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Integrated Policy Strategies and Regional Policy Coordination for Resilient, Green and Transformative Development: Supporting Selected Asian BRI Partner Countries to Achieve 2030 Sustainable Development Agenda

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Transforming Transport in Pakistan: Pathways to Decarbonization

Abstract

The transport sector is a fundamental pillar of any economy, facilitating mobility and significantly influencing a country's energy consumption, investment patterns, and emissions profile. In Pakistan, the transport sector is predominantly road-based, with road networks and vehicles experiencing substantial growth over the past decade. However, the trucking fleet largely relies on outdated technology, while the share of railway freight has dwindled over time. Notably, emissions from the transport sector account for approximately 10% of the country's total emissions.

Decarbonizing the transport sector is essential for advancing broader sustainable development goals. Achieving this, however, necessitates a fundamental shift towards the globally recognized Avoid-Shift-Improve (ASI) framework. This approach involves: (1) avoiding high-emission transport options, such as private vehicle use; (2) shifting towards more sustainable alternatives, including public transportation and electric vehicles; and (3) improving overall efficiency through measures such as adopting cleaner fuels, enhancing charging infrastructure, and modernizing the trucking fleet.

Contents

KEYWORDS: Green Transition, Decarbonization of Transport Sector, Transport Policy, Inclusive Transport Systems, Transport Emissions, Urbanization and Mobility, Multimodal Freight Transport, Sustainable Mobility, Fuel Efficiency, Climate Change and Transport

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Introduction

Transportation is a ubiquitous and intricate phenomenon. Ever since the invention of the wheel, innovation and technological improvements in transport have revolutionized the way our world works: how humans travel, how goods move seamlessly, and the impact these movements have on the environment and our lifestyles. The extent of economic activity and hence industrialization depends on the movement of factors of production and thus has similar environmental impact as the underlying transport system driving them.

It is intriguing and worth mentioning that in the broader scheme of sustainable development and the 2030 Agenda for people, planet, and prosperity, there is no specific goal related to the transportation emissions. A close review of the stated Sustainable Development Goals (SDGs) indicates that this is because of the deep linkages of transportation to other goals and the overarching nature of the sector. For instance: SDG 3 has a target related to road safety; SDG 7 is concerned with clean energy provision (thus involving the economics and operations of the transportation sector); SDG 9 focuses on resilient infrastructure; SDG 11 aims at the provision of safe, affordable, accessible, and sustainable transport systems especially to the vulnerable population sub-groups in urban spheres; and SDG 12 aspires to ensure sustainable consumption and production, essentially addressing the much debated fuel subsidies. The transportation sector is also indirectly linked with SDG targets related to agricultural productivity, access to safe drinking water, and reduction of food losses. Of particular interest to this study are the goals related to air pollution (Target 3.9), sustainable cities (11.6), climate change adaptation (Target 13.1), and climate change mitigation (Target 13.2)[1].

The transportation sector thus not only plays an indispensable role in the achievement of several SDGs but is crucial for building environment friendly industrialization. Besides, it also adds to the resilience of any economy, as observed in the recovery from the COVID-19 pandemic. Here, we can also draw a parallel with how a robust infrastructure affects the ability to bounce back from extreme climate change events, the frequency and severity of which have increased globally as well as locally in Pakistan.

The climate change threat is actively being addressed around the world, even though critical progress is required to keep global warming below 1.5 or 2 degrees Celsius. The Paris Agreement, UNFCC, Conference of Parties (COP), and Net Zero Targets are all efforts at various levels to keep the planet livable for future generations. The results reported by the Sustainable Development Goals Report (2022: 41) show that renewable energy used in transport reached 3.6 percent in 2019, up from 2.6 percent in 2010, but there is a long journey ahead.

This research study is conducted in Pakistan, one of the countries hit hardest by climate change. Pakistan's transportation sector is largely dominated by roads, both for passengers and freight. The share of railways has declined over the decades. The trucking industry is outdated, unregulated, and, hence, inefficient. The transport sector contributes to approximately a quarter of the country's Greenhouse Gas (GHG) emissions from the energy sector. While Pakistan contributes only about 0.9% of global GHG emissions, the emissions are neither negligible in an absolute sense (489.87 Mt

[1] “Transport Targets of Sustainable Development Goals”, SLOCAT, Available at https://slocat.net/transport-targets-sustainable-development-goals/, (19 August,2023)

CO2 for 2017–18 as per Updated Nationally Determined Contributions (2021: 10)), nor estimated to decrease in the future, given the anticipated accelerated travel demand due to the expansion of the economy. Decarbonization, in general, and for the transportation sector in particular, provides a significant opportunity for climate-resilient and people-friendly development through initiatives such as green industrialization.

The objectives of this study are divided into three components: (a) developing an in-depth understanding of the transport sector as well as the climate action landscape in Pakistan vis-a-vis policy choices and implementation therein; (b) reviewing the best practices around the world for making transport sector green; and (c) combining the understanding of challenges and opportunities identified with the knowledge gained in order to suggest relevant policies and actions to support decarbonization of the transport sector in Pakistan.

The report is divided into five sections. Section1 discusses the transportation sector: the historical trends and status of various modes of transportation, the role of the transport sector in the national economy, and the productivity challenges of the same. Section 2 describes the relevant policies in the transport sector and analyzes them with a critical lens. Section 3 describes the contribution of the transport sector to global and national emissions and Pakistan's recent climate action landscape. Section 4 provides a decarbonization plan considering the problems, challenges, and opportunities explored in the preceding sections. Section 5 briefly discusses some practices from around the world for transport finance and pricing and the possibilities of their implementation in Pakistan, and the last section concludes the discussion.

2. Understanding the Transportation Sector in Pakistan

- Land Area of Pakistan: 796,096 square kilometers
- Modes of Transportation: Road, Air, Rail, and Maritime
- Road Network: 501,165 kilometers
- Rail: Passengers carried: 35.70 million; freight tons carried: 8 million tons in 2021-22
- PIA: Fleet: 35 planes, route length: 341,821 kilometers

Overview of the Transportation Sector

The importance of a well-developed, efficient, and environmentally friendly transportation sector cannot be over-emphasized in the context of a country like Pakistan that faces significant economic development challenges, a burgeoning services sector, and climate-related risks. An efficient transportation sector also helps in trade and commerce within as well as across national boundaries. Given the contribution of the transport sector to overall emissions, it is imperative that this sector garners a holistic policy and planning approach with an overt target of reducing emissions and becoming greener (please see Pakistan Economic Survey (2023), Logistics Sector Profile Pakistan, and NTRC Study on Freight Transport (Trucking) in Pakistan (2022) for further details).

Transportation Networks and Modes

Pakistan covers a land area of 796,096 square kilometers and has a population of approximately 240 million. It has 170 districts and around 70 cities. To connect these

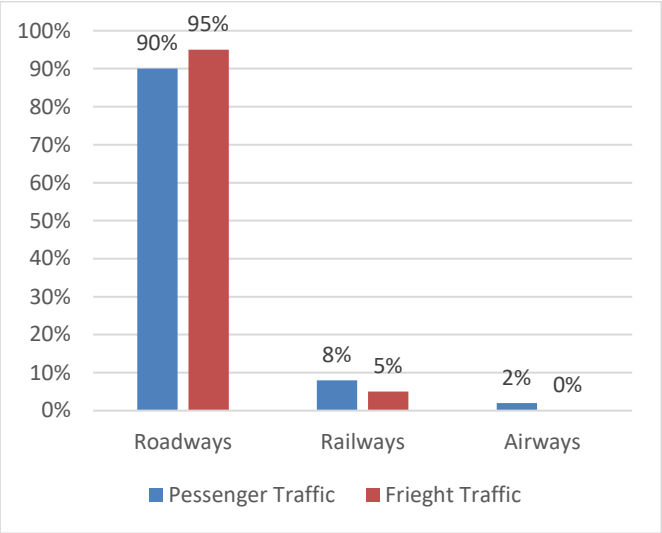
with one another and the outside world, all modes of transport that include road, rail, air, and maritime are utilized.

- The total road length in Pakistan is 501,165 kilometers. The road network comprises national highways, provincial highways, and urban and district roads[2].
- The National Highway Authority (NHA), created in 1991, is responsible for national highways, including access-controlled motorways and expressways, while provincial and district administrators are responsible for provincial highways and district roads. Roads under NHA total 12,131 km, but they carry 80% of commercial traffic. N5 (from Karachi to Torkham) is a critical road carrying 65% of the commercial load on NHA.[3] It also serves 80% of the urban population of Pakistan.
- Considering the breakdown of the road network by provinces, Punjab is clearly thickly populated with roads, and huge differences can be observed across provinces.
- Various road infrastructure projects under the China-Pakistan Economic Corridor (CPEC) have already been implemented or are in progress in all four provinces. These projects have the potential to further strengthen and increase regional connectivity, both within and across national borders.
- The national rail network is operated by Pakistan Railways, facilitating both passenger and freight traffic. The route length of Pakistan Railways is 7,791 km, and it has 461 locomotives. The ongoing reforms in the Pakistan Railways point towards untapped potential in the railways sector that should be capitalized in the decarbonization venture.
- The national flag carrier, PIA, has a fleet of 35 planes with a route length of 341,821 km. PIA has lately made efforts to expand its aircraft fleet. The current fleet includes the Boeing 777, Airbus and ATR. Airbus and ATR are both considered fuel-efficient aircraft.
- The public sector entities in the freight traffic sector through seaways or maritime routes include the Pakistan National Shipping Corporation (PNSC), Karachi Port Trust (KPT), Port Qasim Authority (PQA), and Gwadar Port Authority (GPA). In 2022, KPT, PQA, and GPA together handled 63,461.2 thousand tons of cargo.

Figure 1 shows the dominance of road in the overall transport sector in Pakistan in both passenger and freight traffic, followed by rail. Over time, the share of railways in freight volume has drastically reduced from more than 86% in freight volume transport in the 1950s to approximately 5%, resulting in overburdened roads and loss of any competitive edge through the rail network. Figure 2 shows the breakdown of roads in provinces, depicting the disparities across the country.

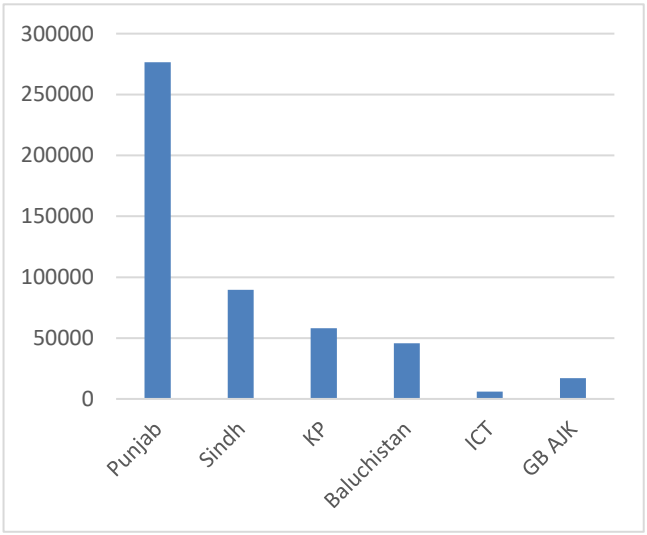
[2] For comparison, total road length in Bangladesh is 369,105 kilometers.
[3] See https://nha.gov.pk/.

Figure 1 Modes in Road Transport



Source: Pakistan, National Highway Authority, Road Asset Management Report, (2021).

Figure 2 Breakdown of Road Length (km)

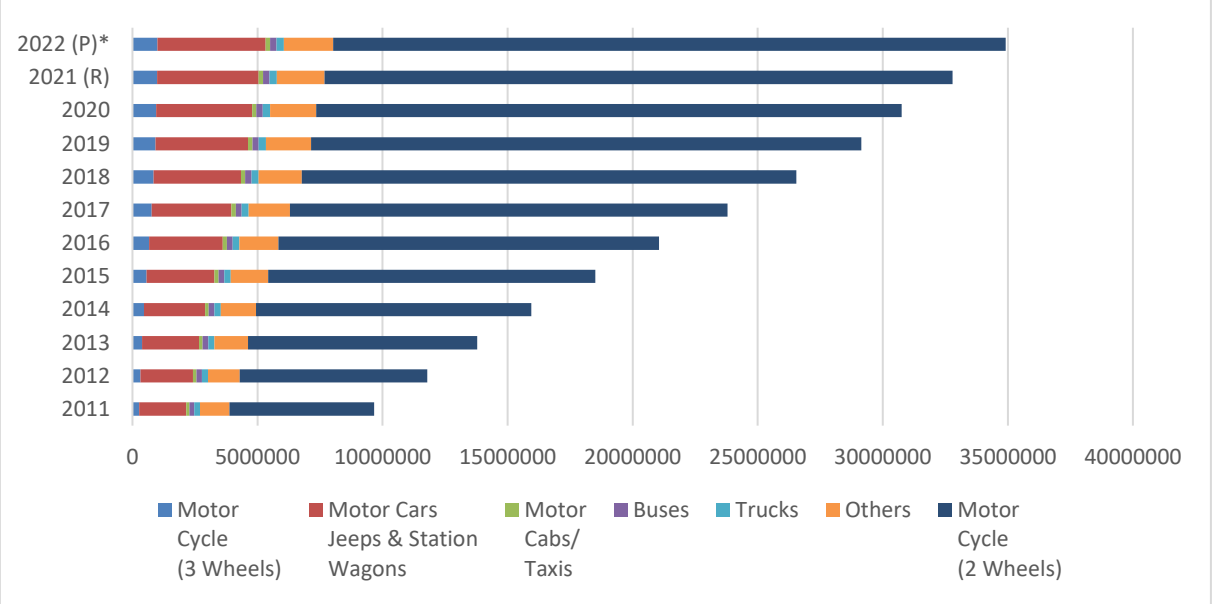


Source: International Finance Corporation and Board of Investment Logistics Sector Profile Pakistan.

