

1. NTDPC's APPROACH TO TRANSPORT POLICY





Bus, railway

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1. NTDPC's APPROACH TO TRANSPORT POLICY

We all use transport in our daily lives. Children travel to school, their parents commute to work and shop for their daily needs; people visit friends, and travel for entertainment purposes, sports and games... There are myriad reasons for travelling both short and long distances, out of necessity as well as for pleasure; for fulfilling personal needs and for business requirements. The transportation of both passengers and goods is thus an intrinsic part of our daily lives.

The production of goods and services needs efficient transport services to take them to where they are needed. Transport connects producers and consumers. Farmers need roads and transport to take their produce to market to serve the country's daily needs. The emerging standard for manufacturing and distribution, with complex supply chains, increasingly requires efficient and responsive logistics systems. Food supply has scaled up and requires timely, predictable freight to avoid wastage. Manufacturing operations are becoming increasingly complex, characterised by specialisation and outsourcing. Their supply chains now look more like networks and may be local, national or global. With transport becoming cheaper, faster and more efficient, it is not unusual for a product to contain components sourced from a multitude of locations spread locally within a country or globally, but subject to 'Just in Time' (JIT) inventory systems. Transport then has to be quick, reliable and predictable. Thus, people's livelihoods depend increasingly on the availability of low-cost and efficient transport, both for convenience in their daily lives and for efficient and competitive production of goods and services. Inadequate transport facilities impinge on higher productivity; higher transport costs increase transaction costs

which reduce efficiency and competitiveness, thereby affecting the whole economy.

But we also need to think carefully about how we create the transport system that will best serve India in the coming decades. We need to do it cost-effectively—generating a transport system that is accessible and affordable to all. We must do it with close attention to passengers and shippers' needs. The system must be safe for both passengers and the transport of goods and responsive enough to meet evolving economic and social geography. High cost, inconvenient, unsafe and inadequate provision of transport impinges particularly on opportunities lost for the very large number of poor people, be they labouring in inaccessible farms or living in large cities with poor transport to work and play. Moreover, urban design affects peoples' accessibility to jobs and other needs: large distances generate demand for cheaper travel, which may not be sustainable.

We also must think about how to create an environmentally sustainable transport system, one that delivers mobility and freight movement with the least possible energy use and emissions. Transport currently accounts for 18 per cent of India's commer-

cial energy use, and 55 per cent of the country's use of petroleum products. Given that 85 per cent of the crude oil refined in India in 2011-12 was imported, the trajectory of the transport sector has serious implications for the nation's energy security. Second, the transport sector is a leading contributor to climate-changing emissions such as CO₂ and dark particulate matter. Transport-related emissions are also a significant contributor to urban air pollution, which in turn affects public health and damages crop yields in downwind areas. Third, the increasing loss of lives and life changing injuries that are occurring in the transport system are unacceptable. The design of a safe transport system is an imperative need for the future.

To achieve a significant improvement in productivity and efficiency, it is imperative that future planning of India's transport network is aimed at the development of multi-modal transport, both within the country and for export-import trade.

and unit costs, it is however imperative that future planning of the network should be aimed at a better integration of the various modes, so as to facilitate the development of multi-modal transport, both within the country and for our export-import trade. This will also call for heavy investments in transport infrastructure; a massive effort at building capacity in the human resources area to raise the level of skills and professional knowledge in the sector; and accelerating reform measures to ease and simplify the regime of taxes, levies and procedures that currently impede the smooth and rapid flow of transport across the country.

The National Transport Development Policy Committee (NTDPC) was constituted by the Government of India in 2010 to formulate a long-term transport policy to address just these issues. Prior to this, the government had carried out two similar exercises. The National Transport Policy Committee submitted its Report in 1980 and the Steering Committee on Perspective Planning for Transport Development in 1988. The latter Report, among other aspects, covered the entire spectrum of newly-emerging technologies for principal transport modes and suggested possi-

ble choices in the context of our economic and social milieu.

The present Report is devoted to setting the conditions for a coherent transport strategy for India in the long term: the horizon is 2032, two decades from the beginning of the country's 12th Five Year Plan to the end of its 15th, which shall also bring us to 85 years as an independent nation. Our vision is that a well-developed and competent institutional system for planning, management and execution of transport should be in place by the end of this period, if not earlier, as it blends investment in and delivery of transport services by the public, private and joint sectors alike. The Report abstracts from current methodologies to solve today's problems, while forging a coherent strategy for the transport sector as a whole and for each of the modes of travel.

This Report draws on the considerable work that has been carried out in the infrastructure sector over the past two decades or so, in India and elsewhere. In particular, it may be seen in some ways as a continuation of the thinking embedded in two previous reports connected with infrastructure and transport—*India Infrastructure Report 1996*¹ and *The Indian Railways Report 2001*². This Report represents new thinking on how to look at different transport sectors in an integrated fashion, and suggests mechanisms and measures for carrying this approach forward in a manner that reduces the resource costs involved. It also addresses a number of wider issues that affect all transport modes.

*The India Infrastructure Report*³ set the stage for the commercialisation of infrastructure as a whole. It facilitated introduction of the private sector in infrastructure, which had largely been in the public sector prior to the 1990s. The Indian telecom sector is now predominantly private, providing among the cheapest services in the world; considerable private investment has also been made in the production of power; the extent of public private projects in roads in India is on the cutting edge in the world despite the emergence of some problems. Thus, much has changed in infrastructure as a whole since the mid-1990s: it is appropriately seen much more as commercial enterprise than hitherto.

*The Indian Railways Report*⁴ served to focus attention on the need for much greater investment in the railways along with the emerging need for a significant reorganisation. This was seen as necessary to enable Indian Railways to undertake the capacity expansion and modernisation necessary for the rapidly growing Indian economy. It provided the rationale for the need for significant expansion of the railway system and focused on the means of raising adequate resources for the volume of investment projected. Although not much has changed in

1. Mohan (1996).
2. Mohan (2001).
3. Mohan (1996).
4. Mohan (2001).

the railways over the past decade, there is now much greater debate and increasing focus on the need for reform, reorganisation and expansion. The initiation of the dedicated freight corridors (DFC) is one illustration of some significant change that has indeed been put into motion. The time is now ripe for a very new thrust for undertaking higher and more effective investment in modernising and enhancing the capacity of the Indian Railways system to serve the transportation needs of the country in the future.

NTDPC provides a renewed focus on significantly enhancing the priority that should be attached to the expansion, restructuring and reorganisation of Indian Railways so that its continuing loss in market share can be arrested and even reversed in the larger interest of the country.

Since the mid-1990s, spanning three Five Year Plans, much has changed in the Indian transport sector, but much has also remained the same. We do now have four-lane highways criss-crossing the country; the Golden Quadrilateral is essentially complete; and East-West and North-South highways are well-advanced. The experience of long-distance travel by road for both passengers and freight today is different from what it was in the 1990s and earlier. Civil aviation has been totally transformed with the initiation of a multiplicity of competing airlines and advent of low fares, guaranteed overnight inter-metro air express services, along with availability of frequent flights between the main urban centres.

There isn't however much substantive change in the railways; urban transport remains inadequate, infrequent, unreliable, unpleasant and unsafe; there are indeed new modern container handling private port terminals, and some new private ports in the state sector, but the overall structure has not changed much, and efficiency in the port sector continues to be relatively low compared with ports globally. The institutional structure for provision of transport is about the same. The changes that have occurred, significant as they are in themselves, have been on a piecemeal sporadic basis with little strategic intent.

Meanwhile, the economy has undergone significant transformation with 7-9 per cent growth being experienced over a decade until the recent slowdown. During this period, India ascended from its low income status to a middle income status quite successfully and without experiencing much restructuring pain.

The challenge confronting the country now is to take the next steps to achieving a sustainable middle income status and beyond over the next 20 years. To achieve this, economic growth over the next 20 years has to be at rates that are at least as high as those achieved in the last 20. But our aspirations are and must be even higher. And transport growth and development must be commensurate with this aspiration. We must aim for per capita income to at least

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double every 10 years so that real per capita income by 2032 is around four times what it is today. That is the example set for us by our Asian neighbours over the last two to four decades, both small and large. It would then reach around US\$ 6,000 (at 2012-13 prices): similar to the present per capita income of China, and just above that of Thailand now.

For this to happen, adequate transport provision in terms of quality, quantity and resource-efficiency is essential. If the required transport investment is not made, and in time, to satisfy both the burgeoning passenger and freight demands, the aspirational growth envisaged will simply not be achieved. *Transport investment is a response to emerging demand, but it is also an economic growth driver in itself. Transport planning and provision therefore must be seen as central to the growth planning process.*

Changing demographics and prosperity with growing incomes will increase the demand for transport infrastructure and its services on a continuous basis. Indian manufacturing growth has faltered in recent years. If this is not revived again to attain growth rates significantly higher than overall Gross Domestic Product (GDP) growth, as it was between 2005 and 2010, India's economic transformation to middle income status will be stymied. For Indian manufacturing to grow and be competitive globally, transport costs have to be minimised, both for inland and international transport. East Asian manufacturing capacity has become globally competitive on the basis of efficient transport provision and logistics expertise. Their manufacturing capacity is based largely on the sea coast with easy access to efficient and cheap international shipping. Much of Indian manufacturing is, however, based in inland locations across the country. Thus, our challenges are even greater in ensuring efficient and competitive transport facilities within the country so that manufacturing and other production is connected to ports that are competitive, and shipping that is cost competitive. The goals of inclusive development will be difficult to achieve without necessary spatial diversity and activity dispersion.

The agriculture sector will also undergo very significant transformation over the next two decades, and much of this transformation will be dependent on universal connectivity of all habitations in the country. High food inflation in recent years has resulted, in part, from supply bottlenecks related to fruits, vegetables, poultry, fish, meat, milk products and the like, whose demand will keep increasing

with higher household incomes. The establishment of efficient supply chains is not feasible without connectivity. This is essential for the spread of income and employment opportunities in rural areas, particularly the less connected ones.

Adequate investment in transport is therefore essential for achieving higher Indian economic growth over the next 20 years and beyond. Hence this Report.

WHAT IS DIFFERENT IN THIS REPORT?

Much of the thinking on transport in India has been project-centric, done within single-mode silos. The focus has been on stepping up investments to address specific problems, usually well after logistic and transport dislocations have begun to appear. Even the Five Year Plans are essentially a collection of projects that are not necessarily connected. The Plans lack an overall coherent strategy to develop transport networks within and across modes designed to leverage transport investments for achieving economic growth. The visions of the National Highway Development Project (NHDP) and the Prime Minister's Gram Sadak Yojana (PMGSY) are exceptions in this regard. By its very nature, transport as a system connects cities, towns and villages within and across countries; and people as consumers and producers to manufacturers, wholesalers and retailers, and vice

versa, once again within and across countries. The 'system' is also composed of various elements: the infrastructure itself, the norms for access and use of the infrastructure (which significantly affect infrastructure's capacity to support flows of goods and people), and the vehicles that move on the infrastructure. So, a key requirement for thinking on transport strategy is that it must be system based. In other words, it must cut across modes

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of transport, administrative geographies, and integrate capital investment with regulatory and policy development.

