Opinion
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Black hole pic epochal in history of science

Every milestone since Einstein published his theory of general relativity has been leading up to this

ON WEDNESDAY, THE world got to see what a black hole looks like in the flesh. The image-reveal of the black hole at the centre of the galaxy, Messier 87, will go down as a seminal moment in the annals of the history of man's understanding of the universe. It corroborates Albert Einstein's theory of general relativity, which helped predict black holes some eight decades before, and thereby should inform scientific discourse in unprecedented ways. It is also living proof, much like the Large Hadron Collider, of the gains of pooling minds and resources from across the globe—200 scientists, part of the Event Horizon Telescope (EHT) collaboration, produced the image, working on signals from eight radio observatories located in remote, high-altitude sites in Hawaii, Spain's Sierra Nevada mountains, the Chilean desert and the Antarctic ice-sheet. These radio telescopes are sensitive to wavelengths of about a millimetre—at that level of radio frequency, the radiation from a black hole can penetrate interstellar dust and gases. While the existence of black holes was theoretically proven, actually seeing one (or more correctly, its shadow) was a gargantuan challenge, since they have gravitational fields so strong that even light can't escape its pull, and thus all that can be visualised is a singularity—a concentrated point of infinite density where the laws of space-time can't exist—enveloped by a shell of darkness called the event horizon, the absolute outer bound from where nothing can escape the singularity's pull. Beyond this is the photon orbit, a region from where light could theoretically escape.

The M87 black hole is 55 million light years away from Earth, and packs a mass roughly equivalent to over 6.5 billion Suns, but its event horizon doesn't extend beyond 40 billion km, which *Science* helpfully notes, is about four times the diametre of Neptune's orbit—not impressive in the intergalactic context. The EHT team harnessed most of the mm-wavelength telescopes worldwide and refashioned it into a virtual, Earth-sized telescope through what is known as very-long-baseline interferometry. Having obtained all the data that they needed to generate the image by April 2017, the scientists at EHT got down to processing that—imagine the volume of data that needed to be processed if the image could be generated only by 2019. It was so large—4 petabytes in all—that it could not be transmitted to large computers at MIT, the US, and Max Planck Institute for Radio Astronomy, Germany. This is where Katie Bouman, who is the now the toast of the scientific community worldwide and her team come in—they wrote the programming that eventually converted the mammoth data into the image. Bouman has become the poster-girl for women in STEM overnight. Given how structural the gender bias in STEM is—evident from the fact that women whose work has been later recognised as seminal to path-breaking scientific developments have seldom received their due even within the scientific community—an idol who shot to stellar fame is manna from heaven for righting STEM's gender gap.

Every milestone since Einstein published his theory of general relativity has been leading up to this. Basing on Einstein's works, German scientist Karl Schwarzschild proposed that an infinitely dense object would exert gravitational pull so strong within a certain distance from itself that not even light can escape it. In 1939, this went from being a mathematical observation to the prediction of massive stars collapsing to form such an object, by American scientist Robert Oppenheimer and his team. In 1967, Jocelyn Bell Burnell discovered pulsars—super dense, spinning dying stars—confirming that Oppenheimer's prediction maybe true; Burnell never received the Nobel, though the discovery was recognised by the Nobel committee in 1974. There has been much indirect evidence since then, the most compelling of which came in 2015 when LIGO detected ripples in space-time emitted by the cataclysmic merger of two black holes.

India badly needs FDI

Neither the govt nor private sector has capacity to spend

AFTER RBI LOWERED its growth forecast for 2019-20, the IMF, too, revised its projections for the Indian economy downwards. The headwinds to growth are well-documented: a slowing world economy pegged to grow at just 3.3% in 2019, a relatively weak banking system and insufficient liquidity to aid affordable credit growth or spur consumer demand. Amongst the biggest roadblocks for the economy is that investments will continue to remain slow with the government unable to spend beyond a point due to fiscal constraints and the private sector lacking the financial wherewithal to create fresh capacity. The many welfare schemes promised by political parties in their election manifestoes will mean additional pressure on government finances, already in a somewhat fragile state thanks to the large extra-budgetary borrowings. The biggest challenge probably will be to rejuvenate the farm sector and boost rural incomes.