Trends in Vehicles

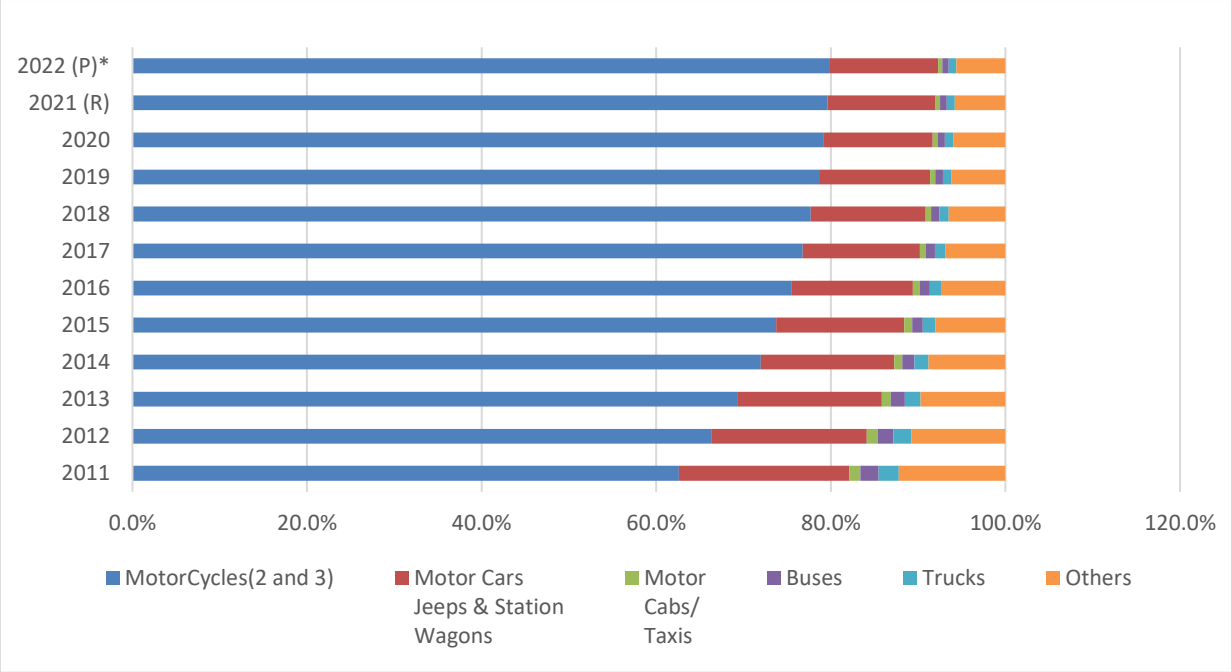
It is pertinent to note the growth of vehicles and their distribution in Pakistan. Figure 3a shows an almost three-fold increase in the total registered vehicles over the last decade. It is important to note the increasing share of motorcycles (2-wheeler and 3-wheeler), a persistent smaller share of taxis, buses, and trucks, and a declining share of cars, jeeps, and wagons (Figure 3b).

Figure 3a Number of Registered Vehicles in Pakistan (2011-2022)



Source: Pakistan, Pakistan Economic Survey, (2023)

Figure 3b Distribution of Registered Vehicles (2011 – 2022)



Source: Pakistan, Pakistan Economic Survey, (2023)

Freight Transport

Carrying freight via rails has been a challenge as railways operations prioritize passengers over freight, explaining the declining share of the railways in the freight. The trucking industry, thus, is the main player in freight carriage. However, the industry is underdeveloped, unregulated, informal, and highly fragmented, with dominant firms owning 1-5 vehicles comprising two-axle and three-axle trucks with slower speeds and

inefficient fuel consumption (Choudhary et al., 2017). Among operators, large road freight transport companies comprise only 2% of the market, while 85% of the market share is held by companies operating on the mode of owner-operator firms.

Regional Connectivity

The geographic location of Pakistan and different transport modes play a critical role in developing and utilizing efficient economic trade routes within the Central Asian region. Various international projects and commission[4] aimed at promoting regional cooperation indicate the potential of greater regional connectivity and its relevance for economic gains, which is rightfully targeted by CPEC projects focused on the Gwadar port of Pakistan. Similarly, the Peshawar–Torkham Expressway envisaged under the Khyber Pass Economic Corridor Project (KPEC) and ML1 (railway project under CPEC and Ministry of Railways) aims at not just facilitating trade between Pakistan and Afghanistan, but also job creation in KP and economic growth in the region.

Transportation Sector Performance Over time

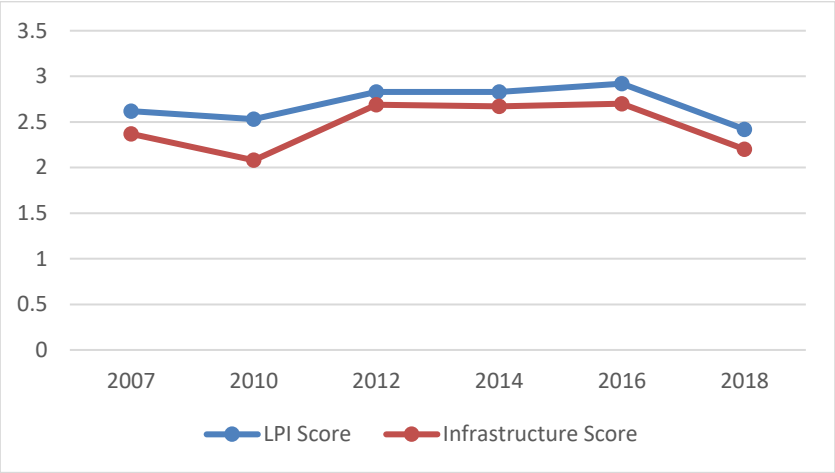
The Logistics Performance Index (LPI)[5] is a World Bank indicator of ease of goods transportation across the country with speed and reliability. It ranks Pakistan at position 122 out of 160, whereas neighboring countries like India and Bangladesh rank 44 and 100, respectively. The index has six components, and the component that measures the quality of trade and transport-related infrastructure (e.g., ports, railroads, roads, information technology) is relevant to this study. Figure 4 shows that over time, there is no marked improvement in the indices, rather a considerable downward trend after 2016.

Transportation Sector Performance Comparison

Figure 5 shows the comparison with India, Vietnam, Bangladesh, and other regional and income group scores. Pakistan lags in both overall LPI score and infrastructure component score in all comparisons, even for the South Asian region. There is thus an untapped potential for better performance in the transport sector. This is duly recognized in Pillar 7 of the Pakistan Vision 2025, which aims at modernizing transport infrastructure and, hence, better regional connectivity. The stated target in Pakistan Vision 2025 is to increase road density from 0.32 to 0.64 km/square kilometer. Similarly, NHA also has *'environment friendly'* as one of the parameters for building the road network, in addition to efficiency, safety, and reliability.

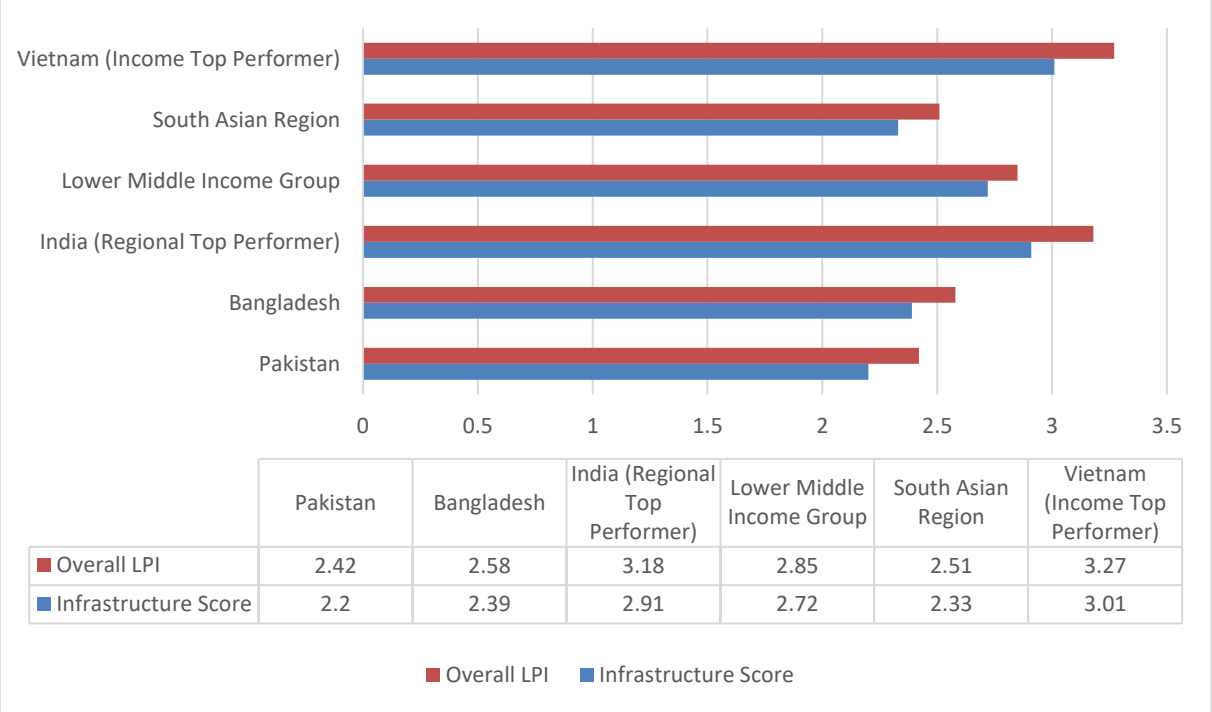
[4] Euro-Asia Transport Link, United Nations Economic Commission for Europe (UNECE), and United Nations Economic and Social Commission for Asia and Pacific (UNESCAP).
[5] Appendix 2 describes how LPI is calculated.

Figure 4 Time trend of LPI and Infrastructure Score in Pakistan



Source: World Bank, "LPI: International Scorecard Page," Full LPI Database Available at https://lpi.worldbank.org/international/scorecard

Figure 5 Comparison of Pakistan LPI & Infrastructure Score (2018)



	Pakistan	Bangladesh	India (Regional Top Performer)	Lower Middle Income Group	South Asian Region	Vietnam (Income Top Performer)
Overall LPI	2.42	2.58	3.18	2.85	2.51	3.27
Infrastructure Score	2.2	2.39	2.91	2.72	2.33	3.01

Source: World Bank, "LPI: International Scorecard Page," Full LPI Database Available at *https://lpi.worldbank.org/international/scorecard*

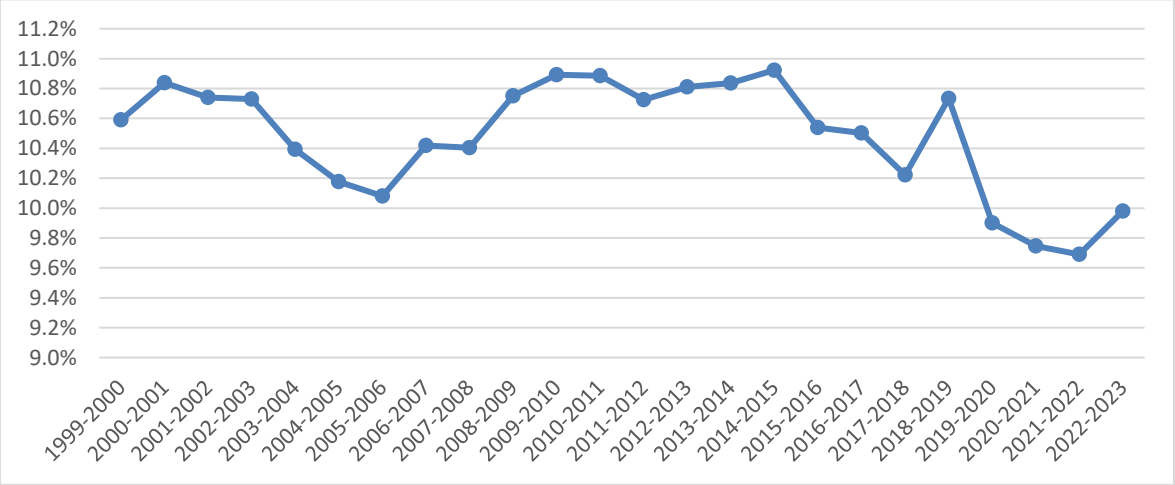
Transportation Sector and Economy

- Transport Sector is critical for mobility, regional connectivity, trade and economic development.
- Transportation sector contributes 10 % to Pakistan's GDP and generates 6 % employment.
- Cost of Inefficiencies is estimated to be 4-6 % of national GDP.
- Growth in urbanization (from 37%) and increase in contribution of manufacturing (from 13%) to the national GDP will substantially increase emissions from the sector.

