

WORLDS @ 2050

**Policy making
for the better future**

India Vision 2047 : Designing Future of India

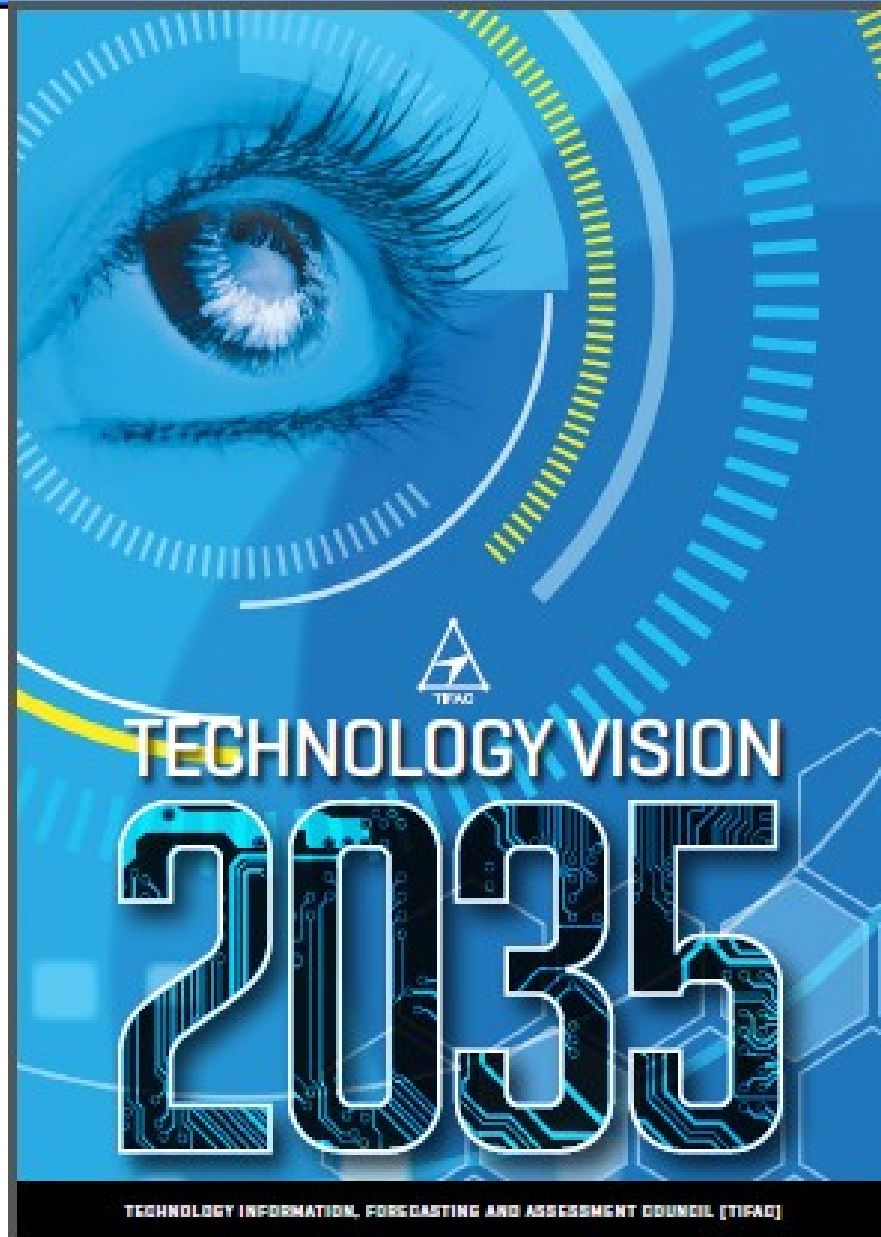
Name
Prabhat Ranjan

Organization
D Y Patil International University, Pune, India

TIFAC

- Technology Vision 2035(TV2035) was developed during my tenure as head of TIFAC from 2013-18.
- TIFAC is setup as a Technology Think Tank for country and is an autonomous body of DST, GoI
- It has been in existence since 1988 and was responsible for Technology Vision 2020 under Chairmanship of Dr Kalam(President of India from 2002-07) in 1996
- TIFAC Governing Council was chaired by Dr Anil Kakodkar during this work

Technology Vision 2035



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Technology Vision 2035: Status

- Technology Vision 2035 Document released by Hon'ble PM on Jan 3, 2016 at Indian Science Congress



Technology Vision 2035: Status



सत्यमेव जयते

प्रधान मंत्री

Prime Minister

FOREWORD

I am happy that Technology Information, Forecasting and Assessment Council (TIFAC), India's technology think-tank under the Department of Science & Technology, Government of India undertook a visioning exercise and has come up with "Technology Vision 2035" for the country.



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Content

- Retrospection TV 2020
- Indians in 2035 and their needs
- Vision Statement
- Fulfillment of prerogatives through technologies
- Capabilities and constraints
- Essential prerequisites
- Grand Challenges
- Call to action
- Comprehensive National Power
- to be followed by 12 Technology Roadmaps

GALLOPING INDIA



TELECOMMUNICATION

India has the second highest telecom subscriber base (2010)



SPACE TECHNOLOGIES

India has emerged as a significant player in building & launching satellite to both polar and geo-synchronous transfer space orbit



NUCLEAR TECHNOLOGIES

Leads with advanced nuclear technology like FBR.



MISSILE TECHNOLOGIES

Self reliance in missile technology with successful completion of Integrated Guided Missile Development Programme (IGMDP).



LIFE SCIENCES, BIOTECHNOLOGY

Spearheading low cost drug delivery to deprived sections in India and other parts of the world.

CANTERING INDIA



CIVIL AVIATION

Ninth largest civil aviation market in the world, still no indigenous aircraft manufacturing capability.



SERVICES

Contributes to 60% of the country's GDP, but skewed IT enabled services (ITeS) in rural India.



CHEMICAL PROCESS INDUSTRIES

12th largest producer in the world & 3rd largest in Asia in terms of volume, but a net importer of chemicals.



ROAD TRANSPORTATION

Notable progress in road infrastructure, but economic losses due to improper maintenance, poor handling of congestion and increasing accidents.



TROTTING INDIA



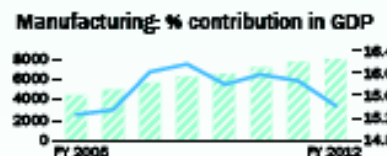
FOOD & AGRICULTURE

Wastage of one-third of the produce hinders growth, but still manages to contribute 12% of India's exports.



ENGINEERING

Contributes more than 40% of total export, while technology depth in manufacturing with value addition is yet to be accomplished.



ELECTRONIC & COMMUNICATION

Leader in software export; on the flip side, is also a large importer of critical hardware & general use electronic items.

27.4%

Electronics export from India in FY 2007-12

<1%

India's electronic product export share



MATERIALS & PROCESSING

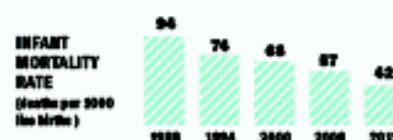
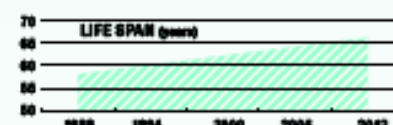
Industry rising in sectors like Steel though technology breakthroughs in metals like Titanium, Nickel, Magnesium etc still awaited; De-growth in mining sector prevails.

WALKING INDIA



HEALTHCARE

Lack of affordable healthcare systems, inadequate infrastructure and expensive diagnostics



ADVANCED SENSORS

Low indigenization, banking solely on import.



WATERWAYS

Less than 1% share of cargo; short of fairways, terminals, navigation aids and fleets

Figures are for corresponding financial years

GALLOPING INDIA



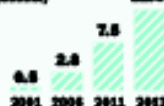
TELECOMMUNICATION

India has the second highest telecom subscriber base (2010)

MOBILE USERS (million)



INTERNET PENETRATION (million)



SPACE TECHNOLOGIES

India has emerged as a significant player in building & launching satellite to both polar and geo-synchronous transfer space orbit



NUCLEAR TECHNOLOGIES

Leads with advanced nuclear technology like FBR.



MISSILE TECHNOLOGIES

Self reliance in missile technology with successful completion of Integrated Guided Missile Development Programme (IGMDP).



LIFE SCIENCES, BIOTECHNOLOGY

Spearheading low cost drug delivery to deprived sections in India and other parts of the world.



SPACE TECHNOLOGIES

India has emerged as a significant player in building & launching satellite to both polar and geo-synchronous transfer space orbit



NUCLEAR TECHNOLOGIES

Leads with advanced nuclear technology like Fast Breeder Reactor

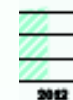


MISSILE TECHNOLOGIES

Self reliance in missile technology with successful completion of Integrated Guided Missile Development Programme (IGMDP).

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GALLOPING INDIA



TELECOMMUNICATION

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MOBILE USERS
(million)

INTERNET
PENETRATION



SPACE TECHNOLOGIES

India has emerged as a significant player in building & launching satellite



LIFE SCIENCES, BIOTECHNOLOGY

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GALLOPING INDIA

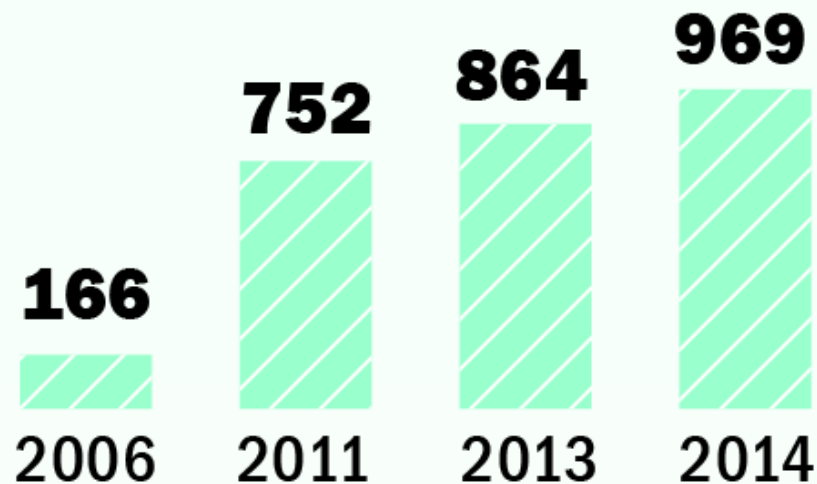


TELECOMMUNICATION

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MOBILE USERS

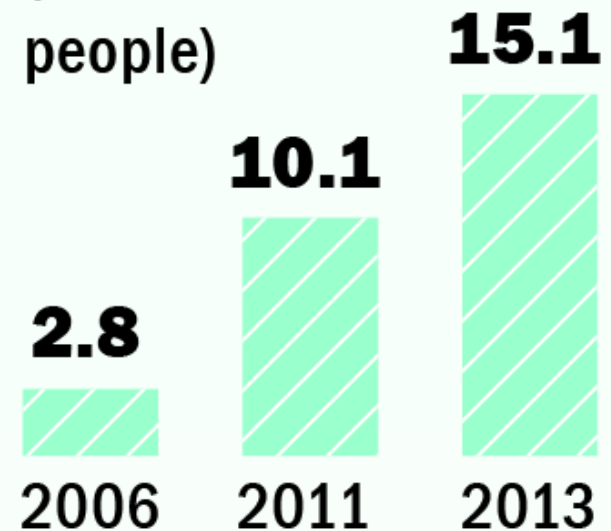
(Million)



SOURCE: TRAI 2015

INTERNET USERS

(Per 100 people)



SOURCE: WORLD BANK



ADVANCED SENSORS

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WATERWAYS

Less than 1% share of cargo; short of fairways, terminals, navigation aids and fleets



with successful completion of Integrated Guided Missile Development Programme (IGMDP).