Perhaps the best way to start out would be to focus on attracting foreign capital into the infrastructure sector. Patient capital will come in but the government must frame easier rules and regulations and must commit to leaving these untouched. Unless there is certainty on the regulatory front—and India's track record is patchy—no foreign investor will commit capital. Also, the government must get over its reluctance to free up FDI norms in sectors such as multi-brand retail and defence. India remains an attractive investment destination, and if the norms are freed up, the country could gain enormously. Even as it works towards mobilising fresh investments, however, the government must work at freeing up the investments locked up in existing projects that are stalled for one reason or another; for instance, some ₹3.5 lakh crore is stuck in housing projects alone. One big reason industry is hesitant to add to capacity is that labour laws remain restrictive. Although the government initiated some reform, it held back which is why the Make in India programme was a complete non-starter. Also, tax terrorism must stop else multinationals will stay away; it is better the economy grows and yields revenues rather than the government coercing companies. As for reviving agriculture, the only way to do it is to initiate reforms—better linkages, more *mandis*, and by boosting electronic trade. Although prices of several products are already at or above global levels, a liberal export policy must be framed so that farmers can take advantage of it at any time.

If the government is to support investments, it must stop subsidising inefficient enterprises—a tough decision given the large numbers employed in these state-owned firms and banks. But throwing good money after bad can only hurt the exchequer and the government's ability to boost growth and create jobs. And there is no room to further re-base the data to show higher growth.

CleaningAir

Vehicular emissions are increasing the incidence of childhood asthma cases in India

TRAFFIC-RELATED POLLUTION caused asthma among 350,000 children in India in 2015, second only to China, according to a Lancet study released on Thursday. The damage to children's health is not limited to China and India though. In British and American cities, better off in terms of development and economic growth, the Lancet researchers blame traffic pollution for a quarter of all new childhood asthma cases. Canada has the third highest rate of new traffic-related asthma cases among the 194 nations analysed, while Los Angeles and New York City are in the top 10 worst cities out of the 125 assessed. With 92% of cases developing in areas that have traffic pollution levels below the World Health Organization (WHO) guideline level, the researchers suggest that this limit may need to be reviewed. The researchers used NO_2 as a surrogate for the traffic pollution mixture as the gas is a pollutant formed mainly from fossil fuel combustion, and traffic emissions can contribute up to 80% of ambient NO_2 in cities.

South Korea (31%) had the highest proportion of traffic pollution-attributable childhood asthma incidence. India ranks 58th for this metric because, although levels of other pollutants in the country are amongst the highest in the world, NO_2 levels (between 2010 and 2012) in Indian cities appear to be comparable with better-placed European and US cities, the researchers said. Two-thirds of traffic pollution-related asthma cases occurred in urban centres globally, and when suburbs were included, this proportion increased to 90%. Therefore, policies tackling air pollution at city, state and national levels are needed, especially in the urban metropolitan areas. Although some countries and cities are pledging to phase out internal combustion engines and policies such as London's new ultra-low emission zone are being rolled out, this transition needs to become global, and it needs to happen faster. Else, the health of future generations will be compromised at birth.

● NO PROOF REQUIRED

INDIAN INSTITUTIONS ARE OPERATING WITH THE SAME MINDSET AND TECHNOLOGY AND OUTLOOK THAT THE PIONEERS DID 70 YEARS AGO. BUT THE WORLD, AND TECHNOLOGY, HAS MOVED ON. NOT US, THOUGH

Unemployment at 45-year high— a statistical embarrassment

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THERE IS AN old saying—no, it is confirmed that it is not a Chinese proverb—that says "be careful what you wish for, it might come true". At present, the political opposition has made jobs and unemployment their number one issue to unseat the Modi government. If I were a Congress strategist, I would do exactly what they are doing. Jobs, and the economy, is where the BJP are maybe the most vulnerable. And the *perception* of vulnerability is enhanced by BJP's misguided stubbornness to *not* release the Periodic Labour Force Survey (PLFS) data on the labour market—employment, unemployment, wages, etc. These data were for the period July 2017-June 2018 and is the last official government survey on the labour market. It yielded the result that unemployment, at 6.1%, was at a 45-year high.

Statisticians and economic experts, who should know better and probably do, are also siding with the opposition with the belief (wish!) that the government will be intransigent enough to not release the data and thereby allow the perception to continue that the economy is really as weak as indicated by the PLFS data. This is where being careful what you wish for comes in; once released, the PLFS data is likely to show that their conclusions are extremely flawed, and embarrassingly inaccurate.

In the next few paragraphs, I report on labour market data for 2011-12 and 2017-18. As the reader peruses the evidence, she will realise that the PLFS data, and results, are in a class of their own—they don't conform to any known economic behaviour. But we won't know that until the data are released.

While the media (obviously!) has concentrated on the reported 45-year high in the unemployment rate (6.1% in 2017-18 vs the 2.2% observed in 2011-12), it is prudent to interpret, in a detached manner, other economic trends contained in the 'leaked' report.