Contribution to Economy

Historically, in Pakistan, the transportation sector has contributed approximately 10% to the country's GDP. Figure 6 shows that there has not been any significant deviation from the trend. The transportation sector generates 6% of employment opportunities. Inefficiencies and poor performance of the transportation and logistics sectors manifested in extra fuel costs, fuel subsidies, additional road user costs, long operating hours, and excessive load carrying at low speeds in the trucking industry, cost approximately 4–6 % of GDP to the economy (Sánchez-Triana et al., 2013).

Figure 6 Share of Transportation and Storage in GDP



Source: Pakistan, Pakistan Bureau of Statistics, *National Accounts Tables* (2023)

The transport and communications sector has historically garnered approximately one-fifth of the development budget for sixty years in the five-year plans. However, despite considerable spending on roads and railways, the spending on capacity building and research and development has been less than 1% for most of the years (Choudhary et al., 2017). Currently, investment in road networks is primarily sourced from the annual budget allocation in the federal Public Sector Development Program (PSDP). The NHA portfolio in the development budget, i.e., PSDP 2022–23, consisted of 115 projects with a budgetary allocation of Rs. 118,403.40 million. According to the Annual Plan 23-24, 30-35 % of PSDP spending is bagged by the transportation and logistics sector. To meet the growing needs of investment in the same, in recent years the government has been trying to promote public private partnerships (PPP) as well as collaborations with donor agencies to garner development loans to reduce the burden from public exchequer.

However, the performance in each sub-sector was ambiguous in 2022-23, as approximately only 72 % of allocated amount from PSDP was utilized due to flooding, and overall bleak economic outlook of the country. The current allocation for the Transportation and Logistics (T&L) sector in the Annual Plan (2023-2024) of the Ministry of Planning, Development and Special Initiatives PSDP is Rs. 271.70 billion PKR for 2023-2024 – primarily allocated for roads followed by rail.

It is essential to understand the inefficiencies in the transport sector that hinder optimal results, stemming mainly from the public transport system. A significant part of the problem associated with road-based public transport systems relates to urban areas; hence, the emphasis shall be on the same. We also discuss the identified challenges in the freight sector: trucking and railways.

An overarching issue in the transportation sector is the lack and disregard of road safety measures.

Productivity Bottlenecks in the Public Transport Sector

Problems shaping the current landscape of public transport in Pakistan include:

- Lower income levels of public transport users make it difficult to balance quality and affordability
- Lack of skilled drivers and mechanics
- Misplaced priorities and financial constraints of the state
- Lack of consistency in policy, poor enforcement of laws and regulations, and corruption
- Difficult road conditions, with poor road surfaces on inter-city and rural routes and severe traffic congestion in urban areas
- Standards of safety, comfort, punctuality, reliability, air and noise pollution, and users' expectations are often far lower as long waiting times are often expected

- A recent promising trend is private sector's investment in the trucking sector, by DHL, Agility, and local players Daewoo, PTN, and BSL
- Increased demand from FMCG and pharma companies.
- The last two years have seen 5 start-ups focusing on trucking solutions.
- It is expected that road will likely remain the dominant mode of transport and grow in the future.
- The tremendous growth of E-commerce adds to demand factors.
- An opportunity for freight companies and a way forward lies in the fact that railways are hardly utilized for transport of perishable goods.

Source: IFC and BOI, Logistics Sector Profile Pakistan

Productivity Bottlenecks in Freight Transport Sector

Studies indicate a positive correlation between global trade competitiveness and an efficient transport sector. Reversing the argument, inefficient supply chains through high transport and logistics costs could impede export and import flows, increasing costs for firms, especially those competing in the export market. In the case of Pakistan, much of the economic gains because of locational advantages are lost due to an inefficient transport sector. According to earlier estimates (United Nations Industrial Development Organization et al., 2016), the country suffers a loss of 8.5% of GDP annually. Some other studies place this loss between 4–6% of GDP annually, but in any case, this number is a significant one. Despite an improvement in the quality of national highways because of continuous improvement projects and road asset management approach, the

overall quality of road infrastructure exacerbates the capacity constraints. The provincial highways lag far behind in quality as compared to the national highway network. Unsurprisingly, the trend in the commercial freight markets across the globe is that of a heavily concentrated industry with multi-axle trucks, whereas in Pakistan, the trucking industry is too fragmented with old vehicles. The consequences of all this are inefficiencies in terms of time, cost, and environmental externalities: freight journeys via road in Pakistan normally take twice as long as they would in Europe, mainly due to an outdated fleet and poor and unreliable infrastructure. Just in terms of agricultural produce and the process of delivering it from the source to the markets, approximately 30–40% of it is lost annually because of these inefficiencies.

The productivity of Pakistan Railways' freight operations is only one-eighth and one-third of China and India, respectively. Instead of supporting the growth of the private sector, the government itself entered the road freight market and now runs the biggest operator in the trucking industry, namely the National Logistic Cell (NLC). NLC was formed in 1978 to perform crisis management tasks during natural climate emergencies and unforeseeable situations, including strikes, shortages, port congestion, etc. However, today, it is a major transportation company owned by the state that is competing with private competitors, having a market share thrice that of the railways.

3. The Transport Policy Landscape

- Review of National Transport Policy 2018 and 2008
- Review of Auto Policy 2021-2026 and Electric Vehicles Policy
- Is building more roads a solution or a problem?
- Is public transport a better alternative?
- How important is inclusivity in transportation?
- Reviewing rail network
- Are low carbon fuels also low-hanging fruits?

The overall policy framework governing the transport sector, in general, is complex.[6] The complexity arises on several accounts: the multiplicity of policies with domain overlaps, involvement, and interdependence of different tiers of government, a wide range of stakeholders that include both public and private entities, and, above all, diversity in modes and the choice between publicly owned or privately operated. This complexity hinders coherence in the planning and management of the sector. Aiming for a dynamic and inclusive transport system capable of handling goods and people established on the principles of inclusivity and sustainability is, therefore, a formidable challenge. Despite its limited role defined by the 18th amendment, the Federal Government continues to influence the transport sector in multiple ways. This section reviews the principles and objectives of the national transport policy and other policies connected with the transportation sector[7].

National Transport Policy 2018 (and 2008)

[6] Appendix 3 lists all relevant bodies dealing with transportation related issues. This includes all the entities that directly or indirectly influence the transportation sector.

[7] The following policies were reviewed extensively for preparation of this section:
National Transport Policy of Pakistan (2018), National Transport Policy of Pakistan (2008), Auto Industry Development and Export Policy (AIDEP) (2021-2026), and National Electric Vehicle Policy (2019).

The National Transport Policy of 2018 is the prime policy document developed after the 18th constitutional amendment that devolved most of the functions—except planning, research on transportation, and the management of national highways, including strategic roads and international maritime operations—to the provincial governments. The policy highlights the sector's much-needed focus on its role in sustainable development, its economic significance, especially regarding women's mobility, and the need for improved connectivity with farms and rural settlements. Comparing this document to the policy draft from 2008, it quickly transpires that although the policies largely reflect the underlying changes in the broad landscape, they lack in devising an implementation guideline and a target-specific review process. The 2008 policy points out the lack of coordination among modes and agencies as a major cause of misplaced priorities in the transport sector but does not provide a mechanism to bridge this gap. The 2018 policy proposed an implementation plan but detailed its top layers only, i.e., the Cabinet Committee on Transport and the Advisory Committee on Transport are expected to meet every three months.

Issues identified

Placing the secretariat for these committees with the Planning Commission without assigning focal departments at the provincial level constrains any meaningful progress. Further, the policy envisages a National Transport Masterplan for ten years, but no such document was ever developed. Given the broad institutional spectrum and stakeholders' diversity, the policy could have done a better job by assigning agency-specific tasks in case of already identified issues, with appropriate timelines to avoid bureaucratic delays.

Auto Policy 2021–2026 and Electric Vehicles

The recently developed Auto Industry Development and Export Policy (AIDEP) 2021–2026 intends to improve local car production and make small cars more affordable to Pakistani buyers. The policy also recommends decreasing import duty on electric vehicles (EVs) to encourage people to use environment-friendly vehicles. As per the Auto Policy 2021–2026, the import duty on electric vehicles has been reduced from 25% to 10% for one year, and the regulatory duty on Complete Built-Up (CBU) import of hybrids has been reduced to 0% for vehicles of 1800cc and below and 15% for those above 1800cc.

Issues Identified

An important concern here is whether the policy aiming for the replacement of fossil fuel vehicles with EVs will be able to reduce emissions significantly. Two important considerations in this regard revolve around the possibility of mass adoption and the affordability of EVs.

1. Mass adoption of EVs is unlikely unless investment in infrastructure is made to establish a network of charging stations. Under the new EV policy, ambitious targets of shifting 30% and 50% of new car and ⅔ wheeler sales, respectively, have been set for 2030. In the same policy, the Government aims for at least one fast charging station in a 3x3 km urban area. Given current urban population density—for instance, Lahore's population density is 6300 per square km—it is hard to imagine its sufficiency in big cities. To put things further into perspective, the United States[8] had an EV-to-charger ratio of 14 to one in 2020, yet the main

[8] Gordon Bauer and others. *Charging up America: Assessing the Growing Need for U.S. Charging Infrastructure through 2030,* International Council on Clean Transportation, (Washington D.C., 2021). Available at https://theicct.org/wp-content/uploads/2021/12/charging-up-america-jul2021.pdf.

barrier to mass adoption in the US remains insufficient charging stations (Bauer et al., 2021).

2. A second, and perhaps even bigger, barrier to mass adoption is the price of EVs. Given the average Pakistani household's annual per capita income of USD 587 [9], the only EV set to be launched in Pakistan is priced at USD 36,603, making it practically inaccessible to the masses (Khan, 2022). A review of AIDEP 2021–2026 reveals that, instead of creating incentives for the use of public transportation, the policy has emphasized the affordable provision of private vehicles by reducing duties and taxes on small cars up to 1000 cc and 2–3 wheelers. Such incentives might appear poor-friendly in the medium to short run but may lead to greater urban sprawl, including the growth of slums on city peripheries, more congestion on city roads, and overall higher volume of accidents and emissions.

Road Expansion: A solution or a problem?

The increased road traffic because of the Federal Government's aim of providing affordable vehicles is handled by the provincial governments using measures that primarily focus on building newer and wider roads. Moreover, the low-density horizontal growth of cities because of lopsided provincial land use rules and local building bylaws causes an ever-increasing demand for private vehicles, especially motorbikes. A predominant paradigm in Pakistan's urban planning landscape is, therefore, investing in building more roads to tackle the congestion issues. It appears that these policies are totally ignoring the fundamental law of road congestion, which states that an increase in road capacity directly generates a proportional increase in traffic, with the effect that congestion and travel times quickly return to (or worsen from) pre-expansion levels (Cortright, 2021). Specifically, traffic miles traveled are found to be unit elastic in response to road capacity expansion (Duranton & Turner, 2011), based on evidence from US cities. The hypothesis was later supported by evidence from Japan and Europe. These studies challenge the dominant approach of resolving urban issues by building more infrastructure, which research suggests is a costly but futile venture.

Public Transport: A panacea?