Whereas this Report also addresses sectoral issues in detail, its focus is on cross-cutting themes underlying transport strategy and resulting investment programmes (Chapters 3 and 4, Volume II). It is less focused on specific solutions than on developing human resource capacity and responsive institutions that observe, analyse and act on developments as they occur while remaining embedded within overall strategies that are articulated (Chapters 5 and 11, Volume II). We have been dismayed to find a significant lack

of expertise within the whole transport system from policy making agencies to executing ones. Hence, the Report provides a sharp focus on research and human resource development in all segments of the transport sector, and overall.

The Report projects India's requirement for transport over the next 20 years to 2032 and what transport investments need to be made on a phased basis to get us there (Chapter 3, Volume II). We are however fully aware that today's projections at some point will indeed be wrong, as conditions change beyond what may be expected or projected today. Transport needs are determined by economic growth as it occurs, by the emerging pace and pattern of urbanisation, by developments in differential sectoral growth, shifts in consumer and producer preferences, and by changes in demographics and technology. But these trends will themselves be impacted by emerging developments in energy availability and prices, and new technologies. So, the economic and regulatory framework underlying transport must be price-responsive. Within a 20-year framework, it is quite possible that radically new transportation technologies may develop or alternative energy sources like solar energy may well become available, cost-competitive and viable. We can recall that there was no internet just 20 years ago; it is now ubiquitous in our daily lives, and has transformed the whole logistics business and other segments of transport services. *Thus, the country must have planning capacity in transport that, on the one hand, develops coherent medium and long-term strategies, but on the other, is also able to respond on an ongoing basis to changes that occur over time.* When significant transport investment has to be made, it must be done with considerable forethought.

Transport infrastructure lasts a long time. For example, the basic Indian Railways network was laid out in the latter part of the 19th century. It has determined much of the spatial distribution of economic activities in India over the last 100 or more years. Within cities, the specific layout of suburban rail networks, as in Mumbai, and of underground metro systems in cities such as London, Paris, New York and Tokyo, have determined the spatial pattern of growth and activity of these cities over a long period. On a different plane, large coordinated investments in mega ports and airports in Amsterdam/Rotterdam, Singapore, Dubai, Hong Kong have enabled these countries to become globally competitive despite their small size and lack of domestic resources. Indeed, transport investments have been among the key drivers of economic growth in these countries. Similarly, Japanese investment in the Shinkansen in the 1960s, along with coordinated investment in ports and airports in Tokyo/Yokohama/Osaka, greatly influenced the concentration of economic activity in this region, and the Japanese economy's rapid growth in the 1960s and 1970s. In the United States, the interstate highway system planned in the late 1950s has

determined the spatial pattern of the economic activity to a very significant extent.

Technology has always played a crucial role in human affairs. In the transport sector, because of the lumpy nature of the investments, it tends to change in cycles. These used to be long, but in the last 30 years, have grown much shorter. India needs to build this fact into its approach to transport policy.

This Report therefore abstracts from specific problems today, but puts them in the context of India's long-term development trajectory. It makes long-term projections and provides guidance on broad magnitudes of needed transport investment. But it accepts that these projections are only indicative and, being made today, will need to be reviewed as new developments occur in the future. It therefore pays particular attention to building institutional and informational foundations that both signal the onset of specific challenges and help in the provision of a range of options for differential needs of the multitude of producers and consumers in the country. As technologies, prices and incomes undergo specific changes over the next 20 years, the absence of such institutional foundations will run the risk of 'lock in' if current choices dominate and restrain adaptation in later periods.

Consistent with this long-term view, in formulating a transport strategy for India, it is also imperative that this be undertaken within the larger context of connectivity within South Asia and between South Asia and South East Asia. NTDPC has taken a conscious view that much greater attention should be paid to the development of these links across our borders (Chapter 13, Volume II). This focus has been absent in the formulation of national transport strategy so far.

As political and diplomatic conditions improve in the region, consideration will need to be given to promote connectivity of countries with one another through a dense web of transport links, encompassing road, rail, waterways, and air. A corollary to this is the need to develop modern, efficient and convenient cross-border transport linkages, in particular, by rail and road. Many of our border areas have been left deliberately underdeveloped because of an outdated notion of security which looks upon borders as walls separating India from a hostile neighbourhood, rather than as connectors bringing peoples and economies together. Transport linkages across our border regions must be developed in tandem with 'backward linkages', i.e., links with the Indian heartland. If the latter fall behind the former, there is a danger of further alienating our border regions and the people inhabiting them. *Consequently, NTDPC has further focused specially on the transport needs of the North East Region (NER) which has otherwise suffered from relative transport isolation within the region itself, connectivity with the rest of India and*

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cross-border with all the countries surrounding the North East (Chapter 6, Volume III). The route dispersal guidelines formulated by the Ministry of Civil Aviation to promote viable air services to remote areas such as the North East, the Andaman Islands, Lakshadweep and Ladakh, have not met their objectives, while the mechanism of cross-subsidisation with passenger air fares has only created undesirable market distortions. NTDPC has made a recommendation on an alternative model of direct subsidy with viability gap funding, which can be managed, as required, to meet national strategic objectives.

NTDPC's view on focusing on international connectivity is similar to that adopted within Europe to facilitate achievement of the common market, and in South East Asia for similar proportion of trade within that region. Equal emphasis has to be given to the development of physical networks as to the soft institutional mechanisms necessary for seamless transfer of goods and services across borders. The current lack of intra-regional trade within South Asia and between South Asia to South East Asia stands out, making South Asia the least integrated region in the world. This must be corrected through the development of transport linkages in all modes.

This NTDPC vision is also consistent with that taken by the Government of India as articulated in its Look East Policy. The government has taken various initiatives to forge closer and deeper economic integration with Eastern and South Eastern neighbours so that trade with these countries can increase at a rate consistent with the expected growth of the East and South East Asia region as a whole.

THE GROWTH CHALLENGE

This Report builds on the macroeconomic growth framework pioneered in the *India Infrastructure Report 1996*⁵. Building on the very significant growth departure of the Indian economy recorded since the turn of 1980s and accelerated in the 2000s, overall economic growth projected over the next 20 years is to rise from the expected 7 per cent in the 12th Plan to 9 per cent per annum in subsequent periods until 2032. Whereas such growth projections were regarded as reasonable until just two years ago, the significant downturn in 2012-14 has raised scepticism regarding the reality of projections at this level. Whereas we have indeed tempered growth expectations during

5. Mohan (1996).

the 12th Five Year Plan period until 2016-17, we believe that there is little reason to doubt the feasibility of achieving the kind of growth projected for the next 20 years, reflecting the record of the last 30 years, and particularly that of the last 10. The achievement of such growth will indeed need very significant policy reform in a range of activities. That such reform has been carried out on a relatively continuous basis since the early 1980s, intensifying in the 1990s and accentuated in the infrastructure sector since the mid-1990s, gives us confidence in the potential ability of the country's policy making system to rise to the challenges of the future. In principle, therefore, Indian institutional capacity for governance and reform has exhibited considerable resilience. Thus, we should not let the current climate of scepticism cloud our vision for the long-term future. We have therefore retained high growth projections between 8.5 to 9 per cent during the 13th, 14th and 15th Five Year Plans covering the period 2017-32 (Chapter 3, Volume II). As this Report emphasises, however, the institutional development and reform needed to get to the

Total investment in transport was about 2.6 per cent of GDP during the 11th Five Year Plan. This needs to rise to about 3.3 per cent in the 12th Plan, and then stabilise at about 3.7 per cent during the rest of the period till 2032.

per cent, while suffering a decline particularly in public sector and household financial savings. Just as India was able to achieve a correction in public sector savings from negative levels in 2000-01 to significantly positive ones from 2003-04, one can be optimistic about a similar turnaround over the next few years with the exercise of appropriate fiscal responsibility, and restraint in yielding to pressures promoting the subsidy culture, particularly in the provision of infrastructure services. In principle therefore, resource availability, both domestic and international, for maintaining the kind of high growth envisaged should not be a constraint.

INVESTMENT REQUIREMENTS

To achieve the kind of growth as projected over the next 20 years, the overall required investment rate would need to increase gradually to around 40 per cent from the current 35 per cent of GDP over the period. The key ingredient for achieving such

growth would be restoration of industrial growth to 10 per cent plus over the next three to four Five Year Plans. There is a symbiotic relationship between efficient transport provision and industrial growth. Thus, the high growth projected will not be possible without enhanced infrastructure spending, and the enhanced infrastructure spending will be infructuous if manufacturing growth does not accelerate significantly.

Our macroeconomic exercise suggests that it is feasible for total investments in infrastructure to increase from the 11th Plan average of about 5.8 per cent of GDP to 6.9 per cent in the 12th Plan and then to around 8 per cent in the subsequent Plan periods upto 2031-32 (on national accounts basis)⁶. In absolute terms, this implies that the annual level of investment in infrastructure would need to increase from the current Rs 6 trillion (\$100 billion) to about Rs 30 trillion (\$570 billion) by 2032 at constant 2012-13 prices. Total infrastructure investment is projected to rise from about Rs 25 trillion (\$ 425 billion) in the 11th Plan to Rs 40 trillion (\$ 745 billion) in the 12th Plan and further to Rs 70 trillion (\$1.25 trillion), Rs 100 trillion (\$1.9 trillion) and Rs 155 trillion (\$2.9 trillion) in the 13th, 14th and 15th Plans respectively (all at 2012-13 prices).

Of this, about 75-85 per cent of total infrastructure investment would have to be domestically financed, while the rest of about 15-25 per cent could come from external sources, assuming that 30-40 per cent of total capital inflows go into the financing of infrastructure.

Total investment in transport, both public and private, was of the order of about 2.6 per cent on average during the 11th Five Year Plan. NTDPC projects that to achieve the kind of growth envisaged overall, this investment in transport would need to increase to about 3.3 per cent of GDP in the 12th Plan, and then stabilise at about 3.7 per cent of GDP during the rest of the period until 2032⁷.