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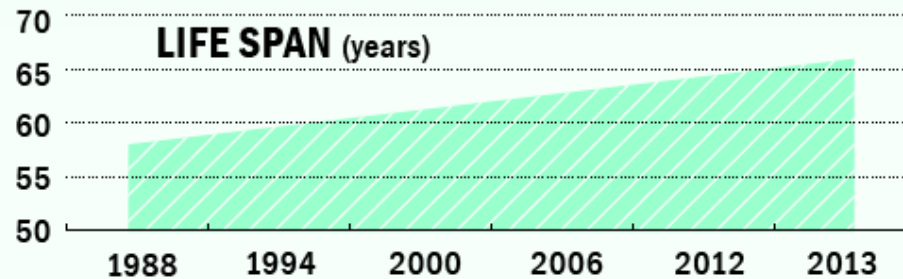
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WALKING INDIA

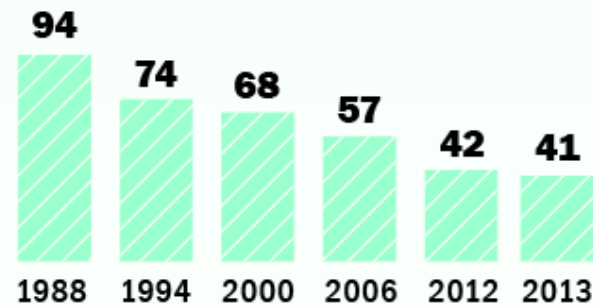


HEALTHCARE

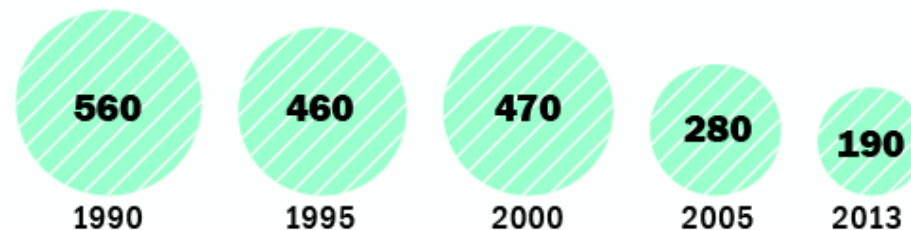
Lack of affordable healthcare systems, inadequate infrastructure and expensive diagnostics



INFANT MORTALITY RATE
(deaths per 1000 live births)



MATERNAL MORTALITY (deaths per 100,000 live births)

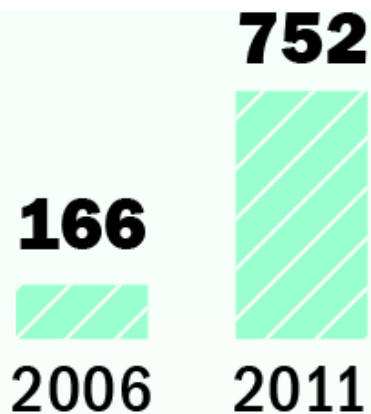


SOURCE: WORLD BANK



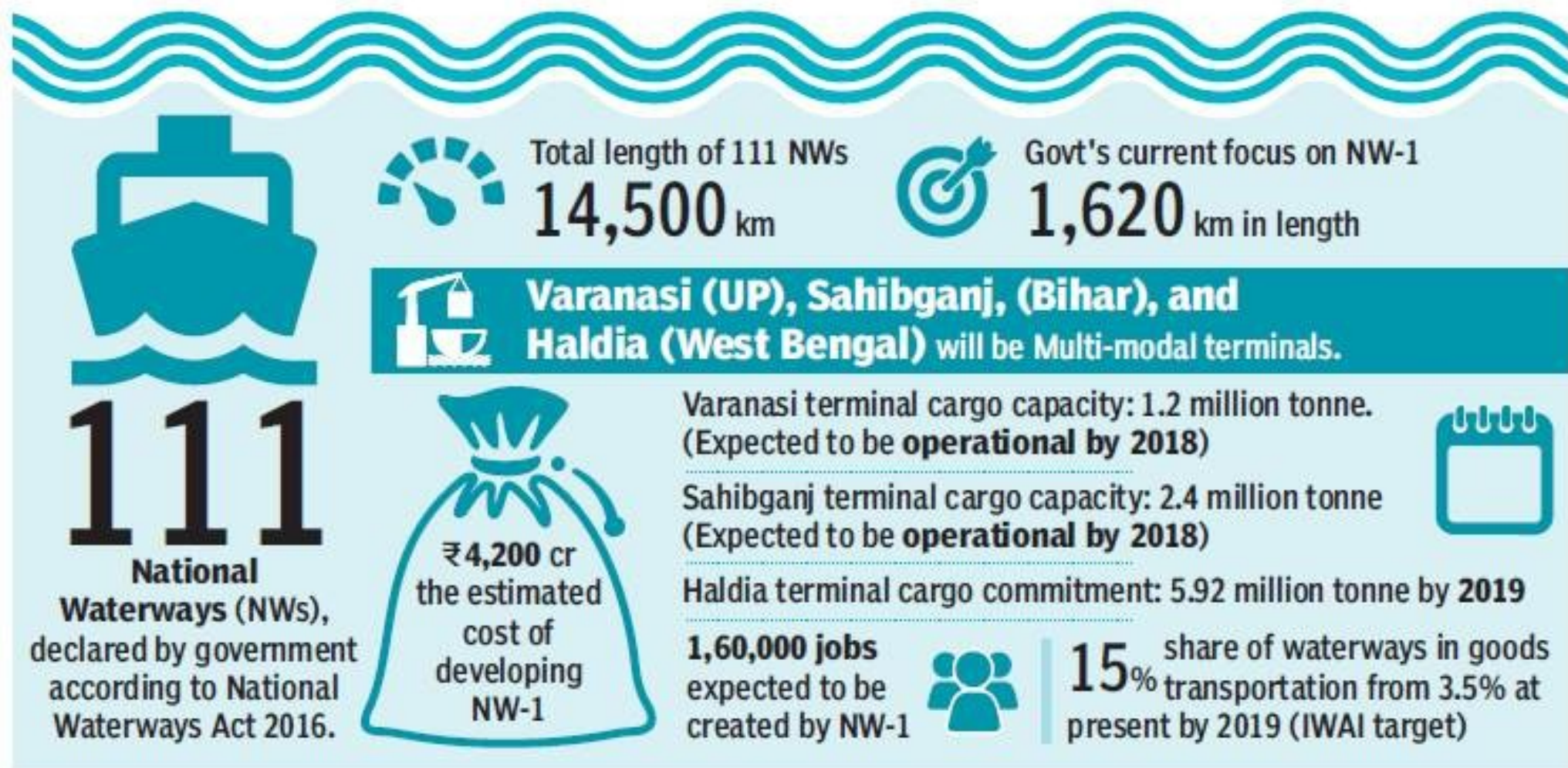
2013

SOURCE: WORLD BANK



SOURCE: PMF 2010

National Waterway 1, linking Haldia, Sahibganj, Varanasi, likely to be ready by 2018



Technology Vision 2035 : Objective

- What should be the objectives for designing India's future?

Can India be a \$42 trillion economy by 2050?

PREETAM KAUSHIK | 5 | OCT 14, 2015, 04.43 PM

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TV2020 vs TV2035

- Technology Vision 2020 focused on developing India as a country
- Technology Vision 2035 focuses on developing quality of life of each Indian!