Count the inexplicable anomalies as we list them. First, some background about labour market reports in India. The NSSO believes (erroneously) that the ratios obtained are sacrosanct, but not the survey method on which they are based. For example, to derive the important data on jobs, NSSO documents advise users to use the *ratios* that they provide (labour force participation rate, worker participation rate, etc) and multiply the ratios by census-based population. Good advice—but how do you believe the building blocks of the survey-based ratios?

For example, first the PLFS reports an urbanisation rate (a ratio) of 2017-18 of 29.3% compared to an estimated 31.2% in the NSSO's own survey for 2011-12. A decline of 2 percentage points, when the reality (yielded by every other observer) is for an increase in urbanisation; how did this simple cross-check escape the NSSO or its oversight body, National Statistical Commission (NSC)?

Secondly, the estimate for overall population in 2017-18 is off the charts—i.e, too low. The NSSO 2011-12 survey reported a population of 1088 million; in 2017-18, it reports a population that is 14 million less. On a survey/census ratio (since the NSSO and NSC are fond of ratios) basis, the 2017-18 ratio of 82% is the lowest observed for the last 40 years, if not ever. This is both an Indian and world record for population underestimation.

Third, what explains this statistical junk? As lucidly pointed out by Avik Sarkar (*bit.ly/2ULHNuA*), it is the sampling technique, stupid. Inexplicably, and seemingly without much consultation with outside experts, the NSSO decided to radically change their sampling method—it was to be now based on educational attainment rather than household per capita consumption. It is one of the biggest statistical no-nos to select a sample based on a criteria that affects the behaviour you are trying to explain. Education affects labour market participation—the last thing you want to do is 'select' on the basis of education. James Heckman got a Nobel prize in 2000 for obtaining reliable results when the sample behaviourally selects itself. And here we are imposing a selection bias.

Simply put, the PLFS 2017-18 survey is a huge statistical embarrassment and someone should inquire as to how it passed all the statistical checks and balances of the experts. My best 'recovery' of what happened—the expert masters felt that the radical change in sampling method would not make much difference to the results.

A large number of households with lower educational attainment (with no member of the household having more than a secondary level of education) were missed out in the PLFS survey. These households are likely to be poorer, and more at work than members of the middle class. Missing them means that you are likely to skew the wage pattern in unbelievable directions. For example, poorer casual workers (those working on daily wages, including agricultural wages) show a big decline in their share in the workforce—a 20% decline from 30.5% of the workforce in 2011-12 to 24.9% in 2017-18. The higher income salaried workers show a large increase in employment share—from 19.3% in 2011/12 to 22.8% in 2017-18—again, a near 20% increase. Such large changes are unprecedented and suggest that, contrary to the unemployment rate jump, the economy is doing very well.

But wait, as there is more to 'release'—all puns intended. Let us look at what has happened to the real income (wage) increase for the two sets of workers comprising almost half the working population (the rest are self-employed, like the farmers, from whom the NSSO abstains from collecting any income data. [Again, revealing a provincial mindset].

The higher income middle class salaried workers show a cumulative 18% decline in their real incomes. Again, unprecedented. Well, there can be an explanation. Look, everybody is getting educated (the sample selection is based on education), there is excess supply of educated people, and the demand hasn't kept pace. Ostensibly because of GST and demonetisation. But wait—the real wages of the poorer casual workers, the ones who are out of jobs because of demonetisation, GST, and a lack of demand, have increased by 29%. If true, the PLFS data would indicate that the Modi government has unleashed the most inclusive growth anywhere, and at anytime in human history. There should be a special Nobel prize for this achievement. Forget farm distress—you are not counting income right. All the farmers have become farm labourers, in order to enjoy these high wages. And inequality *wallahs*, please note—Modi has engineered the highest inequality decline in history, that too in just five years.

The PLFS results can be described in two words—shockingly untrue. The statistical masters who passed the PLFS data report with a 'good housekeeping seal' should hang their heads in statistical shame. All the data are presented in the table—all the data are from the much leaked (and vaunted) media reports. Please, will any of the concerned citizens who have voiced shame, censorship of government data, and decline of public institutions, explain the array of evidence presented?

My own personal view is that the PLFS data is a statistical embarrassment to India and the NSSO organisation. We all complain about how institutions have gone down, and there are a myriad complaints about the authenticity, or transparency, of Indian statistical data. The NSSO was a much-respected institution, as was the National Statistical Commission, which was first formed in 2006 under the chairmanship of the late Suresh Tendulkar (I was proud to serve under his leadership for the first three years of the Commission 2006 to 2009).

Sadly, and extremely unfortunately, many, no, make it most, no, make it all Indian institutions, are still operating with the same mindset and technology and outlook that the pioneers did 70 years ago. But the world, and technology, has moved on. Not us, though.