In absolute terms, this implies an increase in total transport investment from about Rs 10.4 trillion (\$190 billion) in the 11th Plan to about Rs 19 trillion (\$350 billion) in the 12th Plan and Rs 30, 45 and 70 trillion (\$ 575, 850 and 1300 billion) respectively in the 13th, 14th and 15th Plans. In this scenario, both public and private sector investment in transport will need to increase as a proportion of GDP. It is estimated that public sector investment in transport was about 1.8 per cent of GDP in the 11th Plan. This is projected to increase to 2.0 per cent in the 12th Plan and then remain stable at 2.1 to 2.2 per cent till the 15th Plan. We are projecting a somewhat higher pace of increase in private sector investment from less than 1 per cent of GDP in the 11th Plan period to about 1.3 per cent in the 12th Plan and around 1.5 to 1.6 per cent of GDP

6. About 1-1.5 per cent of GDP can be added to make these projections comparable to the Planning Commission definitions of infrastructure investments.
7. Here again, about 0.5-0.7 per cent of GDP can be added to be comparable with Planning Commission investment concepts.

in the following Plan periods until 2032. In absolute terms, this implies very significant increases in private investment in transport. In terms of feasibility of such projections, this would imply that about 5-7 per cent of the total flow of resources to the organised private sector should be utilised for transport investment.

These are clearly very large numbers, even if we look at the more immediate future of the next 5-10 years. Broadly speaking, a major step up in transport investment is required in the current 12th Plan and further in the 13th Plan ending in 2022, in both the public and private sectors. The expectations from the private sector are ambitious, perhaps without equal in the rest of the world. If they do not fructify, the government needs to put contingency plans in place, so that public sector resource mobilisation and execution can substitute for any shortfalls in private sector investment. In any case, as indicated, public sector investment itself has to increase significantly and there can be no expectation of its reductions in transport. In general, it is much easier for the private sector to invest in rolling stock. Private investment in fixed infrastructure is more difficult to organise.

The increase in public sector investment is primarily due to the increased investment proposed in the railways. Overall, a greater effort will need to be made to strengthen and commercialise all public sector entities that invest and manage public sector transport infrastructure at both the central and state levels. The railways in particular will need very significant organisational and accounting reform (Chapter 1, Volume III) if the kind of capacity and quality expansion envisaged is to be achieved. *NTDPC is proposing a significant increase in investment in railways from about 0.4 per cent of GDP over the last two decades to around 0.8 per cent in the 12th Plan and then rising to around 1.1 to 1.2 per cent of GDP in the subsequent three Plan periods. The investment should primarily be on productive capacity enhancement of the system. This would then bring investment in railways at par with that in roads and bridges which increased from about 0.4 per cent of GDP in 2000-01 to about 1.2 per cent by 2011-12. This is manifested on the ground by the progress achieved in the National Highway Development Project (NHDP) and the Pradhan Mantri Gram Sadak Yojana (PMGSY).*

The much enhanced level of investment in roads over the past decade or so relative to previous periods demonstrates that it is possible to achieve such an enhancement in a short period of time. *NTDPC is of the view that it is now time to shift this focus to the railways.*

Where will all these resources come from? In public sector investment, we have projected that 70 per cent of total public sector transport investment may be expected to come from the Budget, with the remaining 30 per cent coming from Internal and Extra

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Budgetary Resources (IEBR). As for the 1.3 to 1.6 per cent of GDP expected to be invested by the private sector in transport over the next 20 years, up to about a third could come from foreign sources. Whereas foreign equity financing of private sector transport investment could possibly be comparable to that of the domestic private sector, domestic debt financing will have to be significantly higher than foreign debt financing, if private investment in transport is to be sustainable. This is reasonable since most cash flows in the domestic transport sector are in domestic currency, although in sectors such as ports and airports, foreign borrowings are naturally hedged. What these projections illustrate is that if we account for the sustainability of the Indian balance of payments over the long term, the extent of external borrowing for the transport sector would be somewhat limited to about 0.25 to 0.30 per cent of GDP overall, leaving the rest of debt required to be raised in domestic markets. It is therefore of utmost importance that much greater efforts are made to invigorate the pension and insurance sectors for greater domestic long-term savings to flow into these funds which would then be the natural source for funding transport and other infrastructure investment. It is these contractual savings that are made for the long term and are hence particularly suited for investment in transport infrastructure assets, that can then provide stable returns on a sustained long-term basis.

The generation of this level of funds from both domestic and foreign sources for both the public and private sectors in transport will be dependent on the economic sustainability of such investments. This requires the levy of user charges, levies and cesses, as appropriate, in all segments of the transport sector, so that its economic viability is seen as feasible and stable. *NTDPC therefore believes that economic pricing and adequate regulation are essential for sustainability of the transport system and hence for attracting the kind of resources that are needed for transport investment.*

These projections were made top down in a macroeconomic modelling framework. NTDPC also made bottom-up estimates for investment requirements in each of the sectoral transport sectors. One of the interesting findings of NTDPC is that the bottom-up aggregate and sectoral estimates provided by the respective Working Groups for the later two Plan periods (2022-32) turn out to be lower than the macroeconomic-consistent model projections of availability of resource flows for transport infrastructure. This is unusual since unconstrained bottom-up

projections are usually far in excess of what is feasible. What these projections suggest is that we can be more ambitious in our transport planning in the 13th Plan and beyond. This outcome suggests that the many proposals in this Report that relate to:

- capacity development
- safety enhancement in all sectors
- use of information technology
- environmental projection through more stringent fuel standards, etc
- universal connectivity of all habitations through PMGSY
- connectivity with and within the North East; and
- international connectivity

have high probability of being financed. Furthermore, beyond the 13th Plan, we can also be more ambitious in implementing full connectivity with all-weather roads of all habitations in the country, and enhancement of their quality. More ambitious projects such as high-speed rail transport and mass rapid transit systems could also be examined more realistically for their economic viability and resource intensity in the period beyond the 2020s.

The given land resources of the country have to meet myriad requirements of its large population. The ever-increasing economic activities are putting great pressure on this scarce resource. Hence, there is an imperative need to have a closer look at the requirements of land for transport projects. Besides, it is equally essential to develop common user facilities at the terminals. In this scenario, it would be prudent to find strategies that minimise the time lag in acquiring land for such projects.

All projections suggest that overall economic growth could be stymied if appropriate strategic choices are not made now to facilitate significant capacity expansion of the Indian railway network.

TRENDS IN TRANSPORT DEVELOPMENT

At present, India's transport networks are severely capacity constrained. During the last six decades, growth in total freight traffic has been broadly consistent with that of GDP, while that in passenger traffic has been much greater. It is now expected that with increasing complexity in the economy, rising incomes and hence greater demand for goods, both food and non-food, the elasticity of freight traffic may well be higher over the next couple of decades. On this basis, NTDPC has projected that freight traffic may increase from around 2,000 billion net tonne kms (BTKM) in 2011-12 to between 10,500 to 13,000 BTKM by 2032, an increase by a factor of about 5-6 BTKM. The increase in total passenger traffic would be

much higher and may well increase by a factor of about 15 over this period. There has been a veritable explosion in air traffic over the past 20 years: domestic passenger traffic increased from about 7.5 million in 1990-91 to about 60 million in 2011-12. These trends suggest that it will be much in excess of 400 million by 2031-32; and international passenger traffic may grow from around 40 million now to over 200 million over the same period. These numbers provide an idea of the key growth challenges facing investment in transport (Chapter 2, Volume II and Chapter 3, Volume III).

A significant feature of developments in the Indian transport network has been the relative decline of railways and corresponding increase in that of roads for both passenger and freight transport. The share of railways in freight traffic fell from about 90 per cent in 1950-51 to about 40 per cent by the end of 1990s and further to just over 30 per cent by 2011-12. The fall in passenger transport was even greater with the railways share falling from about 70 per cent in 1950-51 to about 15 per cent in 1999-2000 and only about 10 per cent by 2011-12. With the kind of growth envisaged in both the economy and the consequent growth in transport, such a pattern of mode share in transport sector is not sustainable. Loss in the share of railways is a global phenomenon, but the decline in India is somewhat steeper than in other large economies. In view of the expected uncertainties related to the availability of future crude oil supplies, the attendant adverse implications for energy prices and the damaging environmental impact of fossil fuels, it is essential that an attempt be made to reverse this trend or at a minimum to arrest it. *This requires making strategic decisions in terms of the relative allocation of resources between rail and road, accompanying pricing and taxation policies and legal changes, which can then be used to nudge transport demand toward desired modal shares.*

The key issue therefore facing the country is the desired strategy for capacity expansion for the railways over the next 20 years. All projections for the growth in demand for both freight and long distance passenger services suggest that overall economic growth could be stymied if appropriate strategic choices are not made now to facilitate significant capacity expansion of the railways, as has been done in China over the past decade or so. Such an expansion would not take place in a business as usual scenario. As indicated there would have to be significant allocation of public resources for investment in the railways which, however, will be difficult to implement without corresponding investment in capacity building and significant reorganisation of the railways system as a whole (Chapter 1, Volume III).

Thus, a vision similar to that of NHDP should be laid down for the railways now, so that we may expect a much expanded and transformed railway network

by 2032. If this is not done, the progressive achievement of NHDP itself will only accelerate the loss in the railways transport share, leading to overall economic inefficiency and a pattern of energy usage that could lead to greater pollution and environmental degradation.

Better understanding of relative energy usages and life-cycle energy costs of different transport modes would be very helpful in such decision making. This Report has made a beginning in this area (Chapter 7, Volume II). Urban transport faces a similar challenge arising from the increasing use of personalised motorised vehicles, lack of efficient public transport systems, and inadequate facilities that discourage walking and cycling.

India has experienced relatively higher rates of growth in its trade since the early 1990s. Going forward, the Government envisages an increase in India's share of world trade from the current 0.8 per cent to 1.5 per cent over the next 20 years. Such high growth in trade needs corresponding investment in ports in a timely manner. At present, there is no comprehensive and coherent strategy for the location of ports in the country or indeed for the overall investment programme of these ports, that is in its turn, linked with the corresponding investments in roads, railways, logistics and coastal shipping. Our specialised work on the transportation of energy commodities has also highlighted the need for such a strategic programme for port investment. Each of the world's major economies has a few mega ports which are then well-connected with the inland transport system through road, rail, inland waterways and coastal shipping. At present, India has no mega port comparable to the size of such ports in other countries. Consequently, at present, a good proportion of India's maritime trade is transhipped in Colombo or Singapore. *NTDPC is therefore recommending the establishment of four to six mega ports over the next 20 years with two to three on each coast.* The location of these ports would need harmonisation with plans for NHDP on the one hand and the Dedicated Freight Corridor (DFC) system being currently planned for the railways on the other so that there is efficient connectivity (Chapter 8, Volume II and Chapter 4, Volume III).

These mega ports can be established either by transforming some of the existing major (or non-major) ports into mega ports, if feasible, by combining some major and minor ports, or by setting up totally new mega ports.

As such a strategic review is taken for investment in ports; NTDPC also recommends the adoption of the concept of landlord ports and corporatisation of the existing Port Trusts. This model can then transform the Port Trusts to statutory landlord port authorities through specific legislation, while the terminal

Four to six Mega Ports should be established over the next 20 years, with two or three on each coast. These Mega Ports could be built by transforming some of the existing ports, if feasible, or by setting up totally new ports.

operations of the Port Trusts would need to be corporatised as public sector corporations. Then, both private and corporatised public sector terminal operators would compete under the aegis of the landlord port authority. Such significant organisational, legislative and regulatory reforms would be necessary if we decide to set up mega ports as recommended, and if Indian trade is to be facilitated on an integrated logistical framework connected adequately with the hinterland road and rail infrastructure (Chapter 4, Volume III).