By contrast, the principles of sustainable transport encourage using low-cost public transport that could perform well in mixed land use and high-density Pakistani cities. Although the National Transport Policy aims to integrate urban land use planning and transport development in accordance with the principles of Transit Oriented Development (TOD)—whereby high-density, mixed land use supporting non-motorized travel (NMT) near transit stations is to be adopted—nothing substantial is being done in this regard. Common TOD traits include *urban compactness, pedestrian and cycle-friendly environments, and public and civic spaces near stations*, to improve productivity and limit the cities' carbon footprint. With several mass transit projects now operational in the country, studies show that population density, development volume, and land use for economic activities increased after the BRT operation (Nadeem et al., 2023). However, despite an increase in intersection density, pedestrian paths have not improved in these locations, signifying that the walkability and open space either

[9] Household income estimates were taken from https://www.ceicdata.com/en/indicator/pakistan/annual-household-income-per-capita that use figures of average household size and household income in PKR from the HIES (Household Income and Expenditure Survey) which is conducted by Pakistan Bureau of Statistics (PBS). This calculation is different from GDP per capita, as discussed in
Nolan, Brian and others. 2016. “GDP per capita versus median household income: what gives rise to divergence over time?.” *Social Macroeconomics Working Paper Series.* May 2016. https://www.bsg.ox.ac.uk/sites/default/files/2019-06/SM-WP-2016-05%20GDP%20per%20capita%20vs%20media%20household%20income.pdf

remained the same or declined in the station areas. The evidence indicates that density and diversity improved, but design criteria remained the same or declined. Therefore, to truly benefit from the investments in mass transit systems through the TOD framework, the government needs to prioritize improving the environment for walking and NMT while keeping security, inclusiveness, and sustainability a cornerstone of its policy.

Inclusivity in Transport

In the same vein, the national transport policy states that transport sector developments shall principally be guided by the needs of the end-users, wherein special consideration will be given to the needs and priorities of vulnerable populations, including the elderly, women, and the Persons with Disabilities (PWDs). Often, policy discourse addressing gender inequality and inclusivity focuses on access to health, education, and workplace rights but scarcely concerns the fundamental issue of mobility constraints that limit their economic choices. The issue is highly gender discriminatory in our society and has negative trickledown effects. The disability situation further worsens the labor force participation of disabled women. Public transport is almost inaccessible while traveling except for traveling by taxi or rickshaw, which is an expensive option. Disabled women and men are heavily dependent on their families to move around, and this makes it very difficult to find and avail economic opportunities (Heymann et al., 2014). The existing shortcomings in the system necessitate an urgent focus on developing a more inclusive, need-based public transportation system[10]. To provide more context, SDG 11.2 that measures satisfaction with public transport system has a score of 58 % in Pakistan for 2022, which is 77 % in India and 76 % in Bangladesh.

Issues Identified

To address these, the policy lacks targeted public transport interventions and instead advocates increasing ownership of private vehicles. Several laws, such as the ICT Rights of Persons with Disability Act 2020, the Special Citizens Act 2008, and the Special Citizens (Right to Concessions in Movement) Act 2009, are in place—and all these highlight PWDs' right to safe and accessible transport. Through the 2009 Act, authorities are bound to provide concessional fares for disabled persons in private and public transportation. The act provides for half-fare charges for disabled people in the railways and other public modes of transportation as well. However, ensuring these rights requires actions, based on the principles of gender mainstreaming interventions, pragmatic recommendations through evidence-based policymaking in transportation, proper data collection and focus on gender-sensitive urban planning.

Progress on Rail Network

The national transport policy places the railways as the major mode of freight movement across the country, except for connectivity with small stations. However, the freight movement data available in the Railway Yearbook described in the Railway Sector Assessment for Pakistan (2021) reveals that between 2007–08 and 2020–21, tons of freight transport have hardly shown any significant increase. A feature of the railways freight traffic in recent decades has been that various types of users have largely shifted to road transport, leaving railways serving a narrower range of commodity types. Figures show that in 2021–22, about 41% of PR freight volume was from coal and coke. PR's freight traffic is largely confined to bulk commodities, with most agricultural products, machinery, and manufactured goods having long ago shifted to road transport.

[10] Even though global number for PWD is about 15% as reported by World Health Organization, data and measurement issues regarding PWD are critical because of which such numbers are under-reported and vary a lot. Roughly 6 % of Pakistan’s population is said to have some form of physical or mental impairment.

An encouraging sign is that container traffic rebounded to account for 28% of freight volume in 2020–22. This is partly due to the expanded role of hinterland dry ports, which has led to more containers being transhipped between the seaports and dry ports. The most significant recent change in commodity composition is the large increase in coal and coke traffic, which is now much higher than in the past. This is due to the rapid expansion of thermal power production in Pakistan that requires the transportation of large volumes of coal and coke to power plants.

Promoting Low Carbon Fuels

The national transport policy emphasizes the adoption of vehicle technology using low-carbon fuel and thereby lower carbon emissions from the transport sector; however, it transpires that the mandate to manage the various contributors to air pollution falls under different government departments, and it has been challenging to bring them together to devise and coordinate a cohesive anti-pollution strategy. Vehicular emissions have been identified as one of the biggest sources of pollution in urban areas. Studies have highlighted an urgent need to revise the fuel standards set by the Environmental Protection Agency (EPA) in 2009 which puts in requirement of minimum Euro 2 standard on the transport fuel by 2012.

Issues Identified

Although in 2020 the government approved the decision to shift to a higher quality, the low-carbon Euro 5 standard fuel is not readily available across the country. The oil refineries are in the process of upgradation, and the local auto industry also needs more time to produce high-quality fuel-compliant vehicles. This problem warrants:[11]

i. an effective motor vehicle testing regime, through the involvement of the private sector for both testing and enforcement of vehicular safety and environmental standards
ii. plan to phase out old, polluting vehicles by offering incentives in partnership with different vehicle manufacturers, banks, and regulators
iii. highlighting the financial and health costs associated with continued supply of low-quality petrol and diesel
iv. provision of safe, reliable, and environmentally efficient public transport to reduce vehicular density on the roads.

4. Transportation, GHG Emissions & Climate Action Landscape in Pakistan

- Transport Sector contribution to global GHG emissions: 25%, second highest
- Transport Sector contribution to GHG Emissions in Pakistan: 10%
- Global Approach to green transportation: Avoid - Shift - Improve (ASI)
- Pakistan Climate Change Act 2017, Ministry of Climate Change, NDC 2021 Targets, National Electric Vehicle Policy
- Pakistan's GHG emissions have increased 160%; higher than global average of 50%

[11] Consortium for Development Policy Research, “Workshop on Air Quality: Key Takeaways”, Available at https://cdpr.org.pk/wp-content/uploads/2018/02/Workshop-on-Air-Quality.pdf

Role of the Transportation Sector in Global GHG

Global GHG today stands at approximately 50 billion tons of CO_2. From 1990–2021, annual emissions from the transport sector have been growing at an average rate of 1.7% and contribute approximately 14 % to total emissions globally compared to 10% in case of Pakistan. However, following the Net Zero scenario by 2030 requires that the emissions from transport sector globally decrease yearly by 3%[12], which essentially requires an overhaul of the entire transport sector (Please also see: Emissions Gap Report by United Nations (2022), Sectoral Guide: low emissions transport by GCF (2022), & Ang & Marchal (2013) for a detailed description of policies and findings discussed in this chapter).

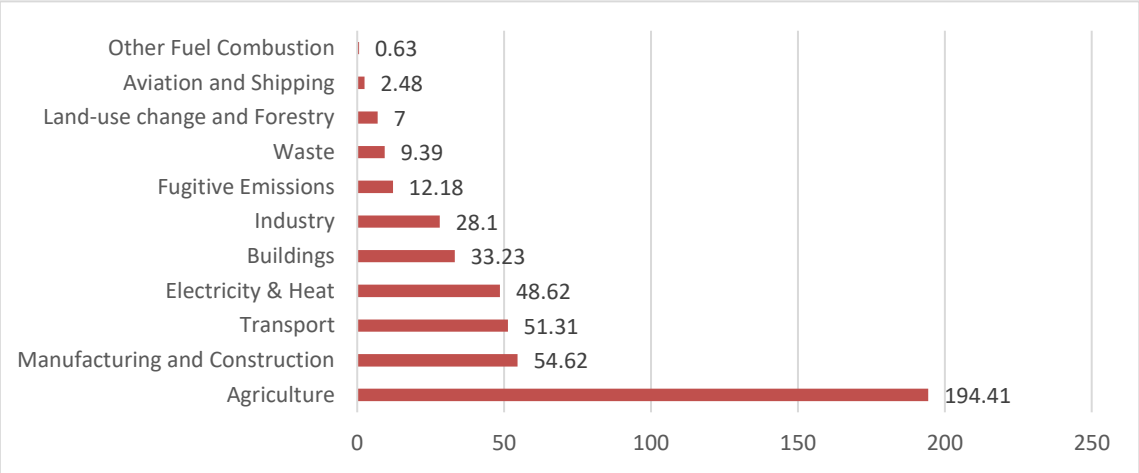
Globally, road traffic contributes approximately three-quarters to the emissions (much lower than 98% in case of Pakistan) followed by shipping and aviation sector. The share of rail and pipeline transport is quite minimal. The global consensus on meeting mobility demand in developing countries while simultaneously decoupling it from growth in carbon emissions rests on three connected pathways based on the 'Avoid-Shift-Improve' (ASI) principles of urban transport: *avoiding* high carbon, private vehicles by *shifting* to more efficient public transport modes integrated with walking and micro-mobility, and *improving* vehicle design by rapid electrification throughout the value chain, supported by innovation invocation in technology as well as business models and also capitalizing on renewable energy (RE) for electrification. Appendix 4 contains a list of some global initiatives aimed at zero emission vehicles and electric vehicles.

GHG Emissions and Transport Sector in Pakistan

Pakistan emits 438 million tons of GHG emissions, accounting for 0.9% of global GHG emissions, as reported by Updated NDC (2021). However, in absolute terms, Pakistan's GHG emissions are in the top 20 emitters group; comparable with emissions of two large economies in the Middle East, North Africa, Afghanistan and Pakistan (MENAP) region: Iran and Saudi Arabia. Sources of emissions in Pakistan are carbon dioxide in the energy sector and methane in the agricultural sector. Since 1990, Pakistan's GHG emissions have seen an increase of 160%, which is higher than the global average of 50%; and only slightly less than the MENAP region's average of 175% (IMF, 2022). Transport sector emissions amount to 51.31 million tons of CO_2 equivalent (approximately 10 % of total country emissions)[13], making it the third biggest contributor to Pakistan's GHG emissions mix. Time trend shows a relatively sharp increase in emissions from transport sector in Pakistan beyond 2010.

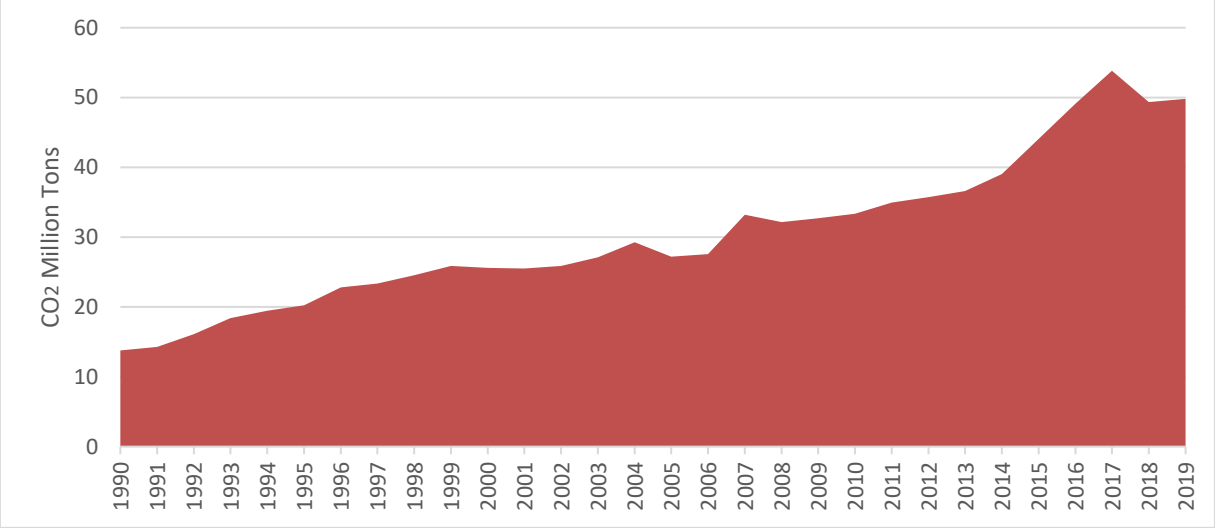
[12] International Energy Agency, “Transport”, https://www.iea.org/energy-system/transport (Accessed on 8 July 2023).
[13] Globally, transport sector contributes approximately 14 % to total emissions.

Figure 7 Pakistan Emissions Inventory – 2019 (Million Tons CO_2 Equivalent)



Source: Our World in Data

Figure 8 Pakistan Transport Sector Emissions (1990-2019)



Source: Our World in Data

It is forecasted that the emissions from the transport sector in Pakistan will rise by 128% between 2012 and 2030. Emissions are forecast to grow from approximately 35.4 MtCO2e in 2012 to approximately 80.7 MtCO2e in 2030. This projection does not incorporate any significant change in the emissions mix from different modes of transport, indicating a latent opportunity for decarbonization by shifting the transport mix on the road from high-carbon to low-carbon modes.