INDIANS IN 2035: OUR NEEDS

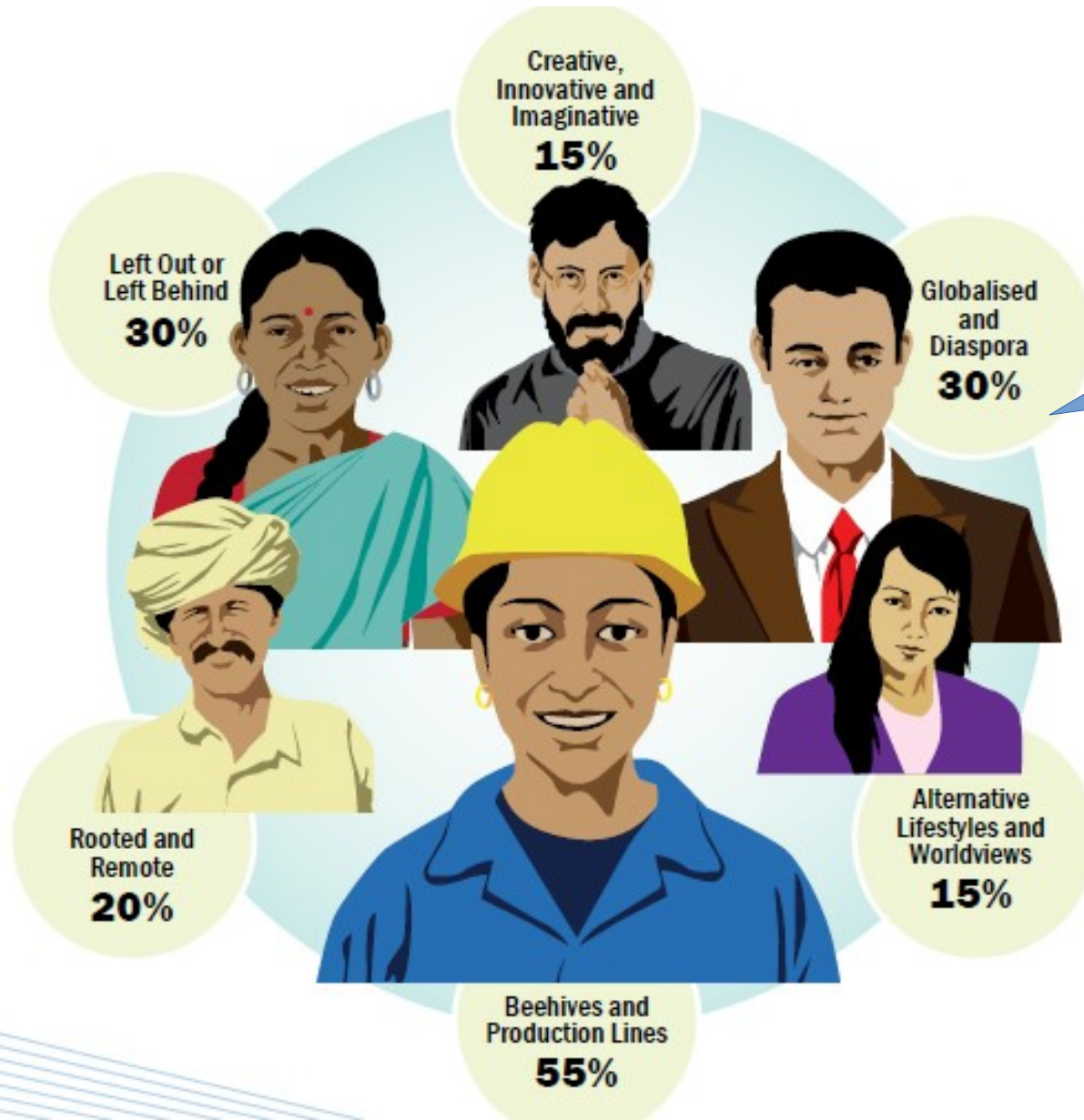
TECHNOLOGY VISION 2035



Need for Technology, Technology for Needs

- TO SURVIVE, TO THRIVE, AND TO BE ONESELF
 - these basic needs are the life force of countries just as they are of individual human beings.
- Are there any aspects of the future of our massive and diverse country that we can be certain about?
 - India will continue to be very large, and
 - that it will continue to be very diverse.

Indians in 2035: Our needs



*Non
Exclusive
Population
Segment*



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Indians in 2035

POPULATION SEGMENTS & BASIC NEEDS FACTORING FOR SEGMENT SIZE

Security Prosperity Identity



Vision Statement

*“Technology in the service of India:
ensuring the **security**, enhancing the
prosperity and strengthening the **identity**
of every Indian”*

... in 22 languages

| | |
|-----------|--|
| AS-SAMEE | ভারতের সেবা প্রযুক্তি বিনা : প্রতিজন ভারতীয়ের নিরাপত্তার নিশ্চিতকরণ, সম্মিলিত বুদ্ধি আঁক সূক্ষ্ম আত্মনিয়ন্ত্রণ ইত্য. |
| BENGALI | ভারতের পরিচরিত্র প্রযুক্তি : নিরাপত্তা নিশ্চিতকরণ, সম্মিলিত বুদ্ধিকরণ এবং প্রতি ভারতীয়ের পরিচরিত্র নিশ্চিতকরণ |
| BODO | ভারতৰী অনসায়নাযাব বিৰোডামিন : সাপ্তোম ভাৰতৱিৰী বৈখাযি হোখাৰনায দাবগাখাংহোনায আৰো বিসৌৰনি সিনাখযিখী কোৰানায |
| BOSNI | भारत दी सेवा च टेक्नालोजी : हर भारतवासी दी सुरक्षा यकीनी बनग, खुशहाली गी बढावा मिलग ते उनदी पहचान सुइट ओग |
| CHINESE | भारत नी सेवा मां टेक्नोलोजी : हरैक भारतीय नी सुरक्षा नी पातरी, समृद्धि वधारो, खोजम मजबूत |
| HINDI | भारत की सेवा में प्रौद्योगिकी : प्रत्येक भारतीय की विश्वस्त सुरक्षा, समृद्धि वर्धन एवं अखंड अभिमान हेतु |
| KANNADA | ಭಾರತದ ಸೇವೆಯಲ್ಲಿ ತಂತ್ರಜ್ಞಾನ : ಭದ್ರತೆಯ ಖಾತರಿ ಎಳೆಗೆಯ ವೃದ್ಧಿ ಮತ್ತು ಪ್ರತಿ ಭಾರತೀಯನ ಗುರುತು ಬಲಪಡಿಸುವುದು |
| MAHARASHI | تکنالوجی ہندوستان کی خدمات: ہر ہندوستانی کی سلامتی، پرجائی امن بریر تم برزائیک دریر. |
| KONKANI | भारताच्या सेवेतले तंत्रगिन्यान : प्रत्येक भारतीयाच्या सुरक्षतायेची खात्री, समृद्धीच वाढ, अस्मितीत घटाय |
| MARATHI | भारतक सेवा में प्रौद्योगिकी : प्रत्येक भारतवासीक विश्वस्त सुरक्षा, समृद्धि वर्धन एवं अखंड अभिमान हेतु |
| MAHARAJAM | സാങ്കേതികവിദ്യയുടെ സേവനം ദേശത്തിന് : ഓരോ ഭാരത പൗരന്റെ സുരക്ഷയും, പുരോഗതിയും, സ്വതന്ത്രവും ഉറപ്പ് വരുത്തുന്നതിന് |

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| INDIAN | भारतकी सेवाया निष्पादन : मि-महामाया मजाकगी मेहीवा, भूभास-नायका सेवयाथावा अमयुः भारतकी मीभूम धूमिनी माऊम कावयाथावा |
| JHARKH | भारताच्या सेवेसाठी कटिबद्ध तंत्रज्ञान : प्रत्येक भारतीयाच्या सुरक्षिततेची हमी, सुवस्तेची वृद्धी आणि अस्मितीची पुष्टी |
| NEPAL | भारत को सेवा मा प्रविधिको : हरेक भारतीय को सुरक्षा आश्वासन, समृद्धि वृद्धि, पहिचान बलियो |
| ORISSA | ଭାରତର ସେବାରେ ବୈଷୟିକ ଜ୍ଞାନ : ପ୍ରତ୍ୟେକ ଭାରତୀୟର ନିର୍ଭୀତ ସୁରକ୍ଷା, ସମୃଦ୍ଧି ବର୍ଦ୍ଧନ, ଏବଂ ସୁସ୍ଥ ପରିଚୟ ଗଠନରେ ନିୟୋଜିତ. |
| PUNJABI | ਭਾਰਤ ਦੀ ਸੇਵਾ ਵਿੱਚ ਟੈਕਨੋਲੋਜੀ : ਹਰ ਭਾਰਤ ਵਾਸੀ ਦੀ ਸੁਰੱਖਿਆ ਦੀ ਯਕੀਨੀ ਬਣਾਈ, ਖੁਸ਼ਹਾਲੀ ਗੀ ਬਢਾਵਾ ਮਿਲਗ ਤੇ ਉਨ ਦੀ ਪਹਿਚਾਣ ਹੈ ਮਜ਼ਬੂਤ ਕਰਾਈ |
| SANSKRIT | भारतस्य सेवायाम् प्रौद्योगिकीयः : भारतीयानां सुरक्षायाः प्रतिभूतिः, समृद्धि विवर्धनं, सशक्तिकर्मभिज्ञानञ्च |
| TAMIL | भारत सेवा सेवारे जोल्लो बिदा : वांजे दारुन दाडे मोदा उरिच, उराल्लो उराल्ल राखल आर सिमित मोदेव भारत बासी आवा उराल्ल दाडे तेवार राखल |
| URDU | भारत जी सेवा में तकनीकी : हर भारतीय जी सुरक्षा जी सुनिश्चितता, समृद्धि में बाधारी, सुन्यादत छे मजबूत करणी |
| TAMIL | வருங்கால இந்தியாவின் சேவையில் தொழில்நுட்பம்: ஒவ்வொரு இந்தியனின் பாதுகாப்பை உறுதியுபடுத்தி, செல்வ செழிப்பை அதிகரித்து, தனி அடையாளத்தை வலுப்படுத்தும் |
| TELEGU | భారతదేశ సేవలో సాంకేతిక విజ్ఞానం : ప్రతి యొక్క భారతీయుడి భద్రతా పరిరక్షణ, సంపద పెంపొందింపు మరియు గుర్తింపు బలోపేతం చేయడం |
| URDU | ہندوستان میں ٹیکنالوجی کی خدمات: ہر ہندوستانی کی سلامتی، پرجائی امن بریر تم برزائیک دریر. |

Real Time Translation

Timekettle's WT2 real-time translation earpieces enable ordinary conversation across language barriers