The civil aviation sector has already witnessed a major transformation over the past 20 years, and particularly over the last 10. The growth envisaged over the next 20 years will be an order of magnitude higher in terms of absolute growth. It is expected that more than 1,000 aircraft will have to be added to the current stock of domestic aircraft. A comparable increase will take place in international airline aircraft serving Indian airports. Total passenger throughput is currently around 150 million: this is expected to increase to over 1.1 billion by 2031-32. We therefore need a coherent strategy that recognises the intermodal linkages required along with the physical expansion of aircraft, airports, air traffic control systems. This challenge also needs to be turned into opportunity: the development of airport hubs, international competitive airlines, facilities for maintenance, repair and overhaul, and even aircraft manufacturing. NTDPC recommends that a holistic view be taken of this growth opportunity through a modernised regulatory framework that encourages such capacity enhancement (Chapter 3, Volume III).

To ensure that the creation of new capacity is dovetailed into the overall framework of a multi-modal transport network for the country, it is recommended that a National Master Plan for airport development over a 20-30-year timeframe is drawn up; and an Airport Approvals Commission is established within the Ministry of Civil Aviation, to review and clear the plans on an ongoing basis. A crucial component of airport development is to ensure the provision of adequate infrastructure to process the country's air exports and imports. This can be created rapidly and cost-effectively by the development of off-airport processing facilities, similar to inland ports and container depots, to supplement the expansion of on-airport cargo terminals, and will require the Customs to adopt a more liberal approach to recognising and manning such facilities (Chapter 3, Volume III).

India needs an efficient network with interchange points that receive short-haul smaller cargo for aggregation, provides longer-haul rail transport to ports and industries and the like, and vice versa.

The Report emphasises that India must adopt a holistic approach in designing integrated transport networks. One of the weaknesses of the planning of transport infrastructure has been the mismatch at the interfaces of the various modes. For example, India needs an efficient network with interchange points that receive short-haul smaller cargo volumes from roads from the hinterland for aggregation, and then provides longer-haul rail transport of vehicle loads forward to ports, industries, and the like, and vice versa from ports/industries to rural/urban centres through disaggregation. Similarly, while the size of the container ships has substantially increased, the corresponding facilities for evacuation of the containers from the ports have not kept pace. Special attention also needs to be given to the development of coastal shipping and inland water transportation, which are also characterised by low energy intensity. It is, therefore, essential to plan in an integrated manner across the entire movement chain. To achieve this, we need governance structures and an organisational culture that supports transport networks with seamless inter-modal and hierarchical connectivity and skilled human resources to innovate, develop and manage such structures (Chapter 4, Volume II).

THE GOVERNANCE AND INSTITUTIONAL CHALLENGE

INSTITUTIONAL DEVELOPMENT FOR TRANSPORT GOVERNANCE

The current approach to transport planning is essentially piecemeal. Given the availability of overall transport projections as we have made, both in the macroeconomic context and in terms of transport demand expectation, a more integrated approach is desirable. The desired end state is an overlay of transportation networks allowing for efficient transport of passengers on the one hand, and of each commodity type on the other, as well as natural interchange points where networks intersect and where large quantities are broken down into smaller volumes for last mile transportation into urban centres. A vastly superior logistics infrastructure is thus essential to achieve such a transportation system. We need a modal mix that will make feasible an efficient, sustainable, economical, safe, reliable, environmentally friendly and regionally balanced transportation system.

Choices should be made between the priorities to be placed on different investments. Given the scenario of significantly expanding magnitudes in terms of transport demands across all categories, it will be crucial to influence the development of the transport network so that there is optimal movement of passengers and of freight by matching cargo category with transportation mode. This implies some judgement on the normative modal shares that are desired for rail, road, air, shipping and inland waterways traffic which we have attempted to some extent.

At present, this prioritisation and decision making is disjointed. For example, decisions on investments on highways and expressways on the one hand and potential DFCs and even possible high-speed trains are made in isolation of each other. Similarly, investments in ports are also not coordinated as closely as they should be with other investments in the overall transport network and developments in the overall economy. This is illustrated in great detail in the work that NTDPC has conducted in the transportation of energy commodities (Chapter 8, Volume II). As demonstrated there, the requirements of energy supplies, consistent with the overall economic growth envisaged, implies a corresponding growth in the demand for coal and hence of its transportation from domestic mines and increasingly from international sources over the next couple of decades. To ensure adequate energy supply over the next two decades, it is therefore essential to undertake corresponding investments in adequate port capacity, in the laying of pipelines, and in rail infrastructure that connect the sources of energy supplies to the points of consumption and power production across the country. At present, this is done on a piecemeal basis.

The main reasons for this state of affairs is that the institutional framework for formulation of transport policy, planning and coordination in India is very weak. We do not have any single agency at either the central or state levels for coordination of policy formulation for the transport sector as a whole. In fact, the constitution of NTDPC itself reflects the lack of such an agency to devise overall transport policy strategies. In the absence of such arrangements, the responsibility of investment coordination rests with the Planning Commission. In addition, the Planning Commission is also expected to coordinate policy formulation for the transport sector as a whole, along with all the other areas of economic policy. Given the increasing complexity of the economy, and in the transport sector itself, the Planning Commission, as constituted at present, simply does not have the technical capacity to accomplish this task in a competent manner.

It might have been expected that the individual transport ministries themselves would have such technical capacity to aid the Planning Commission,

which could then perform the function of integrating the ideas and strategies put forward by the different transport related Ministries. In fact, the individual ministries themselves are bereft of technical capacity to perform this function. Moreover, there is no continuity in the leadership, which could otherwise enable them to take longer term views. By way of illustration, we may note that during the existence of NTDPC of about three and a half years, there have been at least three Secretaries to the Government in each of these ministries and in some cases four. Given the current Indian administrative governance system, senior officials, while being competent administrators, do not in general possess domain knowledge of the ministries to which they are appointed. They are essentially birds of passage. This is not to decry the individual abilities and qualities of any of the administrators in the system, but is much more a reflection of systemic flaws in the administrative governance of transport infrastructure in India, along with other economic areas. With such an administrative system, where there is no continuity or domain knowledge in the ministerial or bureaucratic leadership of key transport and related ministries, there can be little expectation of the emergence of organised and integrated thinking for long-term transport strategy and investment. This has to be corrected.

NTDPC therefore believes that it is of the utmost necessity to develop suitable institutional entities at both central and state levels, which are endowed with adequate expertise to perform such coordination on a continuous basis. Such coordinating entities can then take into account logistic and inter-modal issues that are now essential for formulating and implementing coordinated transport planning and policy (Chapter 5, Volume II).

India faces three main institutional challenges in developing the governance infrastructure to support a transport system that will meet its needs over the coming decades. First, India will have to shed the old version of directive planning to move to a new skill of facilitation, recognising that capital investment in transport infrastructure and regulation or policy are instruments to affect the transport system rather than decrees that determine its final shape. Ultimately, mobility for passengers and services for freight are the products of individual responses to existing infrastructure, policy structures and pricing. Similarly, the transport system is one of many contributors to an emerging economic and social geography that is also the product of millions of households' and businesses' decisions about investment, living, travel, investment and consumption. It is coordination of policy, regulation and fiscal arrangements that influence costing, pricing and supply of transport services made in response to emerging demands. We have consequently provided some pointers to the kind of overall approach required for regulation on

Transport governance in India is far more centralised than international practice. The changes that we are recommending are to re-align transport governance with the principles of subsidiarity in federal design.

the one hand, and fiscal structures that affect transportation on the other (Chapters 6 and 9, Volume II).

Second, progress has to be made in setting up institutional structures that integrate decision making across agencies that have historically focused on particular modes of transport and between elements of the system. Policies concerning physical infrastructure, its use, and investment in rolling stock have historically been undertaken in different parts of the federal system and agencies within each level of government. India's fragmentation of transport investment planning between modes of transport stands out in comparative context: *it is the only country among the 100 largest economies in the world that continues to maintain separate ministries for each mode of transport.* This fragmentation is deeply rooted in the Indian system and will be difficult to overcome. But NTDPC believes that the process has to be initiated to overcome these constraints and to ensure better governance in transport (Chapter 5, Volume II).

'Integration' does not mean centralised decision-making, but rather setting up of systems for information flow, knowledge generation, and continuous, interactive, dialogue between relevant organisations throughout the project cycle. NTDPC emphatically argues for a move towards decentralised coordination, enabled by information flow among agencies with clear responsibilities, and which moreover have adequate financial and human resources to carry out their mandates. NTDPC accordingly has provided a series of recommendations on how to strengthen capacity in the transport sector in all the sectors and at all levels of both government and executing agencies.

Third, India will have to reconsider the division of authority between levels of government. Transport governance in India is far more centralised than international practice, in part because of constitutional divisions of authority between levels of government; because of the power that fiscal centralisation awards to the Union government; and because of the allocation of and adaptation to scarce technical capacity that is currently available. The changes that NTDPC has recommended are to re-align transport governance with the principles of subsidiarity in federal design.

What are we then proposing for the institutional development in the transport sector?

The increased participation of the private sector in the provision of both transport infrastructure facilities and services accentuates the role of regulation through appropriate institutions and frameworks.

First, *NTDPC proposes the immediate formation of a high level Office of Transport Strategy (OTS)*. The OTS must have the resources to build a strong technical team, aggregate, manage and analyse transport data, and be able to assert itself as a compelling advocate of policies that leverage transport for development goals. The proposed OTS should be set up as an independent agency associated with the Planning Commission (possibly along the lines of the Independent Evaluation Office set up recently). The OTS mandate would be to build on the work of the NTDPC by providing ongoing technical support for sectoral investment programmes as they are accepted, evaluating alternatives for institutional reforms, setting up new entities as proposals are accepted, and updating the Committee's analysis in coming years. Strategic transport planning is not a one-time exercise, particularly in times of economic and political uncertainty. As a technical agency, it would effectively complete the triad of capabilities required for transport strategy: generation of sound policy options (OTS), review of consistency with social goals (government), and implementation (existing ministries and later the departments of the proposed Ministry of Transport). It would leave existing agencies to pursue their current mandates, but within a clearer strategic framework. An institutional structure will have to be developed so that the proposed OTS does not work in isolation, but has organic and continuous links with the implementing ministries/departments and the Planning Commission. It must also be given adequate powers so that its recommendations are implemented.