NSSO PLFS data - believe it or NOT

	2011-12	2017-18	% chg
Population (million)			
NSSO Survey	1,088	1,074	-1.3
Census	1,220	1,307	6.7
>=15 years			
NSSO Survey	763		
Census	848	937	9.5
Rates (%)			
Urbanisation	31.2	29.5	-5.8
Unemployment	2.1	6.1	65.6
As % of worker population			
Salaried workers	19.3	22.8	15.4
Casual workers	30.5	24.9	-22.5
Salaries and wages (₹ per day)			
Salaried workers	397.0	475.0	16.4
Casual workers	143.0	263.0	45.6
CPI price index (2012=100)	95.4	136.4	30.1
Real salaries and wages (2012, ₹)			
Salaried workers	416.1	348.2	-19.5
Casual workers	149.9	192.8	22.3

Source: For 2011-12: NSSO Unit Level data on Employment and Unemployment
For 2017-18: Leaked 2017-18 report in Business Standard, various issues

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Tesla's growth story needs a new charge

Negative working capital can be a nice source of free short-term financing. But it comes with risks, especially if sales take a hit and/or suppliers tighten their terms

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Bloomberg

TESLA INC.'S STOCK is back in its $260-$270 hot-zone again, falling on news that a key supplier is taking things down a notch. Panasonic Corp. and Tesla are reportedly "tempering expansion plans" at the Gigafactory, the giant facility in Nevada that produces battery packs for the electric vehicle-maker. Panasonic supplies batteries and has invested heavily in the plant, with capacity there now close to 35 gigawatt-hours, according to Benchmark Mineral Intelligence, an analytics firm specialising in the battery supply chain. That is the amount Panasonic was targeting for fiscal 2019 and is enough for about 450,000 to 500,000 Model 3s a year.

That 500,000-vehicle figure has been a bit of a sore point for Tesla this year. CEO Elon Musk drew the ire of the Securities and Exchange Commission for tweeting in February that the company would make roughly that number of vehicles this year, a claim he quickly walked back. He ended up in a lower Manhattan courtroom last week as a federal judge and attorneys argued about whether he should face contempt charges for that tweet (the judge instructed both sides to negotiate first). That is really just a sideshow, though. The big recent news concerns Tesla's first-quarter sales numbers, which were shockingly bad but also clarified why the company appeared to be going all-out in the first quarter to boost sales and slash costs.

The news concerning Panasonic, which will reportedly now "study" additional investment, adds a further data point. Tesla will continue to make investments as needed at the Nevada plant and says it may be able to wring more from existing equipment, according to Bloomberg News. The company recently reaffirmed its delivery target for the full year. Taken on its own, talk of higher productivity would normally be encouraging. However, in the context of Tesla's deep cost cuts, the big reduction in 2018's capex budget, and those first-quarter sales and production figures, it can also be viewed as one more example of dissonance with high growth expectations. Moderation can be a drawback, rather than a plus, when a stock has dropped almost a fifth in a matter of months, even as its earnings multiple has somehow virtually doubled to 90 times. This also brings to mind another metric worth examining when first-quarter results drop in a few weeks: working capital.

Tesla's working capital has turned sharply negative over the past two years, effectively providing an important source of cash flow from its own suppliers. Of the $2.1 billion swing in Tesla's working capital since the end of 2016, more than two-thirds relates to a big increase in accounts payable. Negative working capital can be a nice source of free short-term financing. But it comes with risks, especially if sales take a hit and/or suppliers tighten their terms. Tesla's likely first-quarter loss and it having to pay out $920 million for a maturing convertible bond put the spotlight on its cash balance. When reporting sales, Tesla made a point of saying it had "sufficient cash" at the end of the quarter. With the spread on Tesla's 2025 bonds having widened again to almost 600 basis points, close to the peak reached last month, that is understandable.

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The perils of chasing indicators

Institutions cannot ignore rankings such as NIRF as financial assistance and choice of institutions by students depend on them. But the questions are: Will orienting to the parameters used in the NIRF and NAAC lead to improvement of the quality of our best institutions? And will chasing these indicators improve the quality of the low performers?

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ILLUSTRATION: ROHNIT PHORE

THE NIRF 2019, the annual ranking of higher educational institutions using the National Institutional Ranking Framework of the ministry of human resource development (MHRD), was released recently. While India has about 900 universities and 40,000 colleges, the number of participating institutions stood at just 3,127, and hardly any of them are of global standards. In fact, there are no Indian universities in the top 100 of the QS World University Rankings 2019.