BY *DEVIN COLDEWEY*

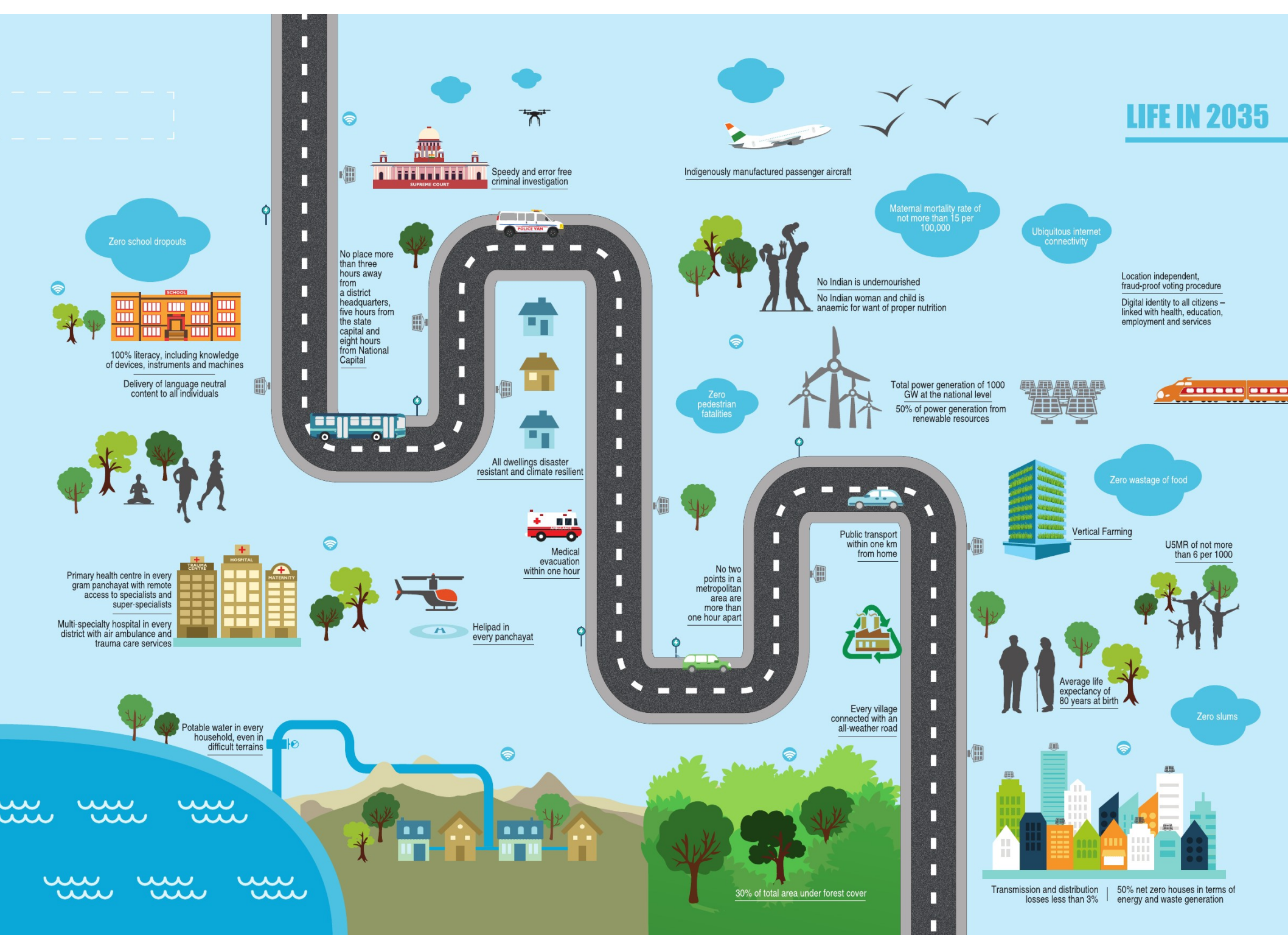
Jul 27, 2017

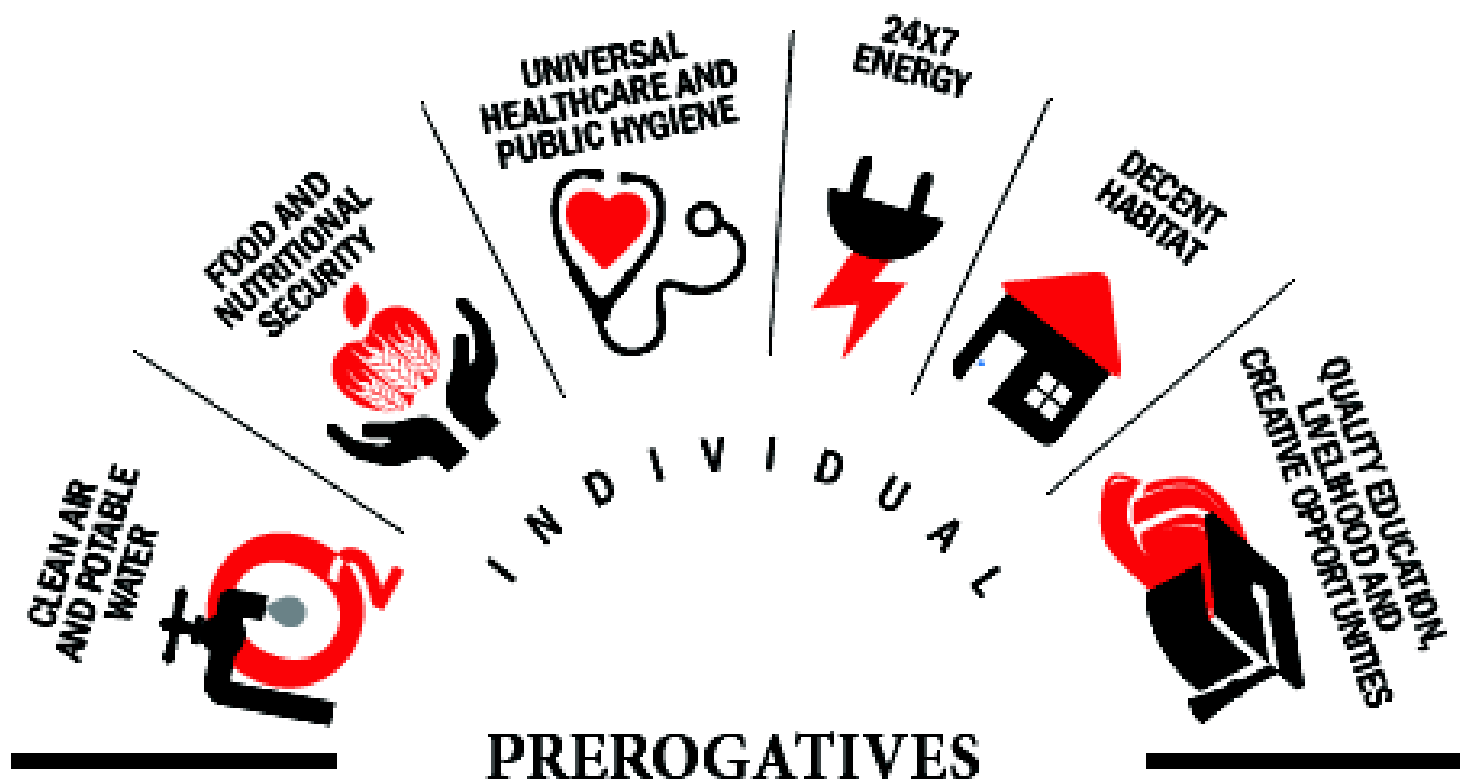




“
*Technology in
the service of
India: ensuring the
security, enhancing
the prosperity and
strengthening
the identity of
every Indian.*
”

LIFE IN 2035





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Clean Air and Potable Water

- Ensuring air quality through effective gaseous effluent management right at source
- Aggressive implementation of green manufacturing, transportation and mining technologies to improve air quality.
- Biomass to be used as significant source for energy for cooking and heating in rural areas
- Augmenting available quantity of water by identifying and exploring new resources, especially underground
- Preventing rainwater run-offs by taking adequate harvesting measures including facilitating percolation to supplement subterranean water tables.
- All accessible water including recycled waste to be free from organic and in-organic contaminants to make it perfectly fit for drinking.
- Access to safe drinking water through tap within or in close proximity of the habitat to all.
- Optimum utilization of available water and making potable water available at prices that all Indians can afford.

TABLE 1

| | | | | |
|--|---|---|---|---|
| ADVANCED CLEAN COAL TECHNOLOGIES | ● | ● | ● | |
| ALTERNATE FUEL BASED TRANSPORTATION | ● | ● | ● | |
| NOVEL PROPULSION TECHNOLOGIES | ● | ● | ● | |
| GREEN MANUFACTURING | ● | | | |
| INTELLIGENT TRANSPORTATION SYSTEM | ● | | | |
| LOW DUST CONSTRUCTION TECHNOLOGIES | ● | ● | | |
| REAL TIME DENSE SPATIAL AIR QUALITY MONITORING | ● | ● | ● | |
| REAL TIME AQUIFER MONITORING INCLUDING SALINITY INGRESS | ● | ● | ● | |
| INSTANT PORTABLE WATER QUALITY TESTING | ● | ● | ● | |
| AFFORDABLE DESALINATION TECHNOLOGY | ● | ● | ● | |
| MEMBRANE BASED WASTE WATER TREATMENT | ● | | | |
| AFFORDABLE DE-SILTING OF WATER BODIES | ● | ● | ● | |
| TECHNOLOGY FOR RUN-OFF CONTROL | ● | ● | ● | |
| SCALABLE POINT-OF-USE WATER TREATMENT TECHNOLOGY | ● | ● | ● | |
| DEW HARVESTING | ● | ● | ● | |
| IN-SITU WATER PURIFICATION IN PIPELINE | ● | | ● | |
| SELF HEALING PIPELINES | ● | | ● | ● |

● Readily deployable
 ● From Lab to Field
 ● Requiring targeted research
 ● In the imagination

Food And Nutritional Security

- *Every Indian is assured of adequate and nutritional food intake and ensuring adequacy of food both in terms of calorie and protein requirement irrespective of diverse food preferences*
- No wastage of food from farm to kitchen
- Prevent food losses, enhance value addition and take measures to prolong shelf life of all kinds of farm produce.
- Production of safe agrochemicals to enhance acceptability of agriculture produce in global markets
- Food traceability from farm to plate through both technological and policy interventions
- Professionally managed value addition and market framework for better risk management for larger investments

Universal Healthcare & Public Hygiene

- *Primary health centre in every gram panchayat with remote access to specialists and super-specialists*
- *Medical evacuation services that can take the patient to a hospital in an hour*
- *Multi-speciality hospital in every district with air ambulance and trauma care services*
- *Average life expectancy of 80 years at birth*
- *Maternal mortality rate of not more than 15 per 100,000*
- *U5MR of not more than 06 per 1,000*
- *Integration of ISM with modern medicine*
- *Development and deployment of adaptive and assistive technologies to enhance the quality of life of persons with disability.*

24x7 Energy

- Uninterrupted access to energy and energy needs to all our compatriots.
- Capacity creation for reaching 1,000 GW of power generation at the national level.
- 50% of the 1000 GW target coming from renewable resources.
- Transmission and distribution losses to be less than 3%.
- Energy use efficiency to be increased.
- Switching to decentralized energy generation from the current centralized and network approach
- Developing technologies that will give quantum leap in emission free energy generation and ensuring the quality of power up to global standard.
- Development of low cost energy storage system in electric mobility in order to reduce carbon foot print.
- Technology intervention to reduce dependence on traditional biomass for meeting the energy requirement of rural areas