The OTS should be visibly technocratic. Its policy advisory functions should be backed by significant in-house expertise as well as research generated by centres of excellence and other transport research institutions recommended by the NTDPC (Chapter 11, Volume II). In order to emphasise the kind of agency that is being envisaged, it may be noted that a comparable institution, the Directorate General for Mobility and Transport in the European Commission has more than 2,000 professional staff; the unified US Department of Transportation has as many as 60,000 professional staff. We are clearly not proposing an agency of such size: this is only to make the point that an effective OTS for a country of the size, diversity and complexity of India requires very substantive technical capacity for transport oversight and generation of transport strategy on a continuous basis.

NTDPC also recommends that, given the federal nature of the country, it would be necessary also to set up state level Offices of Transport Strategy which have functions similar to the central OTS, and which would then have an on-going relationship with the central OTS. Furthermore, the recommended Metropolitan Urban Transport Authorities (MUTA) should also perform OTS type functions at the city level.

NTDPC recommends that consideration be given immediately to the actions that will be required to set up the national OTS within the 12th Plan period.

Second, after considerable discussion, NTDPC suggests the formation of a unified Ministry of Transport encompassing all transport sectors, as is the practice in all other large countries. We understand that this will not be easy, but it must be done in the medium to longer term. The current collection of ministries would then be subsumed within this unified Transport Ministry. The new unified Ministry of Transport must be carefully structured to create and maintain an incentive structure that encourages technical excellence, open-minded consideration of all available options, and consistent attention to transport system goals rather than particular means. The existing ministries should become departments focused on delivering effective transport infrastructure and services for each mode. Every country in the world and all of India's perceived peers, including China, have moved in this direction. Whereas it has often been observed that the Railways Ministry has been kept separate from the unified Transport Ministry, it is observed in recent times that the integration of railways into the larger Transport Ministry also takes place at a subsequent stage. That is usually coincident with the separation of railways operations into a corporatised entity somewhat removed from general government. Similar unification of transport functions can also take place at the state level.

REGULATION

The key new governance issue that has arisen in the last decade or two in the infrastructure sector as a whole, and correspondingly in transportation, is the increased participation of the private sector in the provision of both transport infrastructure facilities and services. This development accentuates the role of effective regulation through appropriate regulatory institutions and frameworks (Chapter 6, Volume II). Transport infrastructure facilities such as rights of way, railway track, airports, ports and roads involve heavy upfront investment and display significant economies of scale, and hence display monopolistic tendencies. Service provision (conveyance of passengers and freight in every mode) varies from being monopolistic, such as in the railways, to almost fully competitive such as in trucking and many inter-city bus services.

Transport services have long been the domain of the public sector in view of the public good characteristics of many segments of these services. Some services may be seen as 'open access services' such as most inter-city and urban roads, apart from limited access highways: it is difficult, if not impossible, to exclude people from such infrastructure facilities or to charge for using them, and nor is it desirable. They thus have public good characteristics. In effect, tax revenues collected from the citizens effectively entitle people to expect the provision of a minimum level of transport infrastructure on a free and open access basis. It is, however, possible to exclude people from most other transport services and hence to charge them for their usage in trains, buses, trucks, airlines and shipping for both passengers and freight. With technological change, it is possible to charge them without exclusion, even for open access services, for example, through fuel cesses or electronic charging. Thus, many parts of transport infrastructure and services are now often classified as private goods that can be made subject to user charges that are based on economic costs. Levy of the fuel cess on diesel and petrol is one example of almost perfect user charge for the use of roads and infrastructure even when there is open access: the consumption of fuel by a vehicle is directly proportional to its weight and the distance travelled by it.

Nonetheless, the transport sector is replete with examples of limited competition, market failure and monopolistic elements that then require economic regulation: most cities have just one airport; the number of ports in any region is limited; it is difficult to construct a limited access highway between two nodes; and it is unusual to have more than one railway track between two cities. Thus, whereas there could be adequate competition between service providers, if permitted, such as buses, trains, airlines and shipping, it is unlikely that there can be competition between transport infrastructure facilities. Furthermore, while it is possible to charge and even exclude people from various transport services, there is also need to ensure universal access to transport. Charging for every transport service should not mean that the poor are excluded from the transport service that they need.

NTDPC believes that there is demonstrable need for regulation of various parts of the transport network: to limit potential monopolistic power exercised by owners of networks through regulated pricing; to manage congestion and air pollution and also to enforce safety regulations. In brief, regulation is needed both to manage the consequences of negative externalities and also to achieve positive externalities through enhanced safety and inducing network effects. One of the main goals of regulation is to induce firms to produce the service at the lowest possible costs, to align prices with costs so that affordable accessibili-

Regulation is needed both to manage the consequences of negative externalities and also achieve positive externalities inducing network effects. A key goal is to induce firms to produce the service at the lowest possible costs, to ensure affordability of access.

ty is ensured to the users of transport services, while monopolistic providers are restrained from making supernormal profits. This has become much more important with the growing use of public-private partnership (PPP) contracts in transport and introduction of the private sector transport in general. New problems have also arisen in the enforcement of PPP contracts, since such contracts are of typically very long duration and economic conditions may well change over the period of the contract. It is also necessary to ensure that there is adequate competition in the bidding for such contracts since once the contract is awarded, the concessionaire effectively becomes a monopoly provider. All of these new developments in transport necessitate enhanced quality of governance and regulation.

Designing good regulatory institutions is complex since it is important to ensure that there is adequate technical expertise in the exercise of regulation that is seen to be both competent and fair. Furthermore, attributes such as independence, transparency, accountability, legitimacy and credibility are also essential as we establish these regulatory institutions. Besides, safety and social regulations to reduce health and environmental impacts are also necessary to be integrated in the overall regulatory approach. Since private investors are confronted with considerable uncertainty and risk in making investments in transport facilities, which provide them returns over the long term, it is essential that regulatory frameworks provide them with stable conditions and a predictable environment that enables them to make credible commitments. Independence implies shielding regulatory agencies from political pressure to the extent possible. Whereas it is appropriate for a government to issue broad policy guidelines and directives, the regulatory agency should be given functional autonomy in its day-to-day activities. The credibility of the regulator also implies that it needs to follow a transparent consultative process in decision making which is seen as fair and representative of the different, often competing, interests in the relevant sector. It is also useful to provide financial autonomy to the regulator to ensure its independence. So far, the government has not seen it fit to provide financial autonomy to most of the regulatory institutions that have been set up. They are generally supported by budgetary allocations through their respective administrative ministries, which can have adverse consequences for the exercise of functional autonomy. It will be desir-

able to find appropriate procedures that can indeed enable regulators in the transport sector to be financially autonomous.

The current proposal in the aviation sector to replace the Directorate-General of Civil Aviation with a Civil Aviation Authority (along the lines of the UK CAA) responsible for the operational regulation of airlines, with separate specialist divisions (covering air-worthiness, licensing, air-space management, etc.) is a step in this direction as it separates the regulatory function into an autonomous body, leaving the Ministry of Civil Aviation to focus on policy and establishing a more conducive environment,

where the Government progressively withdraws from operations and encourages the states and the private sector to play a more active role in the development of the sector (Chapter 3, Volume III).

As regulators have spread across infrastructure sectors, some questions have arisen regarding the overall institutional design for regulation: should regulation and dispute resolution institutions

be created for each sector and sub-sector, or should certain functions be consolidated across sectors? The alternative to sector-specific regulation is the single umbrella transport regulator with specialised departments. After considerable discussion and thought, NTDPC has opted to continue with the current approach of setting up separate regulators for each sector. The argument is essentially that in the current stage of development, it is necessary for the regulator to develop sector-specific technical, economic and legal expertise in an environment which is still developing and changing rapidly. However, as we move towards a unified Transport Ministry as NTDPC has proposed, it may also become feasible at a later stage to combine the various sector-specific transport regulators into an overall unified transport regulator as well.

As the transport sector develops and exhibits greater competition in different sectors, through both greater private participation and technology changes, the role of the transport regulator in price regulation often reduces. This has been observed in the telecom sector where the Telecom Regulatory Authority of India (TRAI) initially focused on tariff regulation, but increasing competition made pricing relatively free. Similar developments could take place in the operations of the Tariff Authority for Major Ports (TAMP) as there is increasing competition between port terminals. Thus, as transport development

takes place, the burden on sector-specific transport regulators could indeed reduce thereby making the possibility of a unified transport regulator more realistic.

As in other aspects of governance, NTDPC emphasises the need for adequate development of technical competence in all the regulatory institutions so that their decision making processes and outcomes are protected from undesirable politicisation. The experience so far has been mixed. It is important that the leadership of regulatory institutions be seen as knowledgeable and competent so that their decisions are respected and hence implemented. There has been a tendency to staff the leadership of these organisations with superannuating civil servants who may not necessarily possess adequate domain knowledge: this must be corrected.

FISCAL ISSUES

The key issue in transport governance that has not been analysed adequately, and which is linked to both government and its regulatory institutions, is the impact of the many fiscal levies on both the supply of and demand for transport services. *We have documented the very wide proliferation and complexity of fiscal levies affecting transport both at the central and state levels* (Chapter 9, Volume II). The distinction between some tax levies (such as fuel cess) and user charges is often not clear cut. Given this complexity, it is difficult to analyse the differential fiscal incidence on different modes.

We have, for example, argued for the use of tax levies and charges (e.g., for parking) for urban transport demand management to discourage the use of personalised motorised transport usage in large cities, while also using this mechanism for funding urban transport investment (Chapter 5, Volume III). As argued in that chapter, the levy of such charges would need the cooperation of central/state and metropolitan authorities, including the proposed MUTAs. NTDPC has therefore proposed that *the multiplicity of state level taxes be simplified and rationalised through a mechanism akin to that used for transforming the complex state-level sales taxes to the simplified state VAT system, which is now moving towards a comprehensive Goods and Services Tax (GST)*.

As this is done, among the tasks that the proposed OTS can do is to keep track of the various taxes and user charges levied and collected by different levels of government, and other user charges regulated by the various regulators. In principle, the combined public and private revenue collected from both providers and users of transport services should collectively finance the provision of these services in the system. Thus, there is a close link between the fiscal system as it affects transport services and the user

The multiplicity of state level transport-related taxes needs to be simplified and rationalised through a mechanism akin to that used to transform the complex state-level sales taxes to the state VAT system.

charge regime, including cesses, as it affects investment in transport infrastructure facilities, the service providers and the ultimate users of the services.

NTDPC therefore views the governance system, the regulatory system and the fiscal framework as components of the overall transport system. Successful operation of this system requires the combined efforts of all the stakeholders to be participants through organised methodologies of mutual consultation.