Figure 9a. Projected: Emission Source Category (MT CO2E)

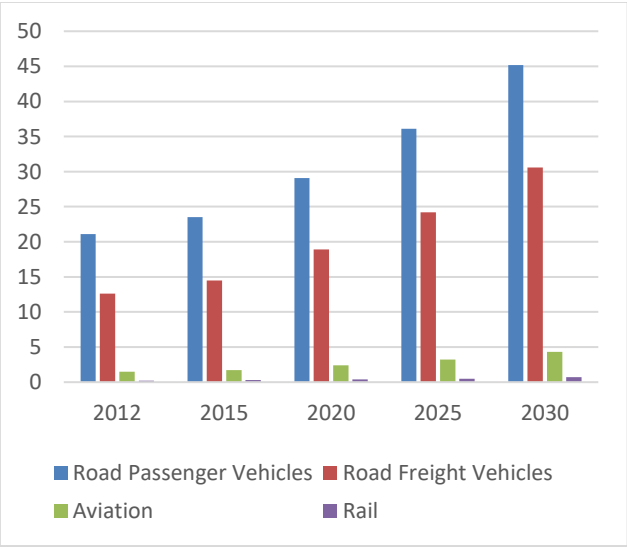
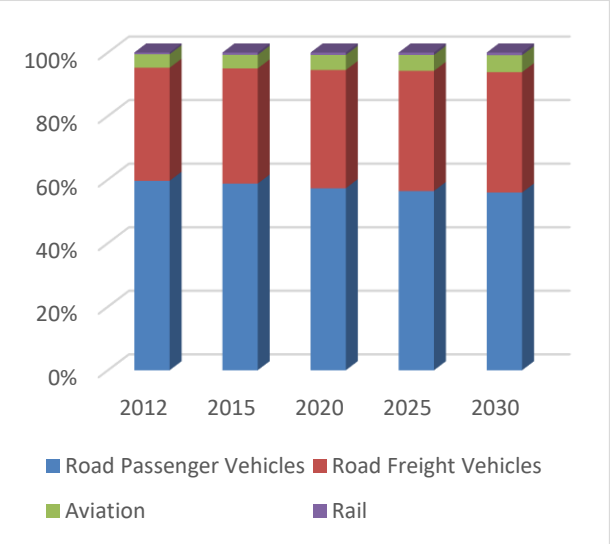


Figure 9b. Projected: Emission Source Category Proportions



Source: Seton Stiebert, Pakistan Low Carbon Scenario Analysis, (2016)

Climate Action Landscape in Pakistan

Pakistan has operationalized the 2015 Paris Agreement and the Global Methane Pledge at COP 26. Under the Pakistan Climate Change Act 2017, Pakistan Climate Change Council and Pakistan Climate Change Authority have been developed. Some promising initiatives include adoption of Nature-based solutio[14] (NBS), carbon-pricing mechanisms, emissions trading system (ETS), target setting of increasing the share of renewable energy to 60 % by 2030 (from 11% currently of all energy production), banning coal imports and placing moratorium on coal-fired plants. The most relevant target is that by 2030, 30 % of all vehicles should be electric. The government has started providing fiscal incentives to bring 500,000 electric motorcycles and rickshaws and more than 100,000 electric cars, buses, and trucks into the market by 2025.

Leveraging low-carbon investments remain overarching theme related to climate action, especially in the power and industry sectors.

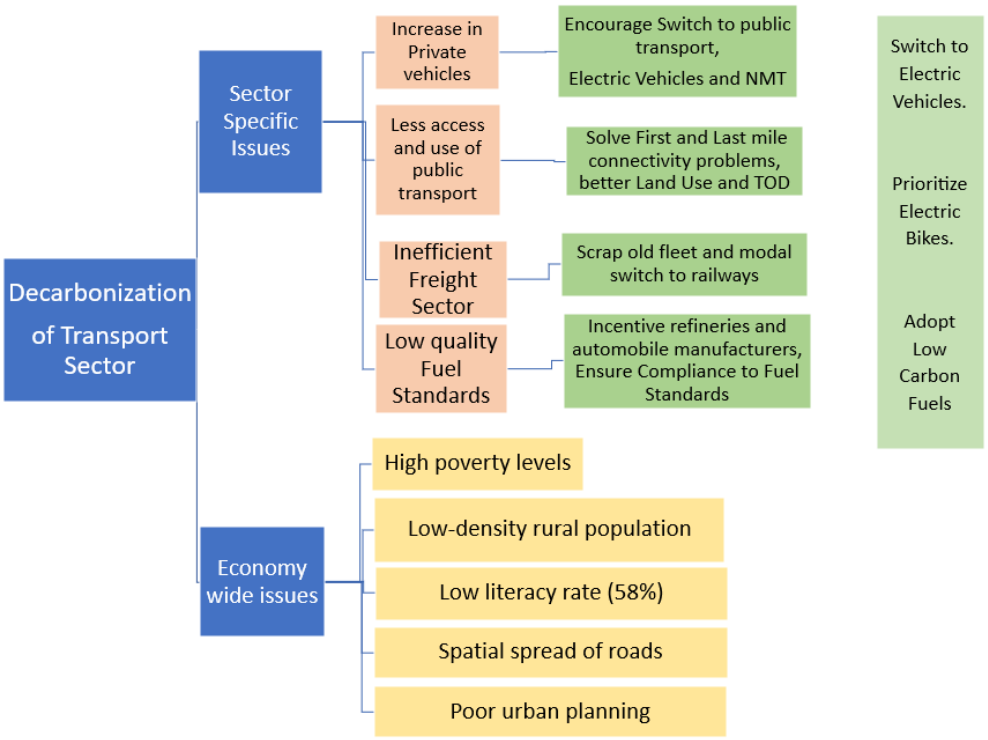
These measures aided in emissions reduction of 8.7 % during 2016-2018 relative to business as usual (BAU) scenario, an achievement beyond the 2016 target. Recently, Pakistan revised its cumulative GHG reduction targets to 50% below its projected 2030 BAU emissions value This comprises an unconditional reduction of 15 percent financed from the country's own resources and a conditional reduction of 35% subject to the provision of international financial support that would require an estimated USD 101 billion just for energy transition. This is quite an ambitious target, surpassing that of its peers in the MENAP region Whether the regional low targets are in anticipation of or a reflection of limited fiscal space and weak capacity or is Pakistan over-committing is yet to be seen.

[14] NBS include Ten Billion Tree Tsunami Program TBTTP (2021–2023), Protective Area Initiative (PAI) and efforts to become a member of the United Nation's Reduction of Emissions from Deforestation and Forest Degradation (REDD) program

5. Decarbonizing the Transport Sector in Pakistan

Decarbonizing the transport sector in Pakistan is challenging and would remain a dream without a neatly specified action plan pursued with strong political commitment. A problem tree shown in Figure 10 helps to systematically analyze the causes and effects of the transport sector problems, identify specific issues, and recommend relevant solutions.

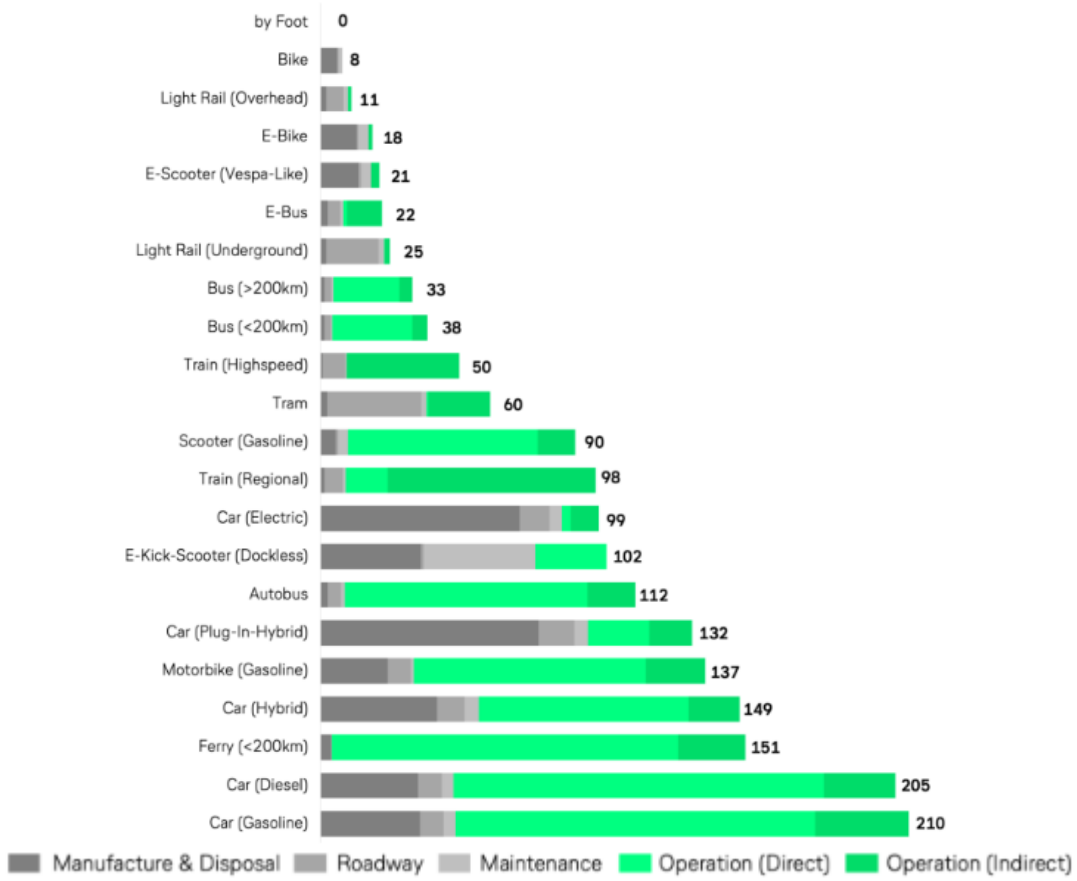
Figure 10 Problem Tree for Decarbonizing Transport Sector in Pakistan



Source: Author's analysis

Despite the challenges mentioned in Fig. 10, the journey is inevitable as decarbonizing transport can significantly help mitigate environmental externalities at the national level and meet multilateral commitments on emissions reductions. Moreover, it could contribute to green industrialization through creating a demand either for low carbon fuels or electric vehicles, and green manufacturing that relies on cleaner freight transportation. Low carbon transport is one of the important precursors for green manufacturing growth besides use of renewable energy, recycling, and an enabling business ecosystem such as green financing. Here, we review the various determinants of emissions from the transport sector, recommend mitigation strategies considering the legal and institutional framework, and propose an action plan. A review of related data and literature identifies urban agglomerations and inter-city freight transport as the main sources of carbon emissions from the transport sector, and hence, our recommendations also focus on these two areas while designing a targeted strategy.

Figure 11: Average CO2 Emissions for Various Transport Types (gCO2/passenger-km)

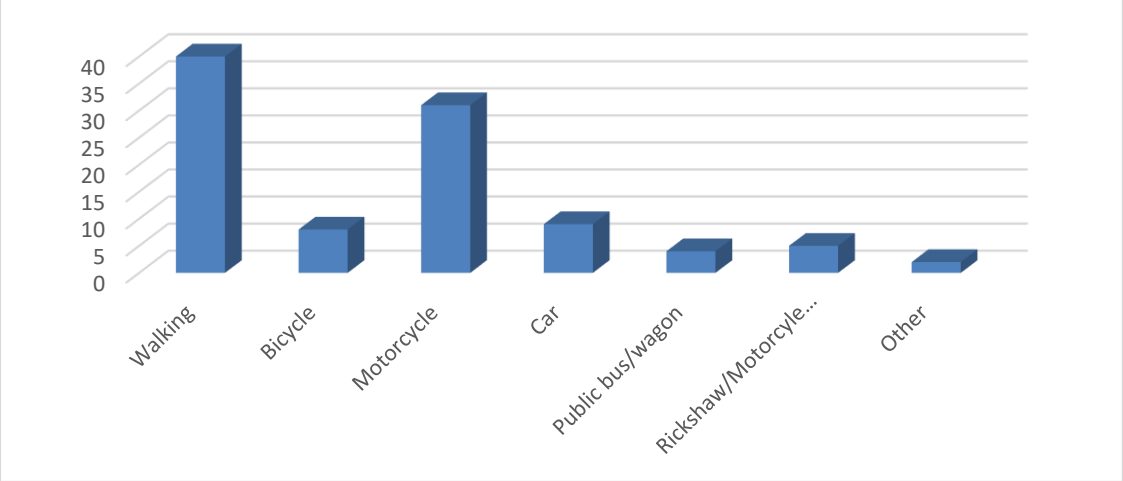


Source: "The Environmental Impact of Today's Transport Types." 2023 TNMT August 7 *https://tnmt.com/infographics/carbon-emissions-by-transport-type/*.