Decent Habitat

- Affordable decent habitat for all
- *India to be a country of zero slums*
- 50% of the houses to be net zero in terms of energy use and waste generation
- 50% of all the buildings to be zero maintenance type
- Make all dwellings disaster resistant and climate resilient
- Faster and more efficient construction with maximum use of recycled materials
- Development of alternative building materials
- Standardization of construction system that deliver on quality and reduce the use of scarce materials such as sand
- Modernize manufacturing of building materials to facilitate faster construction and minimum environmental degradation.
- Development of smarter and sustainable cities

Quality Education, Livelihood and Creative Opportunities

- *To achieve 100% literacy including operating knowledge of devices, instruments and machines*
- There will be no school drop outs
- *Delivery of language neutral content to all individuals at the press of a button, 24X7*
- Learning institutions will be Virtual/ Meta/ Open in character
- Technology based, continuous and broad based evaluation-covering talent, skills & knowledge
- Access to second careers and lifelong learning
- *Teachers will be remain central to education however, they would become navigators and path finders, counsellors and confidants*

Safe and Speedy Mobility

- *Access of public transportation within one Km from our home.*
- *No place will be more than three hours away from a district headquarters, five hours from the state capital and eight hours from our national capital.*
- *Inter-modal mobility should ensure that no two points in a metropolitan area would be more than an hour away.*
- *Every settlement will be connected with an all weather road.*
- *Every panchayat will have a helipad for delivery of emergency services.*
- *Zero pedestrian fatalities in all parts of the country.*
- *Twice fuel efficient vehicle but half the current emissions.*
- *Last mile connectivity through multi modal means of transport .*
- *Integrated high quality infrastructure, road transportation and traffic management.*
- *Faster intercity connection & access through cost effective modes such as semi-high speed and bullet trains.*
- *Prioritise movement of perishable commodities to control waste*

Public Safety & National Security

- Speedy and error free criminal investigation.
- Effective medical emergency services
- Security of citizen data (personal, financial, social, health) for and policy formulation for cross border data flows.
- Tackling internal security and threats (eg: safe city surveillance, cyber terrorism etc.)
- Secure transactions (payment systems, banking transactions, e-commerce)
- Secure natural resources and environment through surveillance of water, forest, food and minerals.
- Development of proper infrastructure facilitated with advanced technology to fight fire and additional hazardous emergencies
- Setting up of CBRN (National Chemical-Biological-Radiological-Nuclear) monitoring and response infrastructure.
- Development of technologies for sensing and predicting bridge and tunnel collapse.
- Development of low cost, reliable sensor networks linking individual dwellings to police, medical and other emergency services for security of residents.

Cultural Diversity and Vibrancy

- *Diversity in culture and languages is the key defining feature of India.*
 - *Cultural diversity is a national asset and power multiplier*
- *We would like India to be as advanced as possible technologically and as rooted as possible culturally*
- Given the right direction, technology could help in preserving and enhancing the rich cultural diversity of India
- Heritage sites – are tangible and visible aspect of cultural past; preserving monuments and cultural entities thereby is of crucial importance
- Aspects of intangible heritage such as cuisine, oral tradition and the performing arts, must also be preserved and promoted through documentation and reproduction
- Technology could play a key role in ensuring that the different regional languages of India get incorporated into the mainstream instead of being at the sidelines and fringes

Transparent and Effective Governance

- All public services will be delivered online securing digital identity.
- All criminal cases would be adjudicated within six months and all civil cases within four months.
- Zero tolerance towards crime
- Courts, prisons and police stations would be interconnected through high speed network.
- Creating and maintaining national digital identity database which would be secured and safe.
- Creating location independent, fraud proof voting procedure without compromising with the sanctity of voting system.

Disaster and Climate Resilience

- Zero death possibly whenever disaster occurs and restoration of essential services within an hour
- Disaster proof infrastructure to withstand the fury of natural disasters, including retrofitting of the existing dilapidated infrastructure and housing
- Development of building structure that resist impact of high strength blasts
- Reduction of carbon intensity by 50% in relation to what it would be under BAU scenario in 2035.
- Creating a system to keep on vigil and to be alert to pandemic caused by newly emerging infectious diseases, often with global vectors and linked to changes in climate systems.
- Development of potent vaccines as per the need in preventing such calamitous situations.
- Improving efficiency , accuracy and fidelity of the early warning systems coupled with reliable weather forecast at the micro level to help farmers take proactive measures to mitigate impact of fickle weather.
- Developing stress resistant crop varieties of major food items.

Eco Friendly Conservation of Natural Resources

- Creation of database of natural resources in terms of location, quality and quantity by 2035.
- All exploration and extraction process to be eco friendly by 2035.
- No key species will be facing extinction and all indigenous biota will be protected from bio-piracy and illegal exploration.
- All fresh water will be restored to its pristine condition.
- Forest cover would be restored and increased by 20% of what it is today.
- Creation of a national registry of our natural resources, including a national genetic database.
- Monitoring the resources of our ecologically mega-diverse nation, particularly in fragile zones and wetlands.
- Development of ICT backed systems for monitoring our resources and working with all strata of population to prevent further degradation
- Development of waterways for cost effective use and parallel development of aquaculture by major technology intervention.

Essential Prerequisites

- Transversal Technologies
 - Materials
 - Manufacturing
 - ICT (Info and Comm Tech)
- Infrastructure
- Fundamental Research

Capabilities and Constraints

- Technology leadership
- Technology independence
- Technology innovation
- Technology adoption
- Technology constraints

10 Grand Challenges

1. Guaranteeing nutritional security and eliminating female and child anaemia
2. Ensuring quantity and quality of water in all rivers and aquatic bodies
3. Securing critical resources commensurate with the size of our country
4. Providing learner centric, language neutral and holistic education to all
5. Understanding national climate patterns and adapting to them

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10 Grand Challenges



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4. Providing learner centric, language neutral and holistic education to all

5. Understanding national climate patterns and adapting to them

Grand Challenges ...

6. Making India non-fossil fuel based
7. Taking the railway to Leh and Tawang
8. Ensuring location and ability independent electoral and financial empowerment
9. Developing commercially viable decentralised and distributed energy for all
10. Ensuring universal eco-friendly waste management

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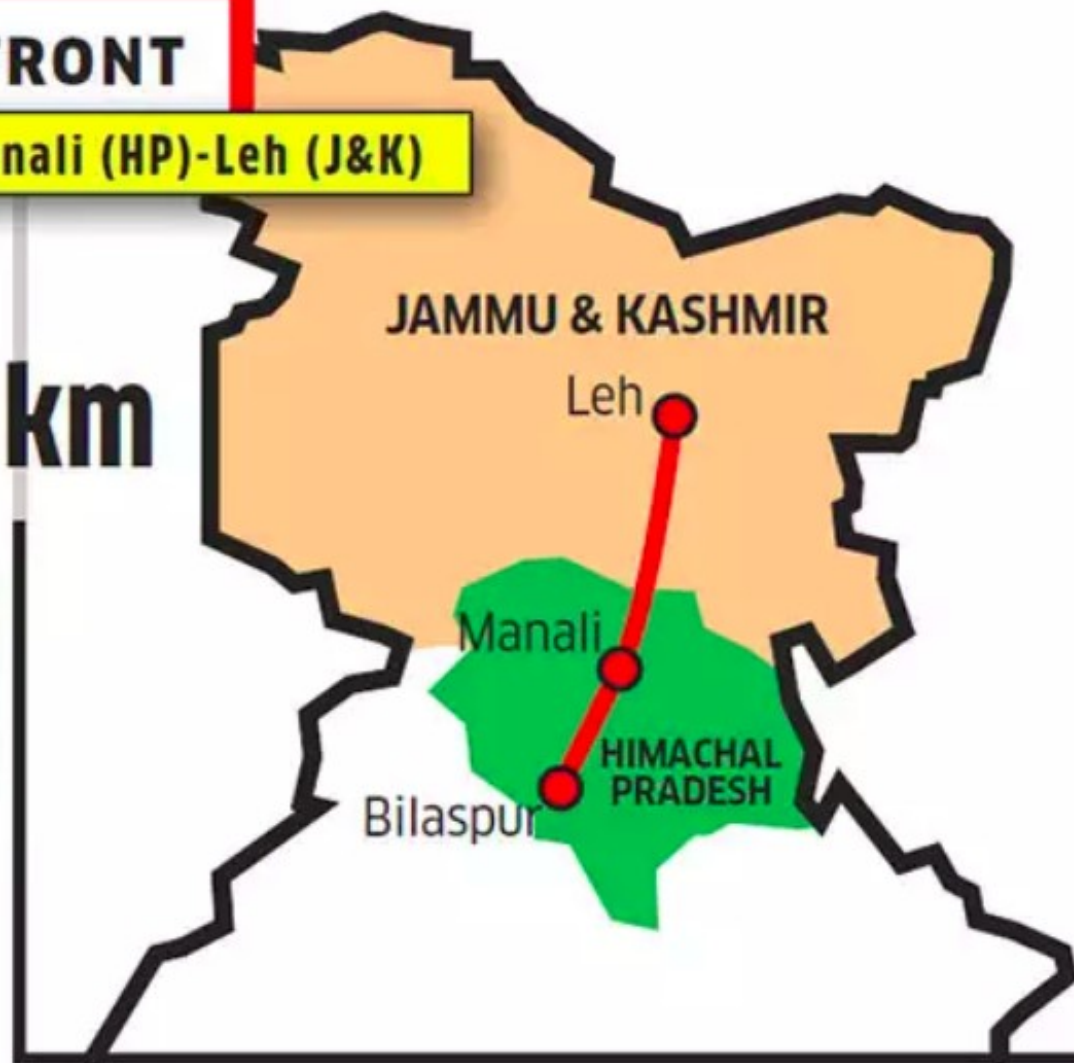
Track IV

WESTERN FRONT

Bilaspur (HP)-Manali (HP)-Leh (J&K)

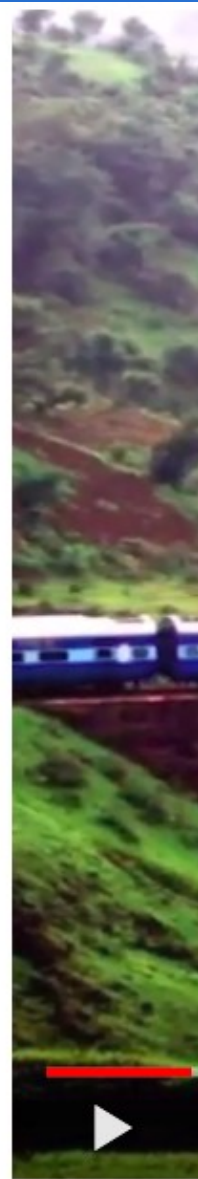
498 km

(Distance by road is **650 km**; the rail distance may change depending on the final alignment)