SAFETY

The existing rates of fatalities and the rate of increase in accidents in transportation in India are both unacceptably high. More than 150,000 people died in transportation-related accidents in 2011 in India or more than 450 a day, the vast majority of them in road accidents. It is estimated that, in addition to the deaths, at least 1,500 persons were probably disabled, 7,000 hospitalised and more than 40,000 sustained minor injuries every day in traffic-related accidents. The cost of road traffic crashes alone may be about 3 per cent of the GDP. With continuing growth in traffic in all modes, particularly on roads, and with increasing speeds, the graph of traffic accidents is inching up inexorably. The situation is therefore quite serious and unless policies and evidence-based counter measures are put in place urgently, the situation is likely to worsen (Chapter 12, Volume II).

There is little expertise, data or information available in India to address the transport safety problem in a scientific manner. The international professional consensus is that it is not very productive to focus on human error alone. Since each accident is a result of a combination of human, vehicular and environmental factors, a sophisticated systems approach is a must in addressing transport safety issues. This approach has not been internalised yet by any official organisation or institution dealing with safety in India. The predominant approach is still based on principles of finding fault with the individuals concerned and then acting accordingly.

Business as usual with regard to safety in transport cannot be tolerated any longer. It is imperative that we give much more importance to transportation safety in India, and this will only happen if the whole system is improved and strengthened on an urgent basis. Significant reduction in accident rates has been seen in all modes of transport in developed countries since the 1960s and 1970s. The reduction has not been due to any single factor, but due to a systemic approach resulting in a wide variety of improvements in designing the vehicles, operating environment infrastructure and enforcement of safety regulation and standards. Thus, it is indeed possible to arrest the continuing increase in accident rates in India, and then to reverse the current

There is little expertise, data or information available in India to address the transport safety problem in a scientific manner. A sophisticated systems approach is a must, and this has not been internalised at all.

trend. The entire traffic and transport system must be designed to account for the limitation in capabilities of users and operators. The requirements of a safe systems approach are:

- an institutional structure that creates a demand for scientific work in safety issues;
- legislation and regulation to promote safety;
- monitoring and measurement (generation of national databases);
- assuring and improving the quality of safety services provided through professionals, individual institutions and the use of specific technology and devices.

All countries that have been successful in reducing transport related injuries and deaths, have set up relatively large professional national safety agencies for each mode of transport. These agencies have different structures owing to different political and administrative systems in different countries, but are generally kept independent of the operating departments.

In the aviation sector, the best practice in this regard is exemplified by the fully autonomous Accident Investigation and Safety Boards in Australia and the UK, where this is an absolute separation from the regulatory agency, the Boards are staffed by acknowledged professional specialists and there is a statutory requirement to publish every report, so that preventive measures can be quickly fed back into the safety regulatory regime. The decision of the Ministry of Civil Aviation to set up such a body in India sets a worthwhile precedent for the other sectors to follow.

Demand for better knowledge and technologies in the transport sector can only be provided by public bodies: central and state governments, and local bodies like municipalities and transit authorities. It is the responsibility of the public sector to create long-term stable demand for safety work, with the understanding that progressive employment of trained professionals will be available on a continuous basis. If respectable professional jobs are available with promising and secure career paths in safety research and operations, talented professionals will gravitate to the field; this in turn will encourage educational training institutions to provide the necessary programmes.

Accordingly, NTDPC proposes that action should be initiated forthwith to establish National Safety Boards

Capacity building in transportation is an urgent necessity. One per cent of investment in each sector should be earmarked for institution and capacity building in transport, in both the public and private sectors.

for road, railways, water/marine and air. These boards must be independent of the respective operational agencies; they should be headed by professionals at the highest levels and these boards should have adequate funding. The recommendations contained in the Report of the Sundar Committee on Roads and the Kakodkar Committee on Railways provide excellent guidelines for formulating the terms of reference for these boards. Furthermore, safety departments need to be set up within operating agencies at different levels for ensuring day-to-day compliance with safety standards, study effectiveness of the existing policies and standards, conducting safety audits, collecting relevant data, etc. The national safety agencies in each of the transport departments should also help in establishing multi-disciplinary safety research centres in independent academic and research institutions, and ensure adequate funding to achieve critical size and adequate levels of expertise.

As institutional development takes place in the area of safety in transportation, we can expect that safety concerns will get embedded in the design of both transport infrastructure facilities like roads, railway track, airports, ports and the like, as well as in the design of all vehicles. It is only if such motivated action is taken on an urgent basis that there can be any chance of reversing the current high growth in transportation accidents resulting in fatalities and severe injuries. This would constitute an important departure for the planning process since this issue has so far not been addressed in an organised manner. The task will be difficult in India in view of the extremely high growth that is expected in all sectors of transport.

NTDPC attaches the highest importance to this matter since it concerns the life and death of many of our citizens on a daily basis.

RESEARCH AND HUMAN RESOURCE DEVELOPMENT

This Report is distinguished by its emphasis on institution building for managing India's burgeoning transportation requirements over the next couple of decades and beyond. Consequently, future transport planning, policy making, regulation, execution, implementation and maintenance of transport systems will require a greatly enhanced number of transport professionals, researchers and educators to run the system. The kind of agencies sug-

gested, the OTS at both the central and state levels, the MUTA at the city level, the various regulators, and the safety boards, will not be possible to set up unless there is an adequate supply of technocratic expertise at every level. At present, the country simply does not have even a fraction of the number of professionals required. Furthermore, the kind of capacity expansion proposed for each of the transport sectors—railways, roads, civil aviation, ports, urban transport and inland waterways—will also require very significant enhancement in the availability of high-quality engineers and associated personnel at all levels. In addition, the new concerns regarding energy and environmental sustainability will need to be integrated in our planning and execution activities, along with much greater concentration on safety issues.

India fares poorly in terms of knowledge output in the transport sector, in comparison with our peers such as China and Brazil. We do not have any institutes within government departments and operating agencies, university centres or stand alone institutions in any areas of transportation that compare favourably with such institutes in our peer countries. The few centres that exist are sub-critical in terms of resources expertise and size. We simply do not have appreciation of the size and sophistication of technical institutions that we need. This must change.

Thus, capacity building in transportation is a key necessity for urgent action so that we enhance the probability of successfully facing the emerging challenges in transport investment and operation over the next couple of decades. Capacity building comprises various challenges: building systems in research and development to update and upgrade capacity on a continuous basis; ensuring production of transport professionals in every sector; and consistent retraining and upgrading of existing personnel.

NTDPC has therefore recommended very significant institution building for transport research, development, education and training in all areas of transport activity (Chapter 11, Volume II). The effort necessary for setting up the structures of the institutions envisioned for the next two decades will be very substantial. The potential availability of adequate resources should not be an issue for this purpose. In comparison with the estimated magnitude of funds required for transport investment for the next 20 years, the resource needs for capacity building are relatively small. *NTDPC suggests that 1 per cent of investment in each sector be earmarked for institution building and capacity building in transport in both the public and private sectors. It is proposed that the Planning Commission may take up the various capacity building proposals made by NTDPC in mission mode and allocate enough resources for*

this activity on urgent basis, within the period of the 12th Plan.

Accordingly, we have proposed a range of institutions to be set up for research and human resource development in the transport sector, each of substantial size: a standalone Indian Institute of Transport Research (IITR) is proposed which could be supplemented with various regional centres; centres of excellence in selected universities and engineering institutions; research institutions in each transport sector; and corresponding institutions at the state level. In addition to the standalone IITR, NTDPC has also proposed establishment of substantive research organisations in each of the transport sectors, railways, roads, civil aviation, ports and urban transport.

Correspondingly, NTDPC also recommends the setting up of an Indian Institute for Transportation Statistics (IITS) which should be responsible for coordinating and generating, where necessary, all the data required for the kind of transport strategy and planning that has been recommended in this report. IITS would be responsible for acquiring, preserving, managing, disseminating transport data, conducting statistical analysis and associated information for use by central, state and city transportation departments. The various research institutions proposed by the NTDPC would also need statistical support from such an institution.

One way of bringing about consistent technical upgradation of roads across the country is through the development of technical standards related to the quality of road surface, signage, pavement (sidewalks), and all other aspects of road design. Each level of road within the designated road hierarchy would then be uniform across the country, both for inter city roads and for urban roads. NTDPC therefore recommends the setting up of a high-quality roads standards institute which can then help in bringing up Indian roads to international-level quality (Chapter 2, Volume III).

Adequate financial and technical resources must be provided so that each of the institutions is of critical size and has the potential to develop expertise over the next 10 years. These institutions will require qualified professionals to staff them. Thus, there is need for adequate expansion of education in all transport related scientific and engineering disciplines across the country.

If we start such institution building, it will take 10 years or more to achieve significant results. Meanwhile, we must initiate a comprehensive programme for upgrading the technical quality and competence of existing personnel at all levels in the country. This must be done through a focused and sustained programme that covers all operating departments, institutions, corporations at both the central and state

While we build the necessary institutions, we must initiate a comprehensive programme for upgrading technical quality and competence of existing personnel in the transport sector at all levels in the country.

levels. The aim should be to sponsor 2-5 per cent of the staff in all such organisations for full-time education to the Masters level every year for the next 5-10 years. The organisations to be covered should include all the transport-related engineering organisations in the central government, state governments, public- and private-sector companies, and at the city level. *Once again, NTDPC recommends that this programme be initiated at both national and state levels within the 12th Plan period.*

Many will criticise NTDPC for the range and size of institutions recommended in this Report as being too large, too idealistic and unrealistic. In fact, the number, size and type of institutions being recommended is based on international comparisons, focusing on large countries with comparable levels of development. International experience suggests that it takes more than a decade to build viable quality institutions. We have had demonstrated successes in the past in the building of high quality technical institutions such as Indian Institute of Science (IISc), the Indian Institutes of Technology (IITs), Indian Space Research Organisation (ISRO), the National Aeronautical Laboratory (NAL), the Bhabha Atomic Research Centre (BARC) and others. *The vision that the NTDPC has offered for capacity building in the transport sector is therefore feasible to be achieved once we make up our minds and decide that such action is necessary to build an efficient, competitive, affordable and sustainable transport sector that is essential for the country's development in the future.* Moreover, if India is to emerge as a global power over time, it needs to invest significantly in human resource institutes to develop much greater soft power than at present.

THE ENERGY AND TECHNOLOGY CHALLENGE

A common theme running through this NTDPC Report is the need for upgrading Indian transport facilities in all their aspects and for modernisation across the board. Much of rolling stock in the Indian Railways is obsolete including both passenger coaches and freight wagons. As the volume of freight increases, and inter-modal transfers become the norm rather than the exception, rolling stock of freight will have to undergo a very significant transformation towards specialised wagons for specialised needs. It will be necessary to enable fast loading from ships as well as from domestic sources; simi-

larly, container handling from ship to train and from train to truck will need to be made efficient at container freight stations. In the case of passenger rail coaches, as average speed increases with the transfer of freight trains to DFCs, the quality of passenger coaches will also need to be upgraded to increase passenger comfort. From the environmental point of view, the open toilet provision in Indian passenger trains is a disaster and a major health hazard⁸. Thus, a significant need is also for modernisation of toilets and other facilities on Indian trains. Existing open toilets also result in corrosion of coaches and tracks as well as resultant high costs in ensuring hygiene and cleanliness.

