack. The top-three use-cases are land registry, farm insurance and digital certificates.

Since ancient times, ledgers have been at the heart of economic transactions—to record contracts, payments, buy-sell deals or movement of assets or property. The journey, which began with recording on clay tablets, made a big leap with the invention of paper. Over the last couple of decades, computers have provided the process of record keeping and ledger maintenance great convenience and speed. Just like the humble Sumerian tablet, DLT can potentially transform and commoditise how society agrees, trusts and transacts.

Lessons we must learn from Ebola

India should invest in developing vaccines for diseases before crisis strikes

VIRANDER SINGH CHAUHAN
The author, a Padma Shri, is a genetic engineer and academic who has been instrumental in developing a vaccine for malaria

EBOLA
HIV
SARS
HBV
MERS
H1N1
MALARIA

THE LAST TWO months have seen a constant and disturbing flow of news from the Democratic Republic of the Congo about the resurgence of Ebola. The current outbreak, which has now been declared a public health emergency of international concern, has already claimed nearly 2,500 lives. The situation has captured worldwide attention, with public health experts, scientists and health workers racing to contain the disease.

A serious and highly contagious virus, Ebola is fatal for approximately half of the people it infects. While experts worry that the worst is yet to come, the current outbreak still pales in comparison to the 2014-16 epidemic, which spread to 10 countries—including four outside of Africa—and resulted in over 28,000 suspected cases and 11,000 deaths.

Luckily, healthcare responders today have a tool that may help prevent outbreaks of such magnitude in the future: an investigational Ebola vaccine. Although Ebola vaccines have been in development for several years, during the 2014-16 crisis, in an unprecedented move, the World Health Organisation (WHO) and partners began using the vaccine in clinical trials in the most affected areas in West Africa.

Now, this yet-to-be-licensed vaccine is being put to work once again—this time, to provide protection to a larger group, including thousands of healthcare workers. This is a huge achievement and the results are promising, with preliminary research finding that the candidate vaccine is safe and highly efficacious, and that the innovative vaccination approaches used in the trial were effective in helping prevent further spread. The Ebola crisis has also inspired the creation of important multi-partner initiatives, such as the Coalition for Epidemic Preparedness Innovations, a global alliance dedicated to developing vaccines against emerging infectious diseases.

But there is a lesson here. Immunisation is a powerful tool, with tremendous potential to help us prevent illness and death from emerging infections and common killers alike. Investing in and accelerating vaccine development *during* an outbreak is not enough. We must consistently prioritise developing, licensing and introducing vaccines, and ensure they reach those who need them the most. This is especially true of a country like India, which has a high burden of infectious diseases that can spread rapidly given the density of population.

By investing in vaccine development, India can create lasting health and economic benefits for its citizens. In fact, vaccines are one of the most cost-effective public health interventions. A 2016 study of 94 lower-income countries found that, for every dollar invested in vaccination, more than 16 dollars are expected to be saved in healthcare costs, lost wages and lost productivity due to illness and death.

Already, there is a significant and exciting progress to develop indigenous vaccines. India is home to mature and successful vaccine production companies, highly respected worldwide. Many vaccines in India's Universal Immunisation Programme (UIP) are manufactured by Indian companies.

Over the last two years, three vaccines produced in India received the WHO's prequalification—two rotavirus vaccines currently used in India's UIP, and the world's first typhoid conjugate vaccine. In fact, there are many vaccine candidates in the pipeline for other serious, but often deprioritised, diseases such as Zika virus, Nipah virus and malaria.

Of course, developing vaccines is not enough—we also need to ensure that they reach the people who need them the most. India's UIP—the largest programme of its kind in the world—aims to reach more than 25 million infants with vaccines against 12 important diseases each year. Since its launch in 2014, the government's immunisation scheme, Mission Indradhanush, has vaccinated over 33 million children across the country. Additionally, the government and its partners have developed innovations to help reach every child, such as the Electronic Vaccine Intelligence Network (eVIN), which provides real-time information on vaccine stocks in 371 districts.

Progress has continued with the introduction of pneumococcal conjugate vaccine (PCV) to help prevent a leading cause of pneumonia. One recent study estimates that PCV introduction has the potential to prevent more than 2 million hospitalisations, 400,000 deaths, and $50 million in healthcare costs in just 10 years. However, ensuring that this critical vaccine reaches every child will require enhanced funding commitments by the government.

Vaccine research and development, introduction and scale-up requires considerable time, government prioritisation, investment and multi-sectoral partnerships. Above all, it requires a sense of urgency. We cannot afford to wait for the next crisis to invest in vaccine development now. We must learn from Ebola and invest early and often in getting promising vaccine candidates through clinical trials and ready for use in communities, and in scaling up access to existing vaccines like PCV and rotavirus vaccine to ensure that they reach those who need them the most. Only if we invest the time and effort today, can we ensure healthy lives for generations to come.