1. Urbanization and Decarbonization

Urban transport is a major contributor to cities' climate-warming greenhouse gas (GHG) emissions. Among urban mobility modes, low occupancy vehicles generate the most urban transport emissions compared to other modes on a person-km basis. Similar to cars, services offered under public transport by taxis and ride-hailing services have higher carbon footprint, (see Figure 11). Managing motorization and encouraging the use of more carbon-efficient non-motorized modes of travel, such as walking and biking, is fundamental to a low-carbon transport policy. Unfortunately, little has been done to preserve and promote these modes, even though a survey (Majid et al., 2018) conducted before the introduction of Metro bus in Lahore during 2010–12 demonstrated that a considerable proportion of commuters in Lahore commuted by environment-friendly modes(see Figure 12).

Figure 12: Common Modes of Commute in Lahore (2010)



a) Issues Around Mass Transit Utilization

Despite the introduction of mass transit in major cities, ridership to capacity level and accessibility issues remain for mass transit authorities and urban residents. Part of the problem arises from the current pattern of land use that determines residential choices and, hence, the spatial pattern of population density in the cities. A study was conducted by the CITY center at LUMS that used GIS network analyst tool on the spatial data of Lahore's population, mass transit lines, and the feeder bus network to assess the access of the public to the public transport bus stop. The results show that switching modes from private to public transport remains difficult for many city commuters.

Table 1 Access of Lahore's population to Public Transport

Number of residents (Millions)	Access of the Lahore population (%)	Access time through walking (minutes)
1.67 million	15 %	5-minute walk
3.37 million	30 %	10-minute walk
4.42 million	40 %	15-minute

Source: **CITY at LUMS[15]**

b) Solving first and last-mile connectivity issues:

On the supply side of mass transit, providing service to a large percentage of the population and recovering its operational costs from often subsidized fares depends on the daily ridership. Access to public transportation, thus, must be improved for the wider population. Studies[16] show that one of the most pressing challenges facing public transportation today is the "first and last mile problem", which is the distance a commuter needs to travel from a transit stop to their destination or vice versa. Figure 13 gives some idea of the problem in Lahore city showing that a considerable proportion must take some

[15] *CITY at LUMS on LinkedIn: Research Thread on Mobility Informatics: By Using the GIS Network Analyst...* November 16 2022. Available at https://www.linkedin.com/posts/cityatlums_research-thread-on-mobility-informatics-activity-6998577424602947584-yqtZ?utm_source=share.

[16] Remix, "How cities can solve first and last mile problems" 8 February 2021.

other transport, like a van, etc., to reach the metro stations, which is a huge hurdle. Enhancing area coverage by *introducing new feeder routes, paratransit modes (by subsidizing private taxis or ride-hailing trips as an alternative to the government-run system), etc.,* can be a possible intervention to address the first and last-mile connectivity issue.

Figure 13a.
Transport Mode used to get to final destination (%)

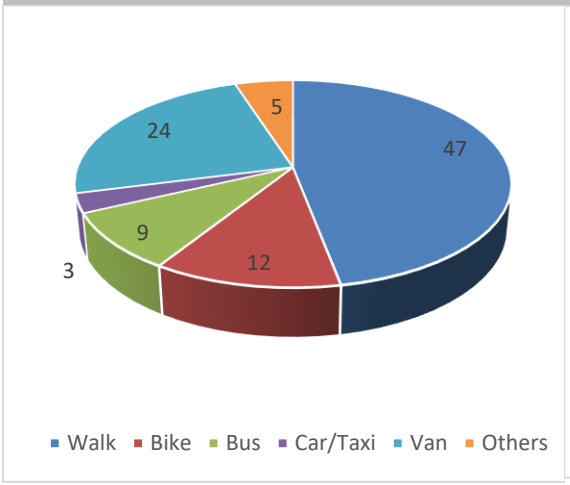
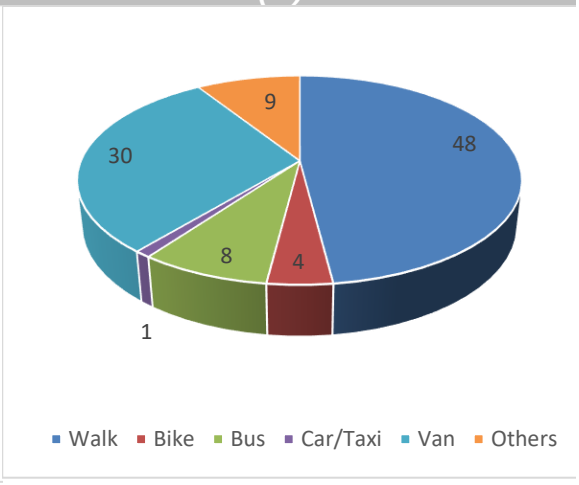


Figure 13b.
Transport mode used to reach final access to the metro bus station (%)



Source: Irem Batool, Muhammad Irshad and Muhammad Abid, "A Policy Move towards sustainable urban transport in Pakistan: Measuring the social, environmental and economic impacts of Lahore BRT system," *The Lahore Journal of Economics,* Vol. 25, No. 1, (Spring 2022).

c) Aligning Urban Land Use Policy- TOD Approach

Despite lower numbers of car users in cities, the highest infrastructural investment continues to be made in urban roads, of which signal-free corridors have recently become popular with city planners and managers. Such roads are primarily designed for cars and often do not provide safe commuting for most moving by public transport and NMT mode. Building more roads to deal with the growing congestion while neglecting to invest intellectually and financially in popular means of transport is not likely to yield desired results. Effective investment in transport infrastructure requires a review of existing land use regulations. Studies [17] show that in many developing cities, inappropriate land use regulations—for example, low floor area ratios, single-use zones, setback and backyard requirements, and minimum parking requirements—are obstacles to achieving compact, mixed-use, and transit-oriented development that can foster greater use of public and active modes. Therefore, new approaches to urban development and land use planning are necessary for investments and reforms in transport infrastructure and services. The Transit Oriented Development (TOD) approach is widely followed internationally, entailing the '15-minute city' concept, devised to remove spatial mismatches between housing and jobs.

2. Multimodal Freight Transport System

The New Economic Geography model (Fujita & Krugman, 2003) explains the system of cities to benefit from economies of scale capitalizing on an efficient and affordable transport network whereby the benefits accrued from the agglomeration economies are

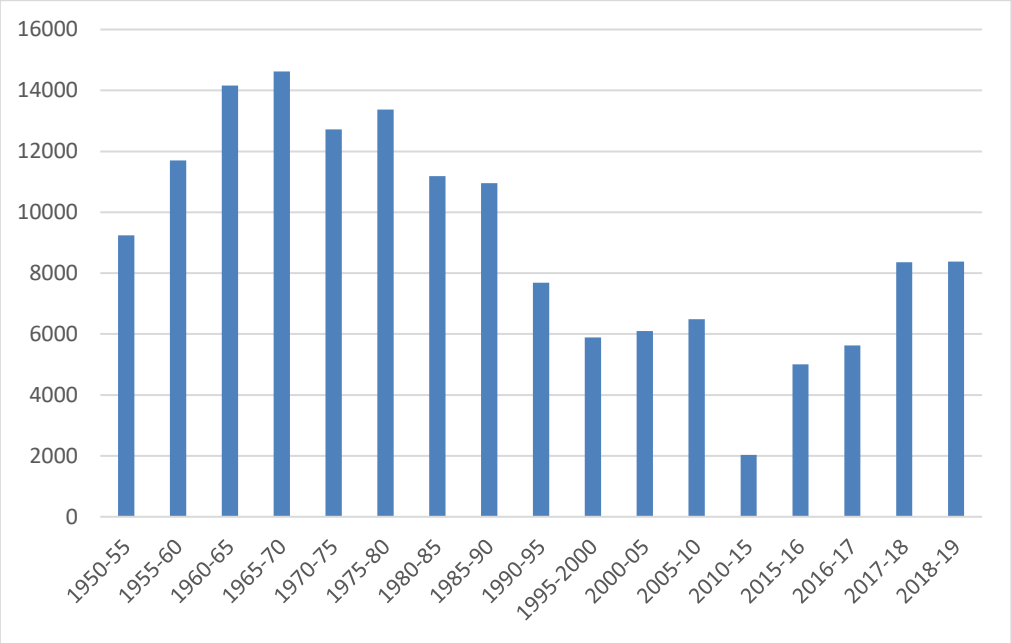
[17] Kamil Khan Mumtaz and Hina Shaikh, “A Framework for Affordable Housing in Pakistan”, International Growth Center, 13 August 2019

shared inexpensively. An operationally efficient and environmentally friendly freight transportation system requires adopting a multimodal system. Under a multimodal system, the rail sector would oversee heavy lifting for long distances, complementing trucking at both ends. An efficiently run rail freight system is generally not competitive with trucking for short distances i.e. below 300 kilometers (Sánchez-Triana et al., 2013); however, rail is far more competitive than road freight for long distances (over 500 kilometers).

a) Railway's share in freight:

Transport demand figures from the draft National Transport Plan 2020 described in NTRC (2022) Study place national freight demand at 195 billion ton-km in 2020, of which 95% is being moved through roads in trucks of different types. Factors for the declining share of railways in freight haulage are the cross-subsidization of passenger traffic from freight and the priority given to passenger service over freight movement. Poor investment and low priority accorded to railways have resulted in declining capacity to deal with the growing need for freight movement. In the 1950s, railways transported 9000–12000 tons of freight, over 86% of the total. Its freight movement remains under 10,000 tons; but with growing freight transport, this is less than 5% of the total demand. Figure 14 shows the average tonnage carried by the Pakistan Railways.

Figure 14 Tons carried by Pakistan Railway (000s)



b) Road transport of freight:

The situation in the road freight industry is also not very encouraging. The road freight industry is primarily owned by private individuals and operators. These are very small fleet owners except for a few organizations that own fleets of more than ten vehicles. A "Trucking Policy" was developed in 2009 to promote the formalization of the trucking sector as an industry and to encourage improvement in several practical and administrative aspects relating to vehicles and drivers, as well as compliance with loading limits and other safety legislation. These aspects have never been implemented. Most of the trucking industry firms in Pakistan belong to the informal sector (United Nations Industrial Development Organization et al., 2016). This segment gives the

trucking industry its fragmented shape, and it suffers from poor growth prospects and unhealthy competition.

c) Lack of access to finance

One of the major problems faced by this informal part of the sector is the lack of access to formal finance. These small operators cannot secure finance for increasing the number and capacity of their fleet from formal financial institutes and must opt for the informal market. The industry does not face any private competition issues regarding barriers to entry, as there is no barrier to entry or exit. However, the presence of a dominant government sector player, i.e., the NLC, and the alleged preferential treatment, exemptions in the form of taxes, etc. received by it create an anti-competitive environment for the private sector companies and hamper their growth. Although Pakistan has the lowest freight rates in the region due to the low investment and informality in the sector, these come with several compromises. Low levels of safety standards and inefficient transport times offset the private benefit and pose significant social costs in the form of accidents and emissions.

3. Cross-Cutting Intervention for Urban and Freight Transport

This section describes two cross-cutting interventions (low carbon fuels and switch to EVs) that can help reduce the environmental impact even with the BAU scenario.

a) Adoption of Low-Carbon Fuels

Table 2 describes how harmful Euro-2 fuel or compatible engines are to the environment, considering modern standards.

The case of India:
Bharat-IV (equivalent to Euro-4) standards were first implemented in 2010, fully enforced in 2017.
In 2017, India announced a complete switch to Bharat Stage-VI (equivalent to Euro-6) emission standard across the country from 2020.
On-board diagnostics (OBD) made mandatory for all vehicles for a stricter check on emissions.
Upgrades by oil refineries and auto manufacturers was required owing to no backward compatibility in the case of BS-VI vehicles.
Maruti Suzuki India Ltd. has announced the upgradation of its entire range of vehicles to meet the Bharat Stage-VI Phase II emission regulations.
India also introduced its Vehicle Scrappage Policy in April 2022.
Passenger vehicles older than 20 years and commercial vehicles older than 15 years to pass a “fitness and emissions test” to keep their registration.

Table 2 Comparing Fuels Standards

Fuel Standard	Sulfur, Parts per million (PPM)
Euro-1	1000
Euro-2	500
Euro-3	300
Euro-4	50
Euro-5 and Euro-6	30

Source: The AA "Limits to improve air quality and health," December 11, 2018.