In urban transport, there is a great need for better technology for traffic management, for transport demand management, for encouraging public transport and non-motorised transport. Similarly, the improvement in the quality of buses for both energy efficiency and passenger comfort is necessary to wean away passengers from individual owned transport vehicles to public transport.

From the point of view of economy in energy usage, there is a clear and demonstrated need to reverse the increasing mode share of road transport in the country for both passengers and freight.

In the case of roads, there is very little standardisation in the quality of roads, road signs and other road furniture across the country. Each of these requires the development of technical standards and their enforcement (Chapter 2, Volume III). NTDPC has accordingly emphasised the development of technology institutions across the board and training to address these and other problems

related to the modernisation of transport in India.

This also includes the increasing use of information and communication technology (ICT) to integrate the different transport systems to reduce energy use and to improve customer satisfaction. Most of the technologies that can be used in all these areas are available off-the-shelf in the world. India is therefore in the fortunate situation that it can indeed pick and choose the technologies that are suitable for usage in India, given its income levels, climate and other economic conditions (Volume II, Chapter 10). The challenge facing us is to make intelligent choices which are commensurate with our needs, income levels and availability of resources at different times. Our challenges also are complicated by the expectation of consistently high growth which results in constantly changing income

levels, demand patterns and increasing availability of resources.

We have documented that with the projected overall economic growth in the country over the next 20 years, it is quite likely that much higher magnitudes of resources will be available for investment in transport from around the early 2020s and beyond. Thus, some technologies that may not be appropriate to adopt today might indeed become feasible from the resource point of view 10 or more years from now.

The world is awash with new ideas in transportation such as driverless cars, electric cars, high-speed trains, monorails, information technology-based charging systems, increasingly sophisticated emissions control systems, and the like. What is important is that we develop mechanisms to make technology choices in an economic manner that is consistent with our current economic conditions and which are adapted to the fast growing changes that we expect in the economy in the coming years. At the same time, where economically feasible, we should not be afraid to also leapfrog technologies so that we use the best in class available globally. To do all this, we need professional competence and an institutional framework that is capable of making such choices on a continuous basis. Hence, in this area also, NTDPC, while providing some focused recommendations that can be adopted readily, has once again emphasised the development of institutions in the area of information and other technologies also. Modernisation needs to be done across the board and in a manner that it serves the needs of all travellers on an inclusive basis.

Energy usage in transportation has been growing at rates corresponding to the growth in transportation itself. With the expectation of continuing high economic growth, along with that in transportation, we can expect similar growth in the use of energy in the business as usual framework. The uncertainties in energy supply, particularly petroleum products in the coming years and decades poses particular challenges for India since much of its petroleum is imported. The increasing share of road transport in both passenger and freight has further accentuated the increasing dependence of India on petroleum and petroleum products. Furthermore, concerns connected with climate change have brought additional focus to these problems as the economy grows and demand for energy increases, including that used in transport. As cities grow, and the number of large cities increases, the pollution concerns relating to emissions from vehicles also assume greater importance in relation to the serious adverse effects on health that is now clearly documented. Attacking these problems needs to be done on an integrated basis using all the various means available.

8. The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 has been passed by the Parliament and came into force on 6 December 2013. The Act prohibits manual scavenging and envisages provision of new cleaning devices and protective gears for existing water flush toilets in railway coaches.

First, there is a clear demonstrated need from the point of view of economy in energy usage and associated positive results on climate change, to arrest and then reverse the increasing mode share of road transport in the country for both passengers and freight. The movement of bulk and over-dimensioned cargo should be considered for transportation through inland waterways and coastal shipping wherever possible. The advantages of this mode in terms of lower emissions and fuel consumption, even when compared with railways, should be fully harnessed. Similarly, within cities, while there will be an inexorable increase in ownership of private motorised vehicles, everything needs to be done to encourage the use of public transport and the use of facilities for non-motorised transport like walking and cycling. Nearly 98 per cent of energy needs of transportation are met through petroleum products, and almost half of the total consumption of petroleum products in India is on account of transport activities. Second, observing the improvement in air quality in many of the cities in developed countries, it is clear that technologies are available for reducing emissions made by motorised transport of every description. Tightening, and more importantly, enforcing vehicle emissions standards will drive further innovation in emissions control and even development of new industries, as it has in other settings around the world. Third, new technologies are also becoming available including information and communication technology for facilitating more efficient use of energy through greater integration of transport modes and logistics efficiency in freight transport. NTDPC has examined these issues in some detail and made appropriate recommendations across the Report. (Chapters 4, 7, 10, Volume II and Chapter 5, Volume III).

With the increase in personal motorised vehicles, and also the expansion of public transport vehicles, the air quality in most cities from middle sized cities to the larger cities has been deteriorating over time in India. One estimate suggests that around 150,000 people died in India in 2005 as a result of ambient fine particulate matter. This number has most likely increased since. In 2002, the WHO calculated a respiratory disease mortality rate of 58 persons per 100,000 in India. This rate is now likely to be much in excess of 100 persons per 100,000. A substantial portion of CO₂ emissions in India are released by the transport sector. In a business as usual scenario, overall transport CO₂ emissions could increase four fold over the next 20 years. Because of the prevailing low income levels, many people walk or use bicycles for their daily travel needs in Indian cities. It is essential that facilities are put in place, through regulations and standards, to make these modes pleasant for all, including the physically challenged, so that these modal shares are, at a minimum, retained over time. This will do much to contain the continuing increase in vehicular pollution. Thus, India requires a com-

We recommend that an auto fuel policy committee should be formed every five years on a regular basis so that we may ensure the air quality for our citizens on a much more firm basis in the years to come.

bination of measures for urban planning, transport infrastructure development and stringent enforcement of emissions control to reduce fuel consumption and emissions.

We can observe that there has been considerable improvement in urban air quality in advanced countries such as the United States, Europe, Japan and South Korea over the last couple of decades. The days of consistent smog in large cities such as London, New York, Tokyo and others are gone. It is seldom that air quality in these cities now falls to levels that were seen on a regular basis in the 1950s and 1960s. It is therefore clear that it is possible to use technology to improve air quality even in the presence of rising vehicle ownership and use. The latest emission control technologies that are already available will have to be taken advantage of to leapfrog to tighter emission standards and reduce fuel consumption.

Vehicle emission standards have been tightened successively in India since the 1980s, both through new legislation and progressively through regulations concerned with vehicular emission. Similarly, fuel quality standards have also been tightened over time, but they remain well behind international best practices. Whereas the maximum sulphur content of 10 ppm in gasoline has already been mandated in Europe and Japan more than five years ago, the standard in India remains at 150 ppm countrywide and 50 ppm in selected cities. The diesel sulphur content remains higher than the gasoline sulphur content in most of the country and well behind international best practices.

The technology for improving fuel quality across the board is readily available and so is that for improving emission standards in vehicles. There is of a course a cost associated with enforcing such standards. Thus, compliance with such standards will take time and adequate resources should be made available for the purpose. *The NTDPC has provided its recommendations for reaching European fuel quality standards and emission standards by 2020* (Chapter 7, Volume II). At present, auto fuel policy committees are formed on a sporadic basis involving considerable delays in mandating newer standards.

NTDPC recommends that an auto fuel policy committee should be formed every five years on a regular basis so that we may ensure the air quality for our citizens on a much more firm basis in the years to come. The responsibility for fuel quality and emission stand-

ards is currently spread across different Ministries such as the Ministry of Petroleum and Natural Gas, the Ministry of Heavy Industries, the Ministry of Urban Development, the Ministry of Road Transport and Highways and state governments. Whereas the relevant responsibilities will remain dependent on the Allocation of Business Rules across Ministries, *NTDPC recommends the formation of the National Automobile Pollution and Fuel Authority (NAPFA) to assume responsibility on institutional basis for setting and enforcing vehicle emission and fuel quality standards in India.* This is a reiteration of the recommendation made in 2003 by the Mashelkar Auto Fuel Policy Committee.

Through the use of Big Data, computing and analytics that match supply and demand for various services, information technology can help in more efficient energy usage, enhancing sustainability.

What is also necessary is a National In-use Vehicle Testing programme to be established to ensure safety, road worthiness and emission performance of end use vehicles, covering all motor vehicle categories. A model Inspection and Certification (I&C) regime needs to be established in a phased manner through the establishment of a dense network of modern I&C centres,

along with corresponding investments in the police force and Regional Transport Offices. This will require allocation of appropriate resources through state governments. Given the environmental challenge, these initiatives need to be taken up on an urgent basis in the interest of ensuring better health for all our citizens.

To examine the differential environmental costs related to different modes, we also commissioned a special study on the Life Cycle Analysis of transport modes. In general, environmental impact assessment exercises carried out to support decision making in the transport sector do not consider the full life cycle energy and CO₂ impact of transport modes but instead focus on the tail pipe impact only. It is however necessary that a more integrated approach is adopted while analysing impact. This is because different transport modes involve varying degrees of construction and maintenance activities. While some modes may be highly material- and energy-intensive, others may be comparatively less energy-intensive. Material and energy consumption at various stages of a transport project, i.e., construction, operation and maintenance, need to be examined in order to fully understand their impact on environment. Such an approach would help identify the stages of a transport system that has maximum impact and would also therefore enable identification of appropriate mitigation strategies. It is found for example that metro rail projects for urban areas

have the highest environmental costs of all alternatives at the construction stage, but such high capacity public transportation systems do exhibit the least observed carbon emissions because they generate no emission at the tail pipe. A life cycle analysis evaluation however indicates that a metro system generates more CO₂ on a life cycle basis, compared to say, a bus traffic transport system which can also be high capacity. Introducing life cycle impact situations can therefore bring more detailed understanding of the overall impact of system or proposed infrastructure project and therefore help decision makers to make informed choices based on the economic, social and environmental goals set by the national, state or city governments (Chapter 7, Volume II). The establishment of the OTS proposed by the NTDPC and other transport research organisations can be expected to develop such analytical methodologies for making the choices that the country will be confronted with on a continuous basis in the years to come.

INFORMATION AND COMMUNICATION TECHNOLOGY

The increasing use of information and communication technology (ICT) in transportation systems has been transforming the organisation and management of transportation services and the quality of the interface between users and providers. The use of ICT can help in integrating different transport systems with other systems resulting in reduced energy use and increased customer satisfaction. Through the use of Big Data, computing and analytics that match supply of and demand for various services, utilities, ICT can help in more efficient use of energy, thus enhancing the sustainability of transport and other infrastructure (Chapter 10, Volume II). The increasing use of logistics systems in freight transportation has been almost entirely due to the availability of ICT over the last 20 years or so. The seamless transfer of both passengers and goods across modes can be made possible through the use of ICT. The introduction of smart cards, for example, can allow for paying for the usage of different modes by consumers in an integrated fashion without having to buy tickets from different transport service providers. Similarly, from the supply side, such systems integration can take place across service providers so that consumers are better able to plan journeys across different modes and different providers in a seamless fashion. This can be particularly useful in urban transport systems where it is not unusual for people to use buses, trams, taxis or trains for the same journey on a daily basis. Similarly, ICT can also enable more efficient and connected scheduling between different modes so that consumers do not have to wait while using different modes in the same journey.