While the window of demographic dividend remains open for India, education remains a major bottleneck. It is a once-in-a-lifetime opportunity for nations. How much we will benefit will depend on the quality of human capital. But India ranks 130th out of 189 countries in the 2018 Human Development Index. And we were ranked 115th out of 157 countries in the first ever Human Capital Index released by the World Bank in April 2018. This index measures the human capital level and predicts the potential productivity of children. India

had a score of 0.44, meaning that a child born today can expect to be only 44% productive compared to her potential with complete health and education. Subsequently, the government rejected the report!

Gross enrolment ratio (GER) for higher education in India is 26. It is 22 and 16, respectively, for scheduled castes (SC) and scheduled tribes (ST). This compares poorly with 51 of Brazil, 48 of China and 81 of Russia. While the quality of education remains poor and access highly inequitable, what we are witnessing in the background is a retreat of the state from the sector, especially higher education. Public expenditure on education was around 3.1% of GDP in 2012-13. It declined to 2.4% by 2015-16. And public expenditure on higher education has been around 1%. This is against the long-standing demand of 6% by the sector.

An urgency to reduce budgetary support and increase efficiency, reflected in the philosophy behind the New Public Management, prompted governments across the world to move towards a

result-oriented approach, from the 1980s onwards. The disenchantment with the public sector led to the separation of the roles of service provider and regulator/policymaking of governments. Competition between units operating in quasi market environments was expected to improve the outcomes leading to the achievement of policy goals. India is treading this path in education. The National Assessment and Accreditation Council (NAAC), an autonomous body under the University Grants Commission (UGC), evaluates, assesses and accredits institutions of higher education for a period of five years. The NIRF ranking is a yearly affair, basically an annual progress card. While it is important to evaluate performance, we should be aware of the unintended consequences of this approach.

That the assessment and ranking approach has intensified the rat race is a foregone conclusion. Institutions cannot ignore the ratings as financial assistance and choice of institutions by students depend on them. But the pertinent question is whether we could make any break-

through in higher education by following this accreditation and ranking approach? Will orienting to the parameters used in the NIRF and the NAAC lead to further improvement of the quality of the best institutions? And will chasing these indicators improve the quality of the low performers?

Excessive emphasis on performance evaluation can result in performance paradox, a weak correlation between performance indicators and actual performance. The reasons are many. Perfor-

> If we have to create better institutions, we must invest more in education, especially in teacher training. And their energies should be channelled into the right activities, undistorted by the spectre of indicators

mance evaluation will shift focus to activities that can be measured. For example, the number of programmes organised will increase without any attention to their quality or even relevance. But these quantifiable aspects increase at the cost of aspects that are difficult to quantify. Quality of teaching eludes quantification. But a shift away from this core activity in colleges will not augur well for higher education.

As emphasis shifts to indicators, more resources will be devoted to documentation and quality assurance mechanisms. Moreover, the organisation will become myopic in its approach, ignoring the medium- and long-term goals. Chasing of indicators also leads to laggards simply mimicking the outward appearance of the best performers. The fact that India leads in the number of publications in predatory journals is ample proof of this. There will also be perverse learning, which are instances where an indicator is achieved in letter but not in spirit.

The NAAC assigns 25% and 15% weightage to research, innovation and extension for universities and colleges,

respectively. The NIRF attaches a higher weightage of 30% to research and professional practices. Research requires faculty with a research bent of mind along with infrastructure and time, set in an environment that encourage critical thinking. But, unfortunately, most of the universities and colleges lack these. That only a handful of universities in India produce any useful or world-class research output speaks volumes about this. Teachers in colleges have a comparative advantage in teaching. If they have to produce one unit of output in research, they will have to give up many units of output in teaching, compromising their core responsibility. In fact, the NAAC attaches a weightage of 35% and 45%, respectively, for universities and colleges for curricular and teaching aspects.

Colleges form the 'catchment area' of universities. Only if colleges succeed in producing graduates with knowledge and skills will universities and other research institutions thrive on their 'catch'. In a welcome step, the UGC has already initiated drafting of Learning Outcome based Curriculum Framework. And this is a continuum, with schools as feeder institutions for colleges. The Economic Survey 2017-18 rightly pointed out that "no country can create a vibrant superstructure of R&D with weak foundations of primary and secondary education for so many of its young." Learning outcome in our schools is pathetic. India had opted out of the Programme for International Student Assessment (PISA) in 2009 following disappointing performance of our children. They were ranked better only to Kyrgyzstan, the worst performer. Participating in such international ranking helps us understand where we stand, which should inform policymaking. It's reassuring that, in January 2019, the government has signed an agreement with the OECD for participating in the PISA 2021.

