"S&T Roadmap for Building a New India"

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Before discussing steps to build "New India", it will be extremely useful for us to know what does a "New India" means.

India already has a unique identity, as the land of spiritualism, the origin for four of the world's major religions. More relevantly, it a large agrarian economy, being at the moment, reliably self-sufficient in that sector. India *was* also a pioneer in city-planning, as some of the first examples of deliberately planned cities were situated in the country. There are many other positive facets to India's current identity, they are characteristics that I would like to see re-iterated and implemented in the "New India".

Now, where does one start when trying to come up with a plan to rejuvenate the glory of a nation where one part of the country is as different to another as night is to day?

It is often said that India is united in it's diversity. So, I think it will be wise to start with what literally ties the country together. India's Transportation systems.

Railways are an important part of travelling in India and if anyone looks at recent developments in the field of its expansion. One quickly sees that new initiatives are mostly directed at making new suburban systems (e.g. Metro systems at Nagpur, Mumbai, etc. and the Shinkansen projects), while this is good, it is important to iterate upon the long distance rail-lines and make sure that they aren't oversaturated or underutilized. One way to do this is by taking massive strides in making schedules more efficient. It is a Herculean task only possible through the miracle that is statistics. Another way is to invest in research to allow for even higher concentrations of cargo/ people to be moved using enhanced infrastructure with the existing system serving as the backbone. Eradicating the negative reputation due to frequent delays is important as failure to do so would lead to wastage of the potential of the 4th largest railway system in the world. Such a shame!

We've talked about rails, so, let's look at its direct competitor, roads, more specifically cars and why they should be replaced. The simple answer is that they are inefficient, very inefficient. A car carries at most 8 people and uses a lot of power while a bus/streetcar/light-rail carries ~20/40/50 passengers while using more power. If the previous sentence were phrased better, the takeaway would be that buses/streetcars/light-rails carry a lot more passengers-per-unit of fuel than cars (~2x optimistically). This is compounded by the fact that in the here and now, we use mostly fossil-fuels to power vehicles. It's no secret that widespread EV adoption is not going to happen fast, an optimistic estimate would say 2 decades and there will still be teething troubles because of the nearly non-existent infrastructure that is the starting point. Even in the most optimistic scenario, it (Electric-vehicle adoption) isn't inherently getting rid of the inefficiency of a car nor is it completely getting rid of GHG-emissions as the electricity being used may still be fossil-fuel-based, in addition to that, car battery production still produces some significant GHGs. Importantly, an EV is only carbon-neutral if the period of usage is >~5 years. So, what's the solution? A move to hydrogen, perhaps? NO. because Hydrogen is most financially-optimally produced from

non-environmentally-friendly-processes. The solution would instead be to essentially use city-planning as a tool to minimize or even actively discourage usage of cars.

This segues perfectly into my point about city planning in the "New India". First of all, there is a lack of both demand and supply of city planners in India. Counterintuitively, there is a severe need for city-planners as they can make places significant more pleasant to live in. Another thing of note is the unregulated expansion of a city in the absence of actions taken against such practices. This can lead to inefficient layouts of parts of a city and also increase the dependency on cars by "designing" the sector around it, basically facilitating an insanely inefficient design due to space wasted in parking lots and other small details that may be overlooked. Another flaw that is currently commonly seen in cities is the existence of streets which have too high a speed-limit and too wide a road with no footpaths. Footpaths not existing is a self-explanatory problem, but what does a road being "too wide" mean? The answer lies in the difference between a street and a road. Too many streets try to be roads as well, trying to cater to an absurd amount of cars and repeatedly needing to be expanded to "tackle" the problem of traffic. Expanding a road does not even decrease traffic! Rather counterintuitively, it actually doesn't do anything significant at all. This is because if you give people a wider road, more people will use it. If people have it, they will use it or will at least try to. But if something is a pain to use, most will prefer not to use it. Most major-cities lack some necessary-features put into design (as can be inferred from the amount of roads without a footpath). More people, who understand the complexities and intricacies of the wonderful science of city-planning, need to be consulted while making a city (or retrofitting it with important features).Also, both demand and supply of urban-planners needs to be increased in tandem. The need for planning cities may not be met only with an increase in supply of qualified graduates in the market. Planners need to be either organised in the private-sector companies to be able to deliver services, or employed by public-sector organisations to serve mandates or hired as faculties at the educational institutions—in the absence of such consolidation, demand–supply will remain disconnected. (Source: Chapter 6, page 81-82 of this document: https://www.niti.gov.in/sites/default/files/2021-09/UrbanPlanningCapacity-in-India-16092021.pdf)

Now for a bit of a tangent about how the infrastructure in schools and colleges needs improvement to help students. The New-Education-Policy is an admirable step in the right direction. But it is a castle built on rotten foundations. The only thing the current education-system did well until now was produce Industrial-Age-factory-workers. It needs a complete overhaul from the ground-up to become an effective education-system.

Sustainability is a very-important thing. A few steps to reduce emissions in a city are to introduce the concept of superblocks and to make more reliable public-transport-systems (urban and long-distance).

Superblocks are basically a big block/sector surrounded by (relatively) major-roads and the roads inside are only supposed to cater to local use. This is beneficial as cars will be used less because reasons to venture out of a

superblock would be reduced as daily needs etc. would be positioned in a way that they are easy to access by foot.

Another thing I mentioned, Reliable long-distance public-transport is directly related to my point about railways. But also of note are buses. They are even more far-reaching than the railways! It is an admirable network, sure, but one dependent on fossil-fuels. Electric/hydrogen/solar-powered buses are opportunities to look into. Further thought reveals that trolley-buses and trams might be suited to more urban-environments and trolleybuses especially could even be used on highways as the infrastructure is relatively cheap. Also Trolleybuses/trams use overhead-wires/third-rails to power themselves. They can even be better than electric-cars in terms of efficiency and emissions!

Mentioned numerous times, Sustainabilty is important. So, how can we act to solve our problem? First, an initiative(s) should be taken to disincentivize corporations/people from prioritizing profit over the environment. A carbon-tax is a promising concept, if well-implemented. A carbon-tax would definitely stop the people from engaging in environmentally-hazardous-activities (viz. stubble-burning). To stop megacorporations from doing so would need a different approach as to them a carbon-tax may just be an "investment" on which high-returns can be obtained through undesirable-yet-not-illegal-environmentally-hazardous-activities (e.g. Hydrogen, if produced using fossil-fuels could be cheaper than if produced by environmentally-favourable-methods even accounting for carbon-tax).

Also, Emphasis is placed on need to replace fossil-fuel based power generation with more renewable options. Phased discontinuation recommended.

Noise pollution control is an important thing to reduce as it indirectly harms people of a place. Traffic is a major cause. Porous concrete/asphalt can reduce noise pollution by 4-8 dB, Also, it allows runoff to become groundwater as an added bonus. Only a few roads like highways/major arterial roads need porous asphalt to reduce noise as elsewhere, speed-limits would be more than enough to cope.

In this science and technology roadmap, till now there has been negligible mention of technology. The reason for this is that there is no way to reliably predict technology as progress in the field is dictated by the perceived needs of people. Most technological-breakthroughs are mostly iterative in some form. Reliable prediction is impossible. So, I focused on existing infrastructure/scientific-methods. The future lies in iteration as much as in innovation. One cannot expect to "innovate" a way out of every problem.

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