Issuance of e-tickets by airlines has greatly facilitated the planning of journeys by travellers across the

world through the use of laptops or other Information Technology (IT) devices from the convenience of homes. A whole industry of travel websites has arisen wherein one can book airlines, car rentals, hotel and the use of other services on a very convenient basis. Within India, e-ticketing by the Indian Railways has transformed the rail booking procedure from having to wait in long lines for physical booking at railway stations to the convenience of making reservations from within one's home. State road transport organisations and private bus companies have also begun to issue e-tickets. What has not happened is the possibility of integrating these different ticket issuing agencies through a single website or the integration of multi-modal journeys through the issuance of a single ticket.

On the freight side, global logistic providers such as Fedex, UPS, DHL have transformed the freight business beyond recognition over the last two decades. Through the extensive use of ICT, they have greatly simplified the procedure that needs to be complied with by the despatcher of goods and that by the receiver, both within and across countries. Such logistics providers undertake to find the most efficient transportation route within or across modes and within or across countries, including customs procedures, etc. Prior to such integration the freight industry was characterised by high degrees of fragmentation that involved a number of intermediaries such as transportation companies themselves, freight forwarders, customs clearing agents, and others, each of which had to be arranged by the despatcher on the one hand and the receiver on the other. The consolidation provided now by logistics companies could not have taken place without the increasing use of ICT.

With the expected expansion of trade that has been projected within our macroeconomic modelling framework, cargo traffic can be expected to increase at both Indian ports and airports. Many of our ports are already stretched to capacity with capacity utilisation already close to 100 per cent or higher. Low productivity, congestion and delays are often the norm at some of our ports. Whereas there is no doubt that it is essential to undertake investment in capacity expansion as proposed by NTDPC, greater use of ICT can certainly help productivity and efficiency at ports. Trade facilitation through ICT can be greatly enhanced to reduce transaction costs involved in the movement of goods through our ports and airports and made more efficient in terms of the time taken for customs processes and otherwise.

In the road sector, with the increasing use of tolled highways, many delays are being experienced by both passengers and freight transport, who have to negotiate their way through different toll gates across the country. Once again, as recommended by the Nandan Nilekani report¹⁰, the use of ICT can

Smart cards and electronic toll collection can make sure that both passengers and freight can move seamlessly across India through different jurisdictions and different toll roads without high-cost delays at toll gates.

facilitate the use of smart cards and electronic toll collection so that passengers and freight can move seamlessly across the country through different jurisdictions and different toll roads without high-cost delays at toll gates.

In urban transport, apart from the use of cross-modal smart cards, ICT has already been used in different cities such as Singapore and London, among others, to introduce congestion pricing, to reduce the number of cars in the city and to encourage the people to use public transportation. The NTDPC approach to urban transport exhibits a similar orientation. The NTDPC, through its Report, emphasises greater coordination between modes for both passengers and freight transport; the increased use of ICT can indeed facilitate this.

This merely provides some examples for the use of ICT in transportation in the future. Many of these technologies are available elsewhere and some of which are already in use in India and others are in the process of being introduced in different places. Here also, what is needed is considerable capacity building of both professionals and institutions. *We have identified different initiatives in each of the sectoral chapters and also in Chapter 10, Volume II (on Potential of Information and Communication Technology to Enhance Transport Efficiency) which are designed to enhance efficiency, utilisation and safety of the transport systems.*

All such initiatives will require a strong institutional foundation for development and implementation. The key functional areas of focus include setting standards for technology in transportation and of processes which facilitate implementation of these technologies; the initiation of training and research and development so that available technologies can be adapted and standardised for use in India; provision of policy advice for government and providers of transport services; and the provision of consulting in project management services for implementation of ICT in different areas. As the prospect of use of information technology in banking began to manifest itself in India in the mid to late 1990s, the RBI set up the Institute for Development and Research in Banking Technology (IDRBT) in Hyderabad for the purpose of research and development as well as consultancy in the application of technology to the banking and financial sector of the country. The IDRBT has been instrumental in setting the relevant IT and communication standards and

10. Nilekani (2011).

protocols in banking and across the financial sector in India, which enables those financial institutions to communicate with each other. IDRBT also does research and runs academic programmes for Masters and Doctorate degrees. *In an analogous fashion, NTDPCC recommends the establishment of the Indian Institute of Information Technology in Transportation (IIITT).* Its function would be similar to RITA (Research in Technology Administration) which coordinates the US Department of Transportation Research programmes. The IIITT would develop the overall ICT framework in the Indian transport sector and coordinate with other proposed central-level and state-level institutions as necessary. It would also collaborate with international institutions to develop new technologies, adapt available technologies for deployment in India and facilitate research, development and training for ICT for transport professionals. The successful application of ICT in each of the different segments of transportation will need adequate institutional development at all levels, details of which have been outlined in the relevant chapters in this Report.

We need very significant and integrated planning of key transport corridors and execution on a timely basis so that the potential and prospects of Indian economic growth are not jeopardised.

TRANSPORTATION OF ENERGY COMMODITIES

Considerable stress has been laid in this Report on the growth in use of energy in transport over the coming years and its impact on the environment and on climate change. The NTDPCC has also focused specifically on the impact of overall energy growth and its production on the transport

system in the future (Chapter 8, Volume II). As is well known, the growth in demand for energy is essentially similar to that of overall economic growth. Thus, if the Indian economy grows by a factor of 4 over the next 20 years, the required production of energy will also have to increase by a similar proportion, in order to meet the increasing demand. Similarly, growth in the production of key commodities like steel will also be comparable or higher. Such growth will imply corresponding growth in the transportation of bulk commodities such as coal, iron ore and steel.

Coal already accounts for almost half the freight volume in Indian Railways and some of the current problems afflicting the power industry include the lack of adequate capacity in crucial links and corridors for the supply of coal to power stations consistent with the increase in power generation. The future poses profound challenges. Given the composition of energy resources in the country, coal is expected to remain the dominant fuel for the power

sector, despite the various apprehensions that are being expressed globally on the environmental impact of coal use in energy projects. According to NTDPCC projections, the production of domestic coal is expected to increase by about 2.5 times over the next two decades. At the same time, it is expected that imports will have to grow much faster by around five times over the same period. The intensity of steel use in the economy is expected to possibly go up by a factor of 8 resulting in a corresponding growth in the transport of raw materials, particularly iron ore for the production of steel. Similarly, the usage of Petroleum, Oils and Lubricants (POL) and natural gas will also grow by large volumes much of which will continue to be imported, but these, of course, will be carried out through pipelines and would not be expected to have a significant impact on over-the-ground transport infrastructure.

These very large increases in the transport requirement of bulk commodities poses a great challenge because our transport system is barely able to cope with the traffic today: the trunk railway network is heavily congested; almost all the major rail routes over which coal and iron ore will be transported are operating at over 100 per cent capacity. The capacity utilisation of ports also averages over 85 per cent with some even over 100 per cent. International norms recommend capacity utilisation in ports below 70 per cent to avoid delays.

In recognition of these challenges facing the Indian economy and its transport system in particular, NTDPCC emphasises the need for very significant and integrated planning of key transport corridors over the next 20 years and execution on a timely basis so that the potential and prospects of Indian economic growth are not jeopardised. The approach taken by NTDPCC suggests the addition of appropriate port capacity for enabling integration for better investment in associated transport links along with similar coordination of links with the domestic sources of coal.

NTDPCC conducted an elaborate technical exercise to make detailed projections of the optimal transport network that would enable efficient transport of domestic and imported coal to the expected location of power plants. As may be appreciated, many different solutions are possible for such an exercise. It is therefore necessary to build up institutional capacity that can enable adequate planning for these very segments of Indian transport systems, particularly railways, over the next 20 years. Once again, NTDPCC recommends that the proposed OTS should be adequately equipped to carry out such exercise.

The result of our own work suggests that the key requirement is to concentrate investment in the railways for the transport of bulk commodities first on the feeder routes from the coal and iron ore mines located mostly in the tri-state area of Chhattisgarh,

Odisha and Jharkhand for connecting them with the trunk routes. Second, among the DFCs, the highest priority may be given to the completion of the Eastern Freight Corridor. Third, adequate attention to be given to promoting coastal shipping from the coal producing areas on the eastern coast to avoid long over-the-land transportation of coal. Fourth, consistent with the NTDPCC recommendation in the ports sector for the establishment of 4-6 mega ports, the increased imports of both petroleum and coal would suggest that the selection of sites for these mega ports should be significantly influenced by the transportation needs of these commodities. This is because mega ports provide very significant economies of scale which can dramatically reduce turnaround time. The need for mega ports is dictated by the fact that at present India is not able to receive large tankers and other cargo and container ships because of inadequate depth available even in its largest ports. The dredging and other engineering works required for creating the depth necessary is very resource intensive. Hence the need for investing in only select locations for mega ports.

As indicated, the planning for the transport of energy commodities which is essential for ensuring the projected high economic growth for the country requires considerable technical analysis and expertise. Furthermore, investment decisions will typically involve difficult choices involving trade-offs between different alternatives. The current system of decision making in different transport sectors such as railways, roads, ports, pipelines, coastal shipping on a segmented basis will not be adequate for the needs of the coming decades.

There has been an enormous increase in the movement of goods produced and distributed in the country. This has led to a growing need for transporting ever-increasing quantities and volumes. This explosion in scale has brought to the fore the critical importance of developing modern terminals—mineral depots, freight centres, dry ports, inland container depots, logistics parks, freight villages, industrial sidings, etc. Indeed, in many ways, the capacity on the transport columns is determined by the efficiency of these terminals.

The transport requirements of bulk commodities poses a great challenge. All major coal and iron ore train routes are operating at over 100 per cent capacity. Capacity utilisation of ports averages over 85 per cent.

SUMMARY

This Report has emphasised the need for modernisation and expansion of all segments of the transport system and the building of capacity in all its aspects to accomplish this: institutions at national, state and local levels, each embedded with adequate technocratic capacity in both quality and quantity; the setting up or operation of existing regulatory authorities with adequate technical competence to mediate between the needs of producers and consumers, to promote competition and to regulate any consequences of monopoly power; setting up or strengthening research and development institutions on transport across the country; providing for education and nurturing of scientific talent for transport; rationalisation of fiscal regimes to remove distortions while raising revenue; and embedding safety concerns in all transport planning and its execution.

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