A holistic approach to education is the need of the hour. Education needs streamlining at all levels. We cannot build the superstructure of higher education on a weak schooling system. Higher education institutions that rank high are there only because of liberal funding, better infrastructure and a dynamic leadership that attracted the best faculty and students. If we have to create more such institutions, we will have to invest much more in education, especially in teacher training, recognising the paramount role of teachers in education. And their energies should be channelled into the right activities, undistorted by the spectre of indicators. Otherwise we will miss the bus.

DATA DRIVE

The dance of democracy

THE FIRST DAY of polling recorded a big turnout—Tripura reported the highest voter turnout of 81.8%, followed by 81% in West Bengal. The polling was held for 91 Lok Sabha constituencies, spread over 20 states. Amongst northeastern states, Manipur reported 78.2%, Nagaland 78%, and Mizoram 60%.

The seven Parliamentary constituencies in Maharashtra reported a voter turnout of 56% as against 63% last time, while the eight Parliamentary constituencies in Uttar Pradesh reported a voter turnout of 63.69% compared to 65% in 2014. The four parliamentary constituencies in Bihar reported a 50% turnout which is the same as last time.

The world's largest democracy, with around 90 crore electors, will elect 543 members for the 17th Lok Sabha in seven phases. Voting turnout has improved significantly, to 66.4% in 2014 from 58.2% in 2009. In fact, the 2014 voting percentage was the highest since 1984. The gap between male and female voter turnout rate declined in 2014.