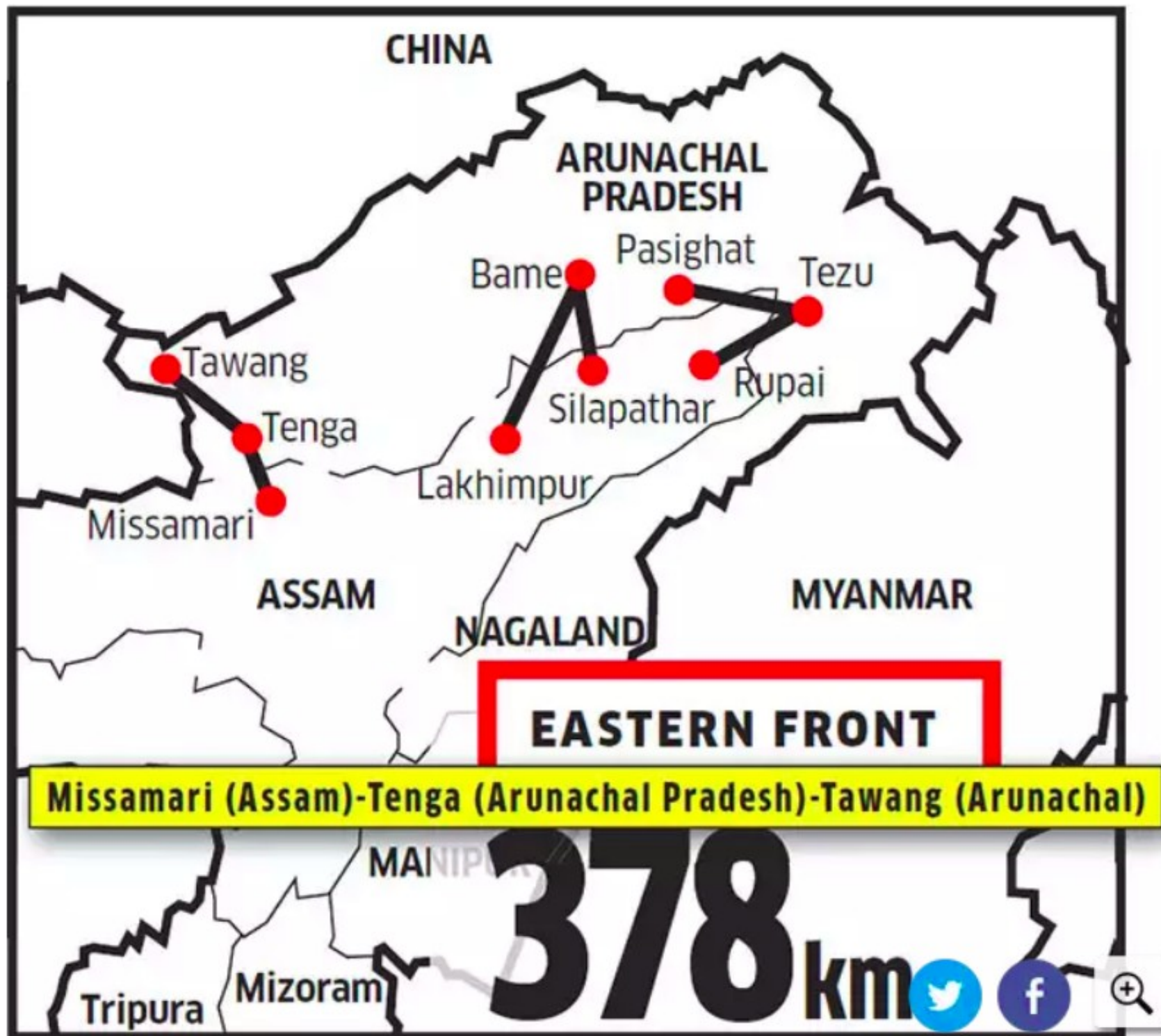




BILASPUR MANALI LEH RAIL LINE TO BE HIGHEST IN THE WORLD, OVERTAKING CHINA'S QINGHAI TIBET RAILWAY



BILASPU
QINGHA



CHINA'S

JUNE

Call to Action

- Principal actors
 - Government
 - Industry
 - Academia
 - R&D institutions
- Key activities
 - Knowledge creation
 - Ecosystem design for innovation & development
 - Technology deployment
- National Missions

Technology Roadmaps

- Education
- Medical Sciences & Health Care
- Food and Agriculture
- Water
- Energy
- Environment
- Habitat
- Transportation
- Infrastructure
- Materials
- Manufacturing
- Information & Communication Technology



India Vision 2047 : World@2050



**D Y PATIL
INTERNATIONAL
UNIVERSITY**
AKURDI PUNE

Education



VISION

*Realizing the full potential
of every Indian*

ISSUES ADDRESSED

- ▲ Literacy, Creativity & Skills
- ▲ Culture, Recreation and the Good Life
- ▲ Access: Anyone, Anywhere, Anytime
- ▲ Lifelong Learning
- ▲ Testing, Evaluation & Certification,
- ▲ Integration, Aggregation & Flexibility
- ▲ Technology in Education

EMERGING TRENDS AND CONCEPTS

- ▲ **Adaptive Learning** programmed for desired learning output
- ▲ **Adaptive Testing** replacing one-size-fits-all assessment of academic proficiency
- ▲ **Collaborative & Social Learning** that allows construction of knowledge with peers or in social groups
- ▲ Lectures and home assignments get swapped in **Flipped Classroom**
- ▲ Game play with defined learning outcomes through **Game based learning**
- ▲ **Hybrid or Blended Learning**, a combination of classroom and online learning
- ▲ **Learning Analytics** which decipher trends and patterns from educational big data
- ▲ **Massive Open Online Course (MOOC)** aimed at unlimited participation and open access via web
- ▲ **Remote/ Internet Labs**

- ▲ **Reputation metrics** as a substitute to institutional certifications like degrees
- ▲ **Virtual Learning Environment** for delivering learning materials to learners via the web and includes assessment, collaboration and communication tools

FUTURE TECHNOLOGIES

- ▲ 3D Printing
- ▲ 4G/5G Communication Technology
- ▲ Artificial Intelligence
- ▲ Brain Computer Interface
- ▲ Cloud Computing
- ▲ Gesture Recognition
- ▲ Holography
- ▲ Internet of Things
- ▲ Machine Vision
- ▲ Machine Augmented Cognition
- ▲ Photonics
- ▲ Quantum Computing
- ▲ Real Time Translation
- ▲ Volumetric Screens
- ▲ Wearable Technology

Medical Sciences & Health Care



VISION

Ensuring affordable and accessible health care to every Indian through prophylactic, promotive, curative and rehabilitative aspects of technologies

MISSIONS

- ▲ Enhance longevity and health span.
- ▲ Encourage nutritional intervention for better health
- ▲ Expand health awareness especially hygiene & public health
- ▲ Eliminate preventable infant & maternal mortality, improve mother and child health care
- ▲ Eradicate natural outbreaks and control infectious diseases
- ▲ Evolve novel therapeutic approaches
- ▲ Ensure minimization of all forms of disabilities
- ▲ Ensure synergy & quality of indigenous and modern system of healthcare
- ▲ Efficient networking of rural and urban healthcare delivery system
- ▲ Encourage and implement indigenous biomedical technologies

FACTS AND FIGURES

- ▲ India's Life expectancy will reach **72 years by 2035** from 66 years in 2013
- ▲ Maternal mortality rate will reduce to **15/100,000 by 2035** from the current 190 deaths/100,000 live births (2013)
- ▲ Under-5 mortality rate will reduce to **6/1000 by 2035** from the current 53 deaths/1000 live births (2013)
- ▲ Total health spending will be **5.7% of country's GDP by 2035**, up from the current 4.0% (2013)
- ▲ Out-of-pocket **health spending** will come down from the current 58.2% in 2013 of the total health-care to **30% by 2035**
- ▲ **Health worker density** per 1000 population (doctors- allopathy, nurses and midwives) will reach **4.66% by 2035** from 1.29% in 2011

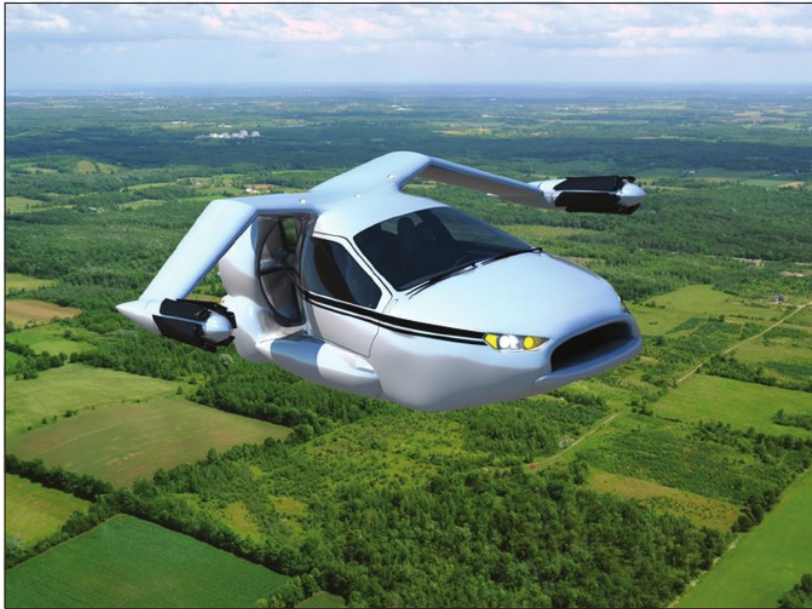
FUTURE TECHNOLOGIES

- ▲ Personalized medicine
- ▲ Digital Health delivery
- ▲ Brain Computer Interface
- ▲ Synthetic Biology
- ▲ Next generation genomics
- ▲ Wearable devices
- ▲ Bio-printing and regenerative medicine
- ▲ Optogenetics
- ▲ Robotic surgical system
- ▲ Controlled drug delivery
- ▲ Smart Assistive devices