Various stakeholders are involved in the implementation of better fuel standards:

- ***Oil Refineries:*** Pakistan adopted Euro 2 emission standards in 2012, which remain operational even after a decade. Pakistan is far behind the developed countries that is about to adopt Euro 7. Although, in June 2020, the government approved the decision to shift petrol and diesel from Euro-2 to higher quality Euro-5 standards, most of the oil refineries are still upgrading the plant to produce higher-quality fuel.
- ***Local Auto Industry*** also sought two years to switch over to Euro-5 fuel or discontinue existing models under production in Pakistan. However, the local auto manufacturers have shared no roadmap regarding discontinuing obsolete Euro-2-compliant passenger cars, motorcycles, and commercial vehicles. It seems that either the fuel standard upgrade decision was taken without involving these two important stakeholders on board, or they are taking advantage of the lax policy enforcement and deliberately polluting the local environment.
- ***Vehicle users*** need a vehicle replacement and scrapping policy simultaneously to avoid shocks.
- ***Old fleet:*** Fleet renewal, especially old buses and trucks, is a major obstacle in implementing upgraded fuel standards in the freight sector. Table 3 shows that trucks manufactured in 1981–1990 comprise over one-fifth (23%) of the total fleet, while the trucks manufactured in 1991–2000 are about 22% of the total trucks plying on the roads of Pakistan.

Table 3 Age Structure of Trucking Fleet

Year of Truck Manufacture	% of Total Fleet
< 1960	1
1961-1970	6
1971-1980	16
1981-1990	23
1991-2000	22
2001-2010	19
2011-2020	13
Total	100

Source: **Pakistan, Ministry of Communications, *NTRC Study* (see footnote 5)**

The age of these vehicles causes them to produce more emissions, which can be detected if there is some annual examination at the time of registration renewal. However, any such enforcement is a challenge. Compulsory technical inspections, which require payment of an annual token (vehicle tax), are not enforced due to a lack of capacity and testing facilities and equipment. A policy to address this issue has recently been developed (National Guidelines for Vehicle Licensing, 2021), but vehicle replacement would need to go hand-in-hand with fuel quality improvements.

b) Transition to Electric Vehicles

Transitioning to electric motorbikes is the most affordable and effective means of reducing emissions from urban transport. The low-cost and low-quality bikes currently plying on the roads increase emission levels and road accidents. Multiple factors like autonomous and quick mobility, easy parking, and affordability explain the preference for motorbikes and rickshaws in intracity travel. However, the rising number of on-road internal combustion engines of ⅔ wheelers poses an alarming threat to air quality, especially by enhancing the particulate matter content[18] in cities. The existing air pollution, especially from particulate emissions, on average reduces life expectancy by 5 years.[19] Reports highlight a potential gain in life expectancy of 6.8 years for urban residents by permanently reducing PM 2.5 emissions to the level of WHO standards. Therefore, a plan to mitigate the adverse climate and environmental impact by transitioning to e-bikes offers socio-economic benefits by reducing tailpipe emissions to zero. According to the current electricity mix, the emissions induced by generating the additional load to charge e-bikes would be about 70% lesser[20] than those emitted from the exhausts of motorbikes, and shifting electric grid loads to renewable resources could further reduce this cost.

The benefits of adopting electric vehicles are multifaceted. Besides producing zero tailpipe emissions, electric vehicles, in general, can also play a crucial role in reducing individual fuel costs and lowering national import bill. Under the recent Auto Industry Development and Export Policy (AIDEP) 2021-26, several incentives to encourage local manufacturing/assembling of electric vehicles have been offered. These include Customs duty of 1% (otherwise around 35%), waiving of Sales tax at import stage on EV specific parts, and 1% Sales tax on local sale (otherwise 17%). Similarly, completely built-up electric buses attract just 1% Customs duty on import. Local as well as international players in the automobile manufacturing sector like Pak-China Huazi Green Energy Pvt Ltd, Huaihai and XinjianJingyi Cheng Group have already ventured into establishing electric vehicle plant, showrooms and other activities in Pakistan[21]. Reportedly, Huaihai is investing USD 10 million in Punjab for manufacturing both two and four-wheeler vehicles.

The predominance of bikes regarding existing vehicle inventory at 77% with new registrations at 82% builds a convincing case that electrification should commence from here.
Similarly, the number of motor rickshaws has increased multiple folds during the last decade from 98,800 in 2011–12 to 788,100 in 2021–22.

[18] Solid and liquid particles suspended in the air, including hazardous elements like dust, pollen, soot, smoke, and liquid droplets.
[19] University of Chicago, Air Quality Life Index: Pakistan Fact Sheet, 2021
[20] "Climate and Environmental Crisis: A Ray of Hope through Uptake of Electric Bikes." 2022. *MHRC*. October 14. https://mhrc.lums.edu.pk/climate-and-environmental-crisis-a-ray-of-hope-through-uptake-of-electric-bikes/.
[21] Kalbe Ali, "*Chinese firm to establish electric vehicle plant in Pakistan*", Dawn, 15 September 2023. Available at https://www.dawn.com/news/1775984
Usman Ansari, "*Pak-China Automobile brand to display its first EV in Islamabad",* CarSpirit, 25 July 2023. Available at https://carspiritpk.com/pak-china-automobile-brand-to-display-first-ev-islamabad/

A recent study [22]on EV's market highlights the potential demand for small cars as opposed to available options which largely fall under the category of luxury vehicles and attract customers from high income group as the most sold EV in Pakistan is Audi E-Tron. The overall car market in Pakistan comprises of low-cost cars having an engine capacity of 1000cc or less. The study suggests that small spec vehicles, may succeed in Pakistan due to the lower capital cost. The dominance of two-wheelers' segment makes it the first contender for potential shift to electric means of transportation. As these are also popular in neighboring countries like Afghanistan, so they have a potential for export as well.

6. International Best Practices on Transport and Climate Financing in Pakistan

Decarbonization of the transport sector is contingent upon investments in the transport infrastructure. If the current investment does not facilitate the shift away from fossil fuel to high-occupancy clean technology in transportation, the odds are high that a fossil-fuel high emission future is locked in for Pakistan. Green transport solutions have several positive externalities, particularly valuable in the context of urban areas. However, governments and markets have historically, consistently failed to incorporate the full costs of fossil fuel-based traditional transport modes making them appear more lucrative and thus, preventing financing to be channeled to sustainable urban transport solutions. Long operational lifelines of green transport projects, multiple stakeholders and involvement of different tiers of government pose further challenges for changing government regimes facing constrained public finances and thus resorting to private sector investments for scaling up of the same (Please see Ang & Marchal (2013), Sectoral Guide: low emissions transport by GCF (2022) for further details discussed in this chapter)[23].

Funding in Pakistan for Green Projects

The provision of concessional finance is critical to achieving Pakistan's ambitious GHG emission reduction target. During 2016–19, Pakistan received USD 5.5 billion for climate-related projects, of which USD 3.4 billion was aimed at mitigation efforts (IMF, 2022). Some recent initiatives include issuance of a green bond of USD 500 million in 2021 for the hydro-power sector, collaboration with China's carbon emission trading scheme for 2021–2025 and VerraStandards which is the most widely used GHG crediting program globally.

Role of BOI & SBP

The Board of Investments (BOI)[24] lists the logistics sector as a priority investment sector and has identified three promising areas for investment in the transport sector: (a) air freight and transport, (b) trucking, and (c) urban transport.[25] To promote private sector participation in infrastructure projects, the development of the Bureau of Infrastructure Development BID has already been proposed. Appendix 6 describes different steps

[22] USAID, Pakistan: Electric Vehicles and Batteries Market Assessment, 06 August 2021, available at https://pdf.usaid.gov/pdf_docs/PA00XXDK.pdf

[23] Other sources include:
Energypedia, "Mobility Portal", 10 September 2022
Ali Ashar Jaffri, "The need for carbon market in Pakistan", *Pakistan Today* (May 21, 2023).
Appendix 5 discusses the global green financing barriers.

[24] BOI assists companies and investors who are investing or intend to invest in Pakistan as well as facilitates the implementation and operation of their projects.

[25] International Finance Corporation and Board of Investment. *Logistics Sector Profile Pakistan.*

taken by the BOI to facilitate investment in the transport sector. State Bank of Pakistan (SBP) played an important role in enabling an environment whereby financial institutions facilitate overall decarbonization by issuing Green Banking Guidelines in 2017 that identify green business facilitation as an 'emerging business'. Public transport is an identified area in infrastructure projects for the green finance portfolio of banks. The GBG also encourages banks to explore multilateral funding resources, for instance, by seeking accreditation under the Green Climate Fund (GCF) by the UN. The SBP signed an advisory agreement with IFC (World Bank Group) in 2018 to develop green banking in Pakistan. Pakistan is also a priority country for IFC.

Recommended Action Plan for mobilizing funds

It must be recognized that transport demand is low-price elastic, especially in the absence of a high-quality and safe public transport system. The limited ability of the masses to switch from private to public transport systems can only be managed by further supply-side regulations, ***zoning policies, and land-use planning like dedicated bus lanes***. This essentially implies a coherent effort whereby financing solutions are integrated into wider policy goals. These efforts should also be supplemented by improved coordination between Ministry of Finance and Ministry of Climate Change. Moreover, in the context of Pakistan, a better law-and-order situation and provision of security in the public transport system can also prove beneficial in increasing the uptake, hence facilitating the switch.

Going forward, Pakistan can implement the following range of instruments to garner the much-needed funds for decarbonization.

Action	**Advantages and Challenges**	**Timeline**
Taxing Carbon content/fuel taxes	Advantages • Does not require new capacity • Popular and simple to implement • Used for general and transport-specific projects • User-pays principle • Can be levied as an extension of existing fuel taxes Challenges • Hard to differentiate based on nature and mode of transport/vehicle. • Hard to align with urban strategies as they accrue to the national account and not the local	Can be implemented rather readily, do not require huge investments or capacity building

Vehicle (Road) Taxes	Advantages • Redistributive • Flexible based on engine size • Can encourage the switch to green transport modes	
Convert Pakistan's NDC 2021 into a guiding document for investors	• Include specific project financials, timelines, estimated cut in emissions, and their categorization in concessional or non-concessional climate finance	
Road pricing and/or Parking Levies[26]	• User-pays principle • Flexible to charge on access to certain spaces (e.g. parking lots), or time of the day, or type of vehicle, or congestion	Medium – long term due to lack of technical and institutional capacity
Develop Carbon Markets	Green projects can help maximize cash flows if carbon markets are developed, Participation in global carbon markets	
Nature-based debt swaps[27]	Potential problems include ownership of carbon stock (provincial after the 18th amendment) versus coordinating body with UNFCC is federal (MoCC)	

7. Conclusion

The role of the transport sector in the economy is well established, and so are the positive externalities that a thoughtfully developed, efficient, and environmentally friendly transport system brings forward particularly for green industrialization through low per unit emissions for workers' commute and goods' movement. The externalities exist in the form of (but are not limited to) better mobility and higher likelihood of economic participation, especially of vulnerable groups, improved regional connectivity that facilitates trade, reduced congestion on roads, reduced travel times, and better air quality

[26] Widely used in Stockholm, London, and Singapore
[27] Recently, the Sindh government earned carbon credits for the mangrove forests and received first trench of USD 14.75 million

and environment. However, establishing a system that promulgates these benefits is a formidable challenge owing to the involvement of multiple layers of government, overlapping domains and policies, a diverse group of stakeholders with often competing interests, and a general myopic approach that ignores the long-term negative repercussions the current production and consumption patterns have on the environment. These realities make decarbonization of the transport sector a difficult but essential task, considering the exacerbating local environmental challenges in major cities, Pakistan's high-risk position to climate threats, and the huge scope of sustainable development in the transition to green transport.

There is a dire need for well-coordinated efforts by all relevant stakeholders and the continuation of these efforts irrespective of changes in government. The policies that are in place need implementation mechanisms and strict monitoring to achieve the goals stated in NDC, 2021. For decarbonization of the transport sector, first and last mile connectivity problems must be solved to encourage the masses to shift to more environment-friendly public transport. Urban policies need to be cognizant of better land use and must be based on transit-oriented development. Electrification of vehicle systems needs not just targets of sales, but also infrastructure that supports EV operating smoothly. This involves better scraping policies to encourage the shift because getting rid of old vehicles is a major barrier. Switching to better quality fuels is another cross-cutting intervention which also needs support from (and to) oil refineries, auto mobile manufacturers as well as strict monitoring mechanisms to identify and cancel registrations of vehicles that fail to comply with the fuel quality standards. In addition to all these specific actions, creating and spreading awareness in the masses so that they switch to and demand green modes, providing safety in public and NMT modes, as well as alignment of financing institutions to mobilize funds in the right (green) direction is indispensable to reaching the larger goals of a decarbonized transport sector in Pakistan.