In the first phase of elections, 213 candidates have criminal cases and 146 have serious criminal cases against them, according to analysis of the facts presented in the self-sworn affidavits of 1,266 out of 1,279 candidates by National Election Watch and Association for Democratic Reforms. Around 401 candidates are *crorepati* and the average assets of candidates is ₹6.63 crore.
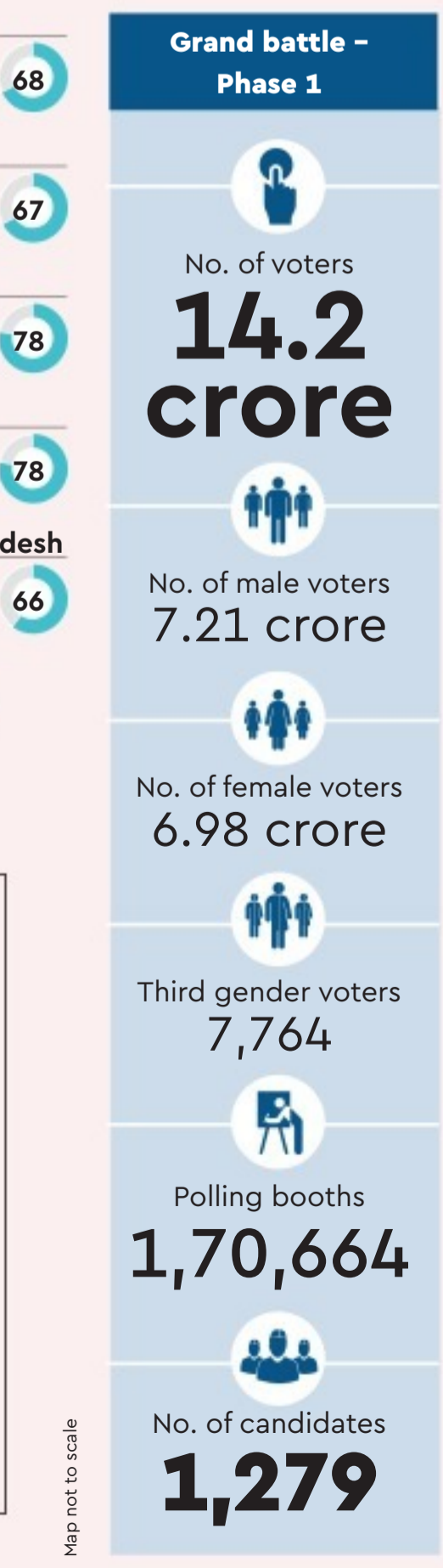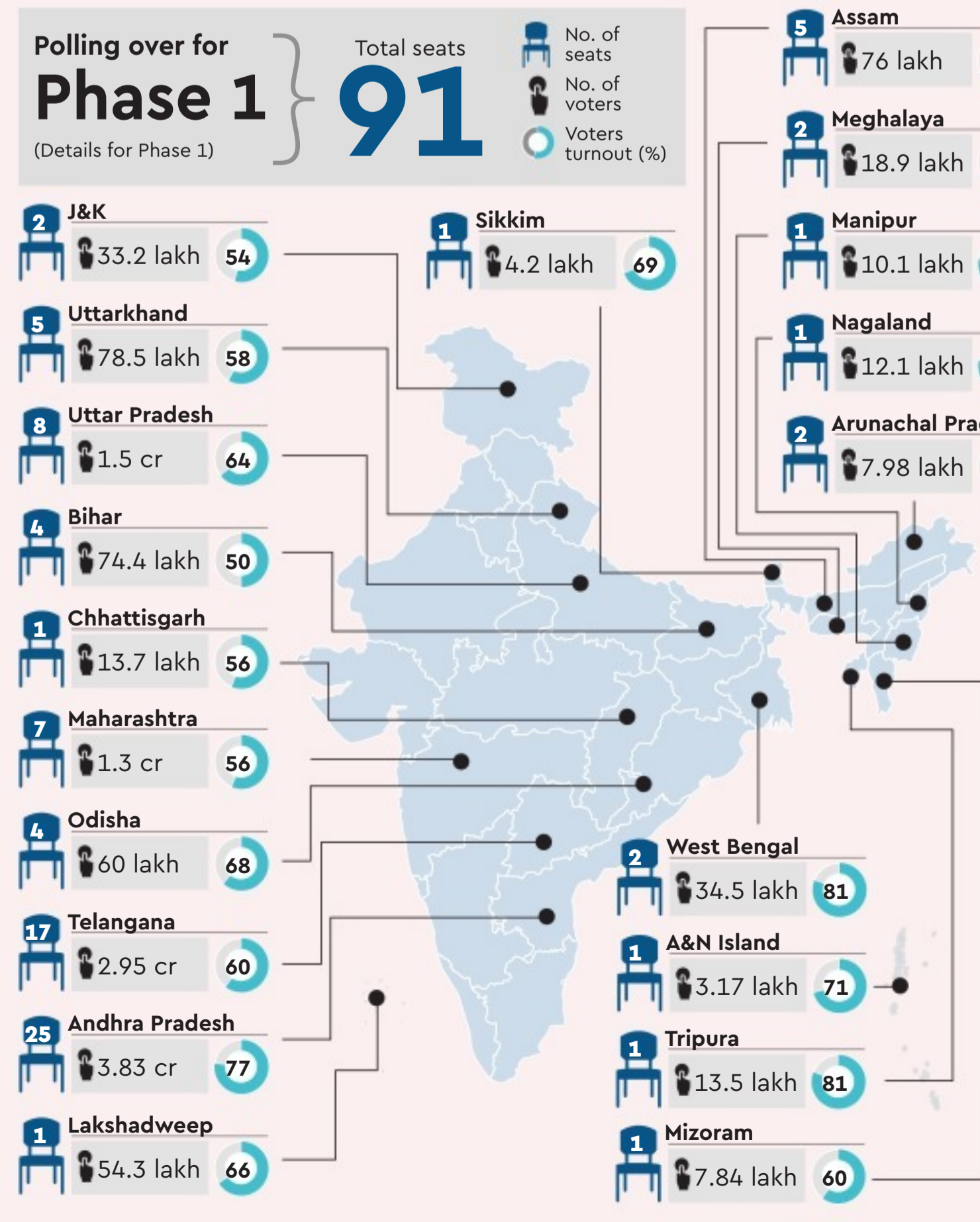
India's date with democracy

	Polling date	No. of constituency	No. of states/UTs	2014 Tally BJP	2014 Tally Congress	2014 Tally Others
Phase 1	April – 11	91	20	32	7	52
Phase 2	April – 18	97	13	27	12	58
Phase 3	April – 23	115	14	62	16	37
Phase 4	April – 29	71	9	45	2	24
Phase 5	May – 6	51	7	39	2	10
Phase 6	May – 12	59	7	44	2	13
Phase 7	May – 19	59	8	33	3	23
Total seats		**543**				

World's biggest election kicks off

Polling over for Phase 1 (Details for Phase 1) — **Total seats 91**

- 🪑 No. of seats
- 🧍 No. of voters
- ⭕ Voters turnout (%)

State	No. of seats	No. of voters	Voters turnout (%)
J&K	2	33.2 lakh	54
Uttarkhand	5	78.5 lakh	58
Uttar Pradesh	8	1.5 cr	64
Bihar	4	74.4 lakh	50
Chhattisgarh	1	13.7 lakh	56
Maharashtra	7	1.3 cr	56
Odisha	4	60 lakh	68
Telangana	17	2.95 cr	60
Andhra Pradesh	25	3.83 cr	77
Lakshadweep	1	54.3 lakh	66
Sikkim	1	4.2 lakh	69
Assam	5	76 lakh	68
Meghalaya	2	18.9 lakh	67
Manipur	1	10.1 lakh	78
Nagaland	1	12.1 lakh	78
Arunachal Pradesh	2	7.98 lakh	66
West Bengal	2	34.5 lakh	81
A&N Island	1	3.17 lakh	71
Tripura	1	13.5 lakh	81
Mizoram	1	7.84 lakh	60