BLUE SKY RESEARCH

- ▲ Gene manipulation to delay ageing process and increase health span
- ▲ Neo-eugenics to reduce or eliminate rare genetic disorders
- ▲ Regeneration of organs
- ▲ Biological scanner to indicate multiple pathogenic load of an individual

Transportation



VISION

Sustainable, clean, safe, inclusive, smart and integrated mobility system

SECTORS COVERED

- ▲ Railways
- ▲ Airways
- ▲ Roadways
- ▲ Waterways

FACTS AND FIGURES

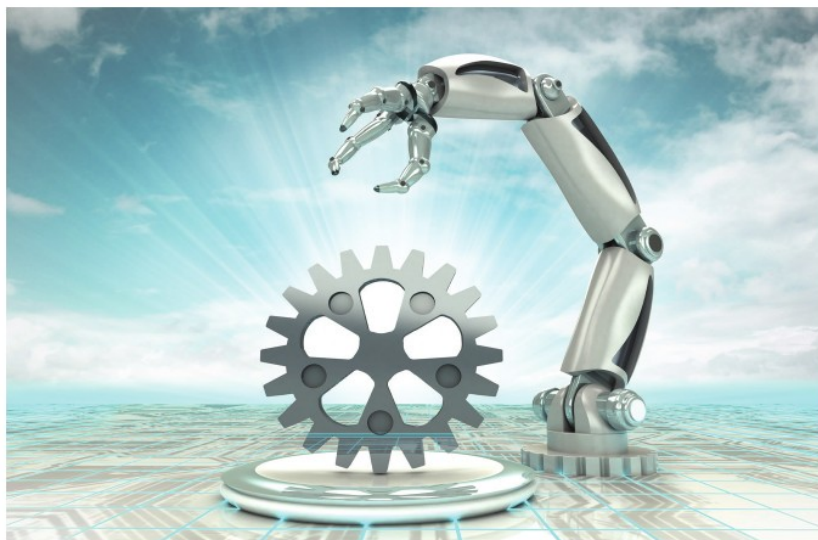
- ▲ Second largest road network (4.7 Million km) in the world carries **85%** of Passenger traffic and more than **60%** of freight traffic
- ▲ **13-fold** growth in passenger **cars** in India by 2035 as against 2005
- ▲ Total **freight traffic** (Road & Rail) will be **13,000 BTKM** in 2031-32 (Billion Tonnes Kilometers) as against 2000 BTKM in 2011-12
- ▲ **Average trip length** of road will increase from 2.5-10.3 Km in 2007 to **4-14.8 Km** in 2031
- ▲ India will become the **5th largest** in domestic **air travel** by 2031

FUTURE TECHNOLOGIES

- ▲ Advanced propulsion technologies
- ▲ Fuel cell drive train
- ▲ Flying cars
- ▲ Alternative fuel based transportation

- ▲ Active aerodynamics
- ▲ Intelligent vehicles- Autonomous power train and vehicle control
- ▲ Super high efficiency electric machines - superconductors
- ▲ Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) communications
- ▲ Magnetic levitation
- ▲ Tilting train technologies
- ▲ Fuel cell technology or renewable sources of energy for all
- ▲ Fog vision systems
- ▲ Next generation avionics and flight control systems
- ▲ Biomimetics design for ship
- ▲ Flexible and foldable vehicles
- ▲ Automotive Paints to help charge the vehicle
- ▲ JPod , Hyper loop, high-speed pressure tubes for transportation
- ▲ Evacuated tube transport, non-stop trains

Manufacturing



VISION

Strengthening manufacturing base through innovation driven clean, green and lean processes

SECTORS COVERED

- ▲ Leather
- ▲ Micro Nano Manufacturing
- ▲ Textile and Apparel Manufacturing
- ▲ Metal Fabrication
- ▲ Composite Manufacturing
- ▲ Electronic Appliances & ICT products
- ▲ Food Processing
- ▲ Chemical Manufacturing

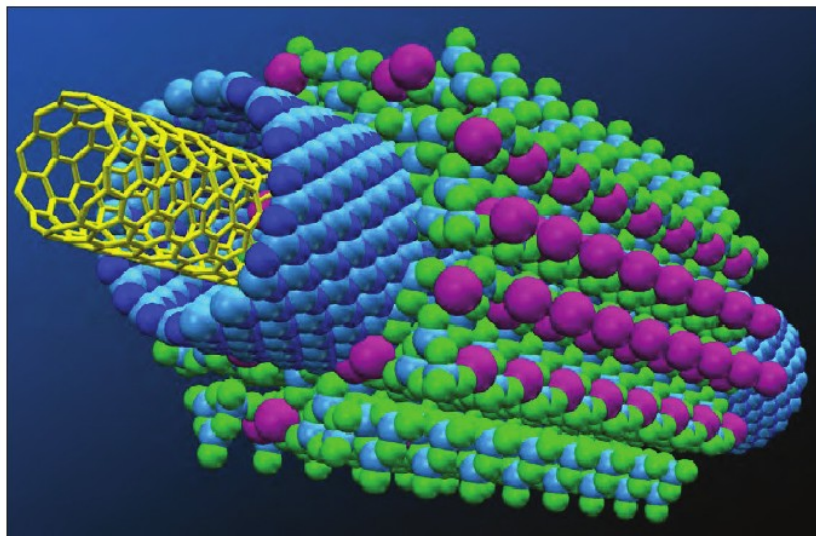
FACTS AND FIGURES

- ▲ **Metal fabrication** sector in India expected to generate revenue of **152 billion USD** by 2035
- ▲ Value of **textile** and apparel industry likely to reach **USD 140 billion** by 2020 and around **USD 385 billion** by 2035
- ▲ Indian **chemical** industry turnover is expected to reach **USD 250 billion** by 2035. Chemical production will reach **260 MTPA** by 2035
- ▲ Demand for **electronics** in the Indian market is expected to grow from US\$ 45 billion to USD 400 billion by 2020 and **USD 3200 billion** by 2035 at a growth rate of 15%. The export market is likely to grow from USD 4 billion to **80 billion** by 2020
- ▲ Indian **composites** industry is expected to grow steadily and reach approximately **7 billion USD** in 2035
- ▲ **Leather garment** would become a high value product with a low volume production. By 2035, main market for leather garments would be the **fashion industry**

FUTURE CONCEPTS & TECHNOLOGIES

- ▲ Additive manufacturing (3D printing)
- ▲ De-materialisation
- ▲ Precision manufacturing
- ▲ Process intensification
- ▲ Multi material construction
- ▲ Lean manufacturing
- ▲ Embedded flexible electronics
- ▲ Adaptive automation
- ▲ Micro-nano manufacturing
- ▲ Modularity
- ▲ Mass production of multifunctional products
- ▲ Nano Photonics
- ▲ Water-less processes
- ▲ Noise and odour free production
- ▲ Zero emission processes
- ▲ Biologically inspired nano scale process/fabrication
- ▲ Modulating raw material quality through genetic modulations
- ▲ Biodegradable/recyclable products
- ▲ Big data in bioactive molecule discovery

Materials



VISION

India to be a global leader in niche materials and its processing technologies by 2035

BROAD COVERAGE

- ▲ Electronic & Energy Materials
- ▲ Metallic Materials
- ▲ Biomaterials
- ▲ Glass & Ceramics
- ▲ Polymers & Composites

FACTS AND FIGURES

- ▲ India to emerge as world's second largest **steel** producer **300 Mtpa** by 2025
- ▲ Annual consumption of **Aluminium** is expected to touch **10 Mt** by 2020
- ▲ India is expected to be the **2nd largest copper** market by 2025, with a size of 2.7 MT
- ▲ Recycleability of **Zinc** makes it a preferred metal today and the figure of **~30% recycling** in India is estimated to reach >80% by 2035
- ▲ 5% of total world production of **Silicon** during next five years. By 2035, India should aim to target **30%** of total electricity production through Silicon
- ▲ In future, **glass** consumption in India to grow at **9%** in construction, **20%** in automotive, **10-12%** in consumer goods and **12-15%** in pharmaceutical sectors

NEXT-GENERATION MATERIALS

- ▲ Super-strong Graphene
- ▲ Smart Materials and Sensors
- ▲ Environment friendly & Bio-degradable
- ▲ 100% recyclable ▲ Sports Material
- ▲ Light-weight high strength alloys
- ▲ Shape-memory ▲ Energy saving
- ▲ Meta-materials
- ▲ Programmable Matter
- ▲ Biomimetic materials

FUTURE TECHNOLOGIES

- ▲ Functionalised Magnetically directed Ceramic Nanoparticle (MNP) technology for advanced drug delivery
- ▲ Perovskite material based solar cells
- ▲ Battery made of Self healing polymers
- ▲ Technologies for growing large area high quality Graphene
- ▲ Injectable scaffolds
- ▲ Transparent polymers with a 10-fold reduction in permeability via additives

Information and Communication Technologies



VISION

Paperless activities and services in every form with no physical computer by 2035

APPLICATION AREAS

- | | |
|-------------------------------------|-----------------------|
| ▲ Electronics for inclusive society | ▲ Industry |
| ▲ Healthcare in India | ▲ Education |
| ▲ Banking | ▲ Commerce |
| ▲ Telecom | ▲ Agriculture |
| ▲ Energy and Smart Grids | ▲ Cyber Security |
| ▲ Government | ▲ Disaster Management |
| ▲ Transport | |

FACTS AND FIGURES

- ▲ **Second largest** telecom industry in the world with **969 million** subscribers
- ▲ **100%** Tele-density by 2020
- ▲ **6100 million** smart phone users by 2020
- ▲ **550 million** internet users by 2018 (160 million)
- ▲ More than **300** million 3G subscribers by 2020
- ▲ **Electronics** hardware demand to reach **USD400 billion** by 2020
- ▲ Machine to Machine communication (M2M) /Internet of Things will grow to **26 billion units** by 2020
- ▲ Cloud Services Market is estimated to reach USD **1.9** billion by 2018 (USD 638 million in 2014)

TECHNOLOGY AREAS

- ▲ Solid State display and Photovoltaic
- ▲ Photonics
- ▲ VLSI design
- ▲ Processors and Computers

- ▲ Quantum computing, and IC manufacturing
- ▲ Speech Technologies
- ▲ Robotics
- ▲ Cloud Computing Technologies
- ▲ Image processing and computing, media and entertainment
- ▲ Artificial Intelligence
- ▲ Decision, Control and Security systems
- ▲ Solar power (PV) battery