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Appendix 1: Information on Bus Rapid Transits in Pakistan

	Metro Bus Multan[28]	**Metro Bus Transit System Ferozepur Road (Corridor-I) Lahore"**[29]	**Metro Bus Rawalpindi**[30]
Launched by	Multan Development Authority (MDA)	Traffic Engineering & Transport Planning Agency (TEPA), LDA Lahore	Rawalpindi Development Authority (RDA)
Executed by	Multan Development Authority (MDA)	Traffic Engineering & Transport Planning Agency, Lahore Development Authority, Lahore.	Rawalpindi Development Authority (RDA)
Project Launched	2014-15	2012-13	2013-14
Approved at Cost	PC-I cost of Rs 28,901.79 million	PC-I cost of Rs 30,824.79 million	PC-I cost Rs 44,840 million
Tentative Completion Period	Nine months	One year	11 months
Funded by	Government of Punjab	Government of Punjab	Government of the Punjab and the Federal Government equally
Completed in	January 2017	February 2013	July 2015
Total cost incurred	Rs 28,377.507 million	Rs. 29,896.96 million	Rs 40,832.90 million
of Initial Environmental Examinations (IEE), **IEE**	Not conducted	Not conducted	Not conducted
Environmental Impact Assessments (EIA)	Not conducted	Not conducted	Not conducted
Current Status	At the time of the audit report, the Government was paying a subsidy against a nominal ticket fee of Rs 20, and the number of passengers commuting between the last four stations of Bosan Road was extremely low.	According to the audit report, the project is viable and sustainable only if a huge amount of subsidy is provided by the Provincial Government.[31]	According to the audit report, the project was found to be viable only if a subsidy was provided by the Government because only a nominal ticket fee of Rs 20 was being charged, and the Government was paying a subsidy of Rs 54.19 per rider

[28] https://agp.gov.pk/SiteImage/Policy/1-SAR%20Metrobus%20Multan.pdf
[29] In the light of Rule 8 of the Second Schedule of Delegation of Financial Powers Rules, 2006, ECNEC is the final approving authority for any provincial project costing more than Rs 10,000 million. However, this project, which otherwise required ECNEC approval, was split into nine packages (I to IX) and each package was got approved separately from the PDWP to avoid approval from ECNEC
[30] https://agp.gov.pk/SiteImage/Policy/6-PAR_MTBS_Pindi.pdf
[31] https://agp.gov.pk/SiteImage/Policy/1-PAR%20MTBS%20Lahore%20Approved.pdf

Appendix 2: Logistics Performance Index

The international Logistics Performance Index (LPI) score[32] uses six key dimensions to benchmark countries' performance and also displays the derived overall LPI index. The scorecard allows comparisons with the world and with the region or income group on the six indicators and the overall LPI index.
LPI is the weighted average of the country scores on the six key dimensions:

1. Efficiency of the clearance process (i.e., speed, simplicity, and predictability of formalities) by border control agencies, including customs,
2. Quality of trade and transport-related infrastructure (e.g., ports, railroads, roads, information technology),
3. Ease of arranging competitively priced shipments,
4. Competence and quality of logistics services (e.g., transport operators, customs brokers)
5. Ability to track and trace consignments,
6. Timeliness of shipments in reaching destination within the scheduled or expected delivery time.

[32] https://lpi.worldbank.org/international/scorecard/column/C/PAK/2018/C+VNM+2018

Appendix 3: Transport Landscape – Governments and Bodies[33]

Federal	Planning Commission Cabinet Committee on Transport (relevant Federal Ministries, chaired by the Prime Minist Advisory Committee on Transport (relevant Federal, Provincial & Territorial Ministries and National Trade and Transport Facilitation Committee Cabinet Secretariat Civil Aviation Authority Ministry of Climate Change Pakistan Environmental Protection Agency Pakistan Climate Change Council Pakistan Climate Change Authority Pakistan Climate Change Fund National Steering Committee (Chaired by Special Assistant to the Prime Minister on Climate Change) Mitigation Working Group Adaptation Working Group Global Change Impact Studies Center (GCISC) Ministry of Communications National Highway Authority Construction Technology Training Institute National Highways and Motorway Police National Transport Research Centre Ministry of Energy (Petroleum Division) Oil and Gas Regulatory Authority Ministry of Finance, Revenue and Economic Affairs Ministry of Industries and Production Engineering Development Board Ministry of Inter-Provincial Coordination Ministry of Interior Ministry of Maritime Affairs Government Shipping Office Port Authorities Pakistan National Shipping Corporation Directorate General Ports and Shipping Ministry of Planning Development & Special Initiatives On behalf of the GOP in charge of the China-Pakistan Economic Corridor Planning Commission of Pakistan National Initiative for Sustainable Development Goals Public Sector Development Programme Ministry of Railways Pakistan Railways Ministry of Science & Technology Pakistan Standards and Quality Control Authority

[33] Various websites of official bodies

	National Committee on the Establishment of Carbon Markets
Provincial	Departments Responsible for: Environment and Climate Change, Urban and Rural Development, Works and Transport Traffic Engineering and Planning
Local	Municipal and Metropolitan Authorities

Appendix 4: Initiatives for green transport across the world[34]

Road sector initiatives, both for light- and heavy-duty vehicles, either focus on both efficiency (Improving) and promoting zero-emission vehicles (improving and shifting) or exclusively on electrification (which tacitly includes fuel cell electric options, in many cases). Some examples from around the world include:

- The ZEV Transition Council, led by the UK COP26 presidency and supported by the International Council for Clean Transportation, under whose auspices various signatories have set pledges under the International ZEV Alliance. Council members which include California State, Canada, Denmark, European Commission, France, Germany, India, Italy, Japan, Mexico, Netherlands, Norway, Spain, South Korea, Sweden, United Kingdom and United States
- The Electric Vehicle Initiative, under the Clean Energy Ministerial, has 16 member countries and the International Energy Agency as the secretariat. The members include Australia, Brazil, Canada, Chile, China, Denmark, European Commission, Finland, France, Germany, India, Indonesia, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Saudi Arabia, South Africa, South Korea, Spain, Sweden, United Arab Emirates, United Kingdom, and the United States
- EV 100, led by ClimateWorks, has launched a Drive Electric Campaign[35], under which over 100 companies have committed to 100% electrification of road transport by 2030. Other initiatives focusing on more sustainable road transport include the ZEV Transition Counsil (members include (California, Canada, Denmark, European Commission, France, Germany, India, Italy, Japan, Mexico, Netherlands, Norway, Spain, South Korea, Sweden, United Kingdom & United States) and C40's Green and Healthy Streets campaign (members include Paris, London, Los Angeles, Copenhagen, Amsterdam, Auckland, Austin, Barcelona, Berlin, Bogota, Cape Town, Heidelberg, Jakarta, Madrid, Medellin, Mexico City, Milan, Oslo, Quito, Rio de Janeiro, Rome, Rotterdam, Santiago, Seattle, Seoul, Tokyo, Vancouver, Warsaw, Birmingham, Honolulu, Liverpool, Oxford, Greater Manchester, Santa Monica and West Hollywood).
- The major initiatives and pledges to promote and deploy zero-emission heavy-duty vehicles include CALSTART's Global Commercial Drive to Zero Campaign[36] and the ACEA-PIK Joint Statement on the transition to zero-emission road freight transport which was signed by European Automobile Manufacturers' Association (ACEA) and the Potsdam Institute for Climate Impact Research (PIK)

In addition, the members of the Global Fuel Economy Initiative focus their activities both on vehicle efficiency and promoting zero-emission vehicles. The members of Global Fuel Economy Initiative include FIA Foundation, UNEP, UC Davis Institute of Transportation Studies, IEA, International Council on Clean Transportation, and International Transportation Forum.

[34] https://www.iea.org/reports/transport
[35] Information of member companies and the initiative can be found at https://www.driveelectriccampaign.org/partners/
[36] Information on pledge partners can be found at https://globaldrivetozero.org/about/pledge-partners/

Appendix 5: Global Green Finance Scenario and Barriers to Green Finance

Global Green Financing: Facts

- Sustainable transportation, with full cost and benefit accounting, can provide savings of USD $70 trillion by 2050 globally.
- According to OECD estimates, USD $ 2 trillion per annum will be required to transform the transport sector through 2030 to achieve climate and development objectives.
- Developing countries receive less than 40 % of the global share of infrastructure investments
- Transport is the largest recipient of public sector climate investments globally
- Renewable energy gets the maximum funds from the private sector climate finance, and green transport received only 15 %
- Green bonds issued in 2019 exceeded $ USD 2, and approximately a quarter was allocated to transport sector projects.
- Globally, the private sector contributes to 61 % of total investment in transport in high-income countries and 44 % in low-middle-income countries.
- Public-private partnerships (PPP) have been increasing in developing countries since 2000, and the transport sector is the largest recipient of PPP investments.

Source: United Nations, *Fact Sheet, Financing Sustainable Transport,* 14-16 October 2021, (Beijing)

Barriers to Green Finance

- Increased demand for private, motorized transport owing to rapid urbanization and income growth.
- Systematic bias towards providing funds for unsustainable transport modes, i.e., urban highways, flyovers, and private vehicles, by different stakeholders.
- Capacity constraints at the institutional level to procure and manage funding
- Lack of coordination among fragmented tiers of government and concerned bodies (different modes, regions, infrastructure vs. operations, pricing versus service provision)
- Hesitation by the masses to new financing methods
- Conventional financial systems still favor profits over sustainability; hence, the major chunk of available capital is channeled to sectors and corporate projects not aligned with 'net-zero' targets of the world.

Source: Energypedia, "Financing Sustainable Urban Transport", 10 December 2014

Best practices for Transport project finance

Following financing methods have been used worldwide to finance mega transport projects:

- Public-private-partnerships (PPP) for BRT systems, rail links, and shared used vehicle and bicycle systems
- Land-value-capture (LVC) tools to finance green projects like metro and rails.
- Loans, grants, loan guarantees from national or international bodies (bilateral or multilateral institutions) or environment, social, and governance (ESG) funds, at lower interest rates, to leverage private investment in large-scale rail or metro projects, traditionally most of the fundings acquired has been channeled into road building which does not always align with sustainable urban transport.

- Green bonds to attract institutional investors
- Subsidies in the short term to encourage the transition. Some favorable avenues for targeted subsidies include innovative solutions, support in production, offsetting initial capital costs, and compensation for redesign of network infrastructure biased towards fossil-fuel-based road transport
    - However, subsidies must be supplemented by accountability measures to ensure they are not misused or mistargeted. Differentiated products, i.e., pricing mechanisms and different tax rates, often eliminate the need for subsidizing operations.
- Involving the private sector in managing large-scale projects often helps improve the efficiency of operations by increasing healthy competition. Performance-based contracts are a good tool to ensure transparency in the private sector.

Source: Organization for Economic Cooperation and Development, Mobilising Private Investment in sustainable transport infrastructure, (2013).

Appendix 6: Incentives by Board of Investment (BOI) for boosting investment in the Logistics, Electric Vehicles, and Automobiles sector[37]

Logistics	***Electric Vehicles***	***Automobile and Auto-parts***
• Custom Duty Exemption on import of Aircraft & related items • No Sales Tax on the supply/import of goods for setting up workshops and Greenfield airports. • Exemption from Advance Tax on import of Aircraft & related items. • No Customs duties on the import of Ships other floating and specialized crafts. • Zero percent Sales Tax on supply, repair, and spare parts for ships. • Sales tax exemption on import of containers for cargo transportation. • Exemption of Advance Tax up to 2030 on import of Ships and other floating crafts. • Tax credit available for shipbuilding business. • Presumptive Taxing for ships/vessels flying the Pakistani flag. • The shipping industry is allowed to avail Long Term Finance Facilities. • Customs duty exemption on Imports for warehousing & transshipment businesses at Gwadar Free Zone Area. • Low Tax rate on Income from Freight related Services.	• There is no customs duty on the import of plants and machinery for the manufacture of EVs. • No Sales Tax on imports of CKD kits of EVs. • Low rate of Customs Duty on import of EV CKD and specific Parts. • Concessionary rate of Customs duty on import of Completely Built EV Units (CBUs). • Low Customs duty on import of Electric Vehicle Chargers. • VAT Exemption on CBU/CKD import of certain types of Electric Vehicles. • Exemptions of Custom duty on Inputs for manufacturing EVs.	• Reduced Customs duty on import of CKD kits of small cars up to 850cc. • Exemption from Value Added Tax (VAT) on small cars. • There is no Advance tax on the import of Motor vehicles up to 1000 cc. • Low Customs Duty on Import of Hybrid Vehicles Parts. • Low Customs Duty for Vehicle Assembly (New Make or Model). • Low custom duties on Automotive Parts of Vehicles. • Low Custom Duties on Vehicle Assembly (TBS Regime).

[37] https://invest.gov.pk/incentives-database?language_id=en