Map not to scale

Grand battle – Phase 1

- No. of voters: **14.2 crore**
- No. of male voters: **7.21 crore**
- No. of female voters: **6.98 crore**
- Third gender voters: **7,764**
- Polling booths: **1,70,664**
- No. of candidates: **1,279**

2014 Tally — Total: 91

Party	Seats
BJP	32
TDP	16
TRS	11
YSRCP	9
Congress	7
BJD	4
Trinamool	2
Shiv Sena	2
Others	8

Criminal records of candidates in phase 1 of polls

Candidates with criminal cases	213
Candidates with serious criminal cases	146
Candidates with declared convicted cases	12
Candidates with cases related to murder	10
Candidates with cases related to attempt to murder	25
Candidates with cases related to kidnapping	4
Candidates with cases related to crime against women	16
Candidates with cases related to hate speech	12

Major party-wise candidates with declared criminal cases

	% of candidates with declared criminal cases	% of candidates with declared serious criminal cases
YSRCP	52	40
INC	42	27
BJP	36	19
TRS	29	18
BSP	25	13
TDP	16	8
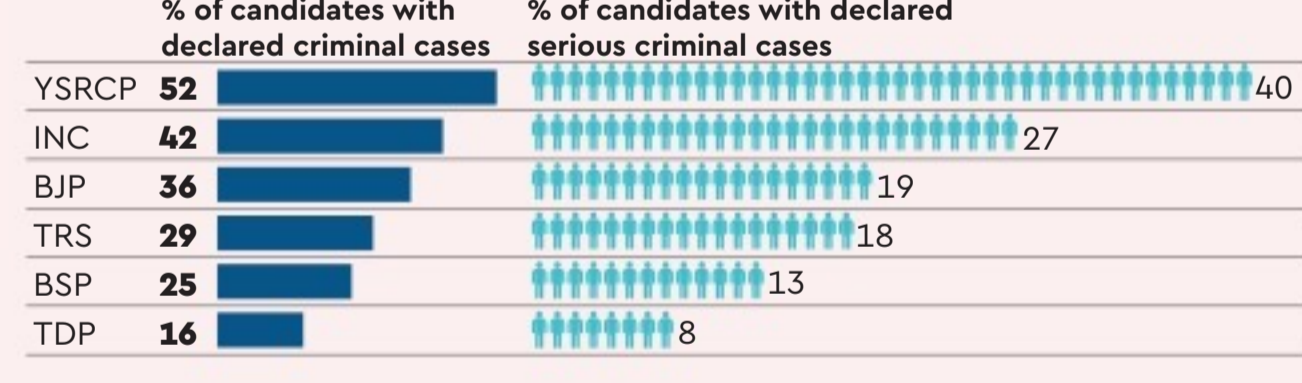
Wealth of contesting candidates

Value of assets	No. of candidates	% of candidates
5 crore and above	177	14
2 to 5 crore	99	8
50 lakh to 2 crore	254	20
10 to 50 lakh	320	25
Less than 10 lakh	416	33

Analysis from self-sworn affidavits of 1266 out of 1279 candidates by National Election Watch and Association for Democratic Reforms

Voting turnout in 2014 Lok Sabha elections

	Total no. of seats	Turnout rate (%)	Women turnout rate (%)
Andhra Pradesh*	42	74.5	74.1
Assam	14	80.1	79.4
Bihar	40	56.3	57.7
Chhattisgarh	11	69.4	68.1
Delhi	7	65.1	63.8
Goa	2	77.1	78.9
Gujarat	26	63.7	59.4
Haryana	10	71.4	69.7
Himachal Pradesh	4	64.5	65.4
J&K	6	49.7	48.3
Jharkhand	14	63.8	63.5
Karnataka	28	67.2	65.8
Kerala	20	73.9	73.7
Madhya Pradesh	29	61.6	56.6
Maharashtra	48	60.3	58
Odisha	21	73.8	74.5
Punjab	13	70.6	70.9
Rajasthan	25	63.1	61.1
Tamil Nadu	39	73.7	73.8
Uttar Pradesh	80	58.4	57.4
Uttarkhand	5	61.7	62.6
West Bengal	42	82.2	82
NE States	11	79	78.7
All India	**543**	**66.4**	**65.5**

*Include Telangana · Source: Election Commission of India, Association for Democratic Reforms