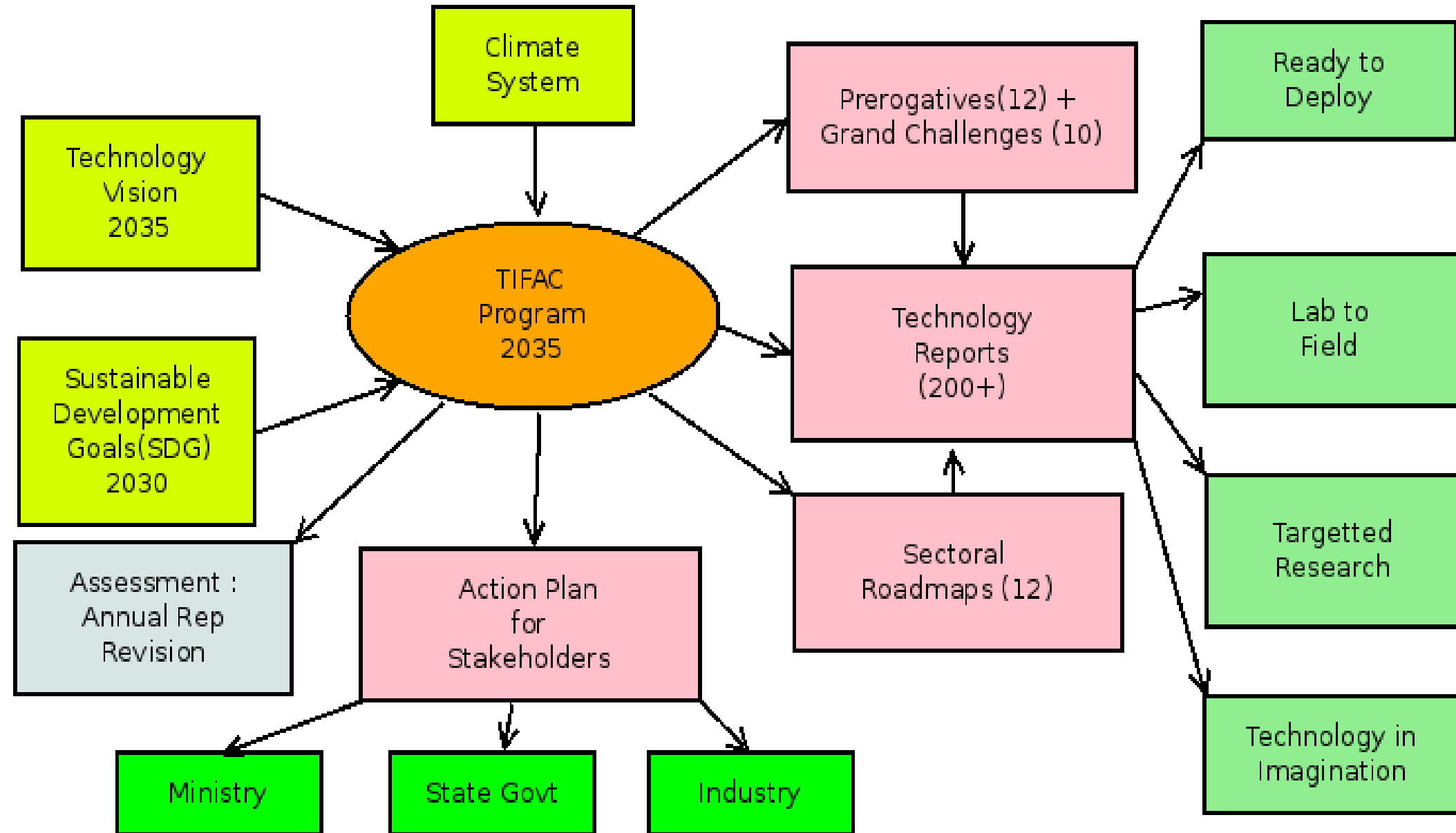
BLUE SKY RESEARCH IDEAS

- ▲ Machines /robots to connect all personal and emotional needs
- ▲ Inter-planetary communications systems
- ▲ 3D telepresence
- ▲ Sensing devices to be able to feel the product on internet before buying it
- ▲ Intelligent vehicles to detect emergency situations and take over the control
- ▲ Virtual Courts and Digital Evidence
- ▲ Complex real time dynamic disaster management response systems
- ▲ 3D holographic displays with foldable screens

Road ahead ...

- Experience after Technology Vision 2020
- Build network with S&T organizations, Ministries/Depts, State Govts, Industry, Academia
- ..

TV2035 follow up



TV 2035 Follow up...

- PMO has directed Dept/Ministries to follow TV2035 and take the agenda forward with Lead being taken by NITI Aayog
- S&T Dept, Line Ministries .. action being worked out in consultation with TIFAC
- State Govt – UP, MP, Kerala ...
- Industry Associations ...

Mission 2035

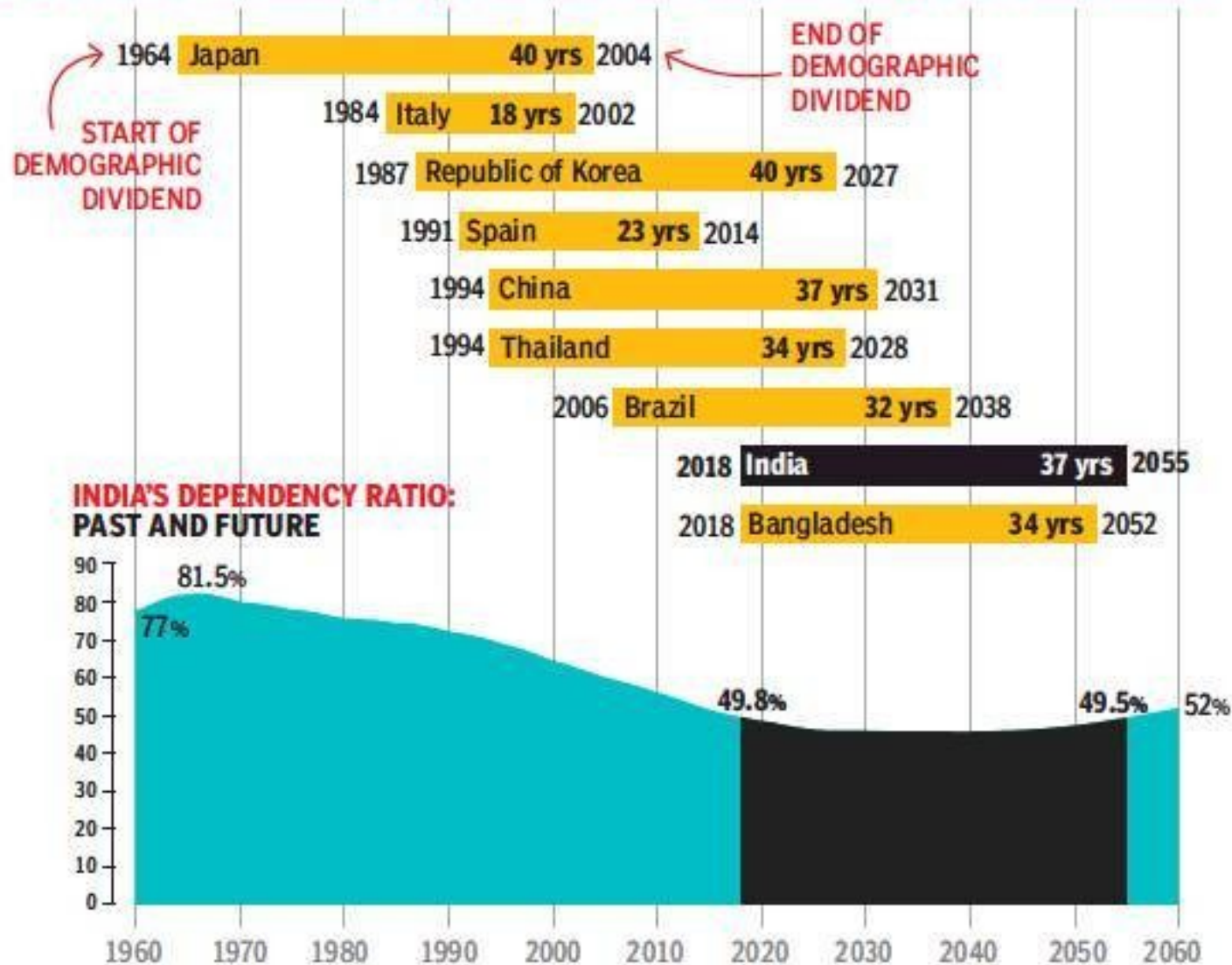
- My tenure at TIFAC got over on April 24, 2018
- Non political non governmental citizen centric initiative “Foundation 2035” being started
 - Break vision into small pieces, which can be taken up by students, individuals, groups, NGO, Organizations
 - Assessment of progress
 - Data collection and validation
 - Technology Development
 - Awareness campaign
 - ...

India 2047

- India completes 100 yrs of its independence in 2047!
- Expected to be country with largest population on earth
- What quality of life changes from 2035 → 2047?
- Technology is happening at much faster pace than expected
 - Technology diffusion is also happening at faster pace
 - Technology obsolescence is also happening at fast pace

Demographic Dividend till 2055

Period of demographic dividend in large economies



Technology 2047

- Biology and Technology is merging together
 - Would this lead to demographic dividend calculations go wrong?
- Digital Avatar is likely to become common by 2047
- Computers would have moved ahead of brain
 - A computer/phone of less than \$1000 would be more powerful than all the brain power on earth
 - Brain computers would not only compete with each other but merge into each other
 - Would the concept of citizenship still be relevant?

Past → future

- One of the strength of India is its culture and diversity
 - India should remain rooted to its culture at the same time adapt to most advanced technology to improve quality of life of citizens
- Development of medical science is expected to bring much better understanding of India's traditional knowledge of healthcare
 - result in lowering of healthcare costs as well as improvement in quality of life

Past → future

- Technology would remove language barriers and learning in one's own native language would become very easy
 - For multi-lingual country such as India, this would be very important.
- Ultrafast transportation and development of ICT sector, would make sure that urbanization would start to reverse and population would be distributed geographically
- Buildings would become mini cities and commute would become more for leisure than for work

India → World 2047

And last but not the least, India will continue to provide spiritual leadership to the world!

Thanks!

