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HIGH VOLUME TRANSPORT
APPLIED RESEARCH

# Country scoping of research priorities on low-carbon transport in Pakistan

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# Table of Contents

## Appendices



## List of Tables



## List of Figures



## Acronyms

| | |
|---|---|
| AASGI | Accessible, Affordable, Safe, Green and Inclusive |
| ADB | Asian Development Bank |
| CAREC | Central Asia Regional Economic Cooperation |
| CBO | Community Based Organisations |
| CCRD | Centre for Climate Research & Development |
| CDKN | The Climate and Development Knowledge Network |
| CPEC | China-Pakistan Economic Corridor |
| COMSATS | COMSATS University Islamabad |
| DFID | Department for International Development |
| ECN | Energy Research Centre of the Netherlands |
| EDB | Engineering Development Board |
| EEG | Energy and Economic Growth Applied Research Programme |
| GCISC | Global Change Impact Studies Centre |

| | |
|---|---|
| GDP | Gross Domestic Product |
| GOP | Government of Pakistan |
| HVT | High Volume Transport Applied Research Programme |
| IISD | International Institute for Sustainable Development |
| IMC | IMC Worldwide |
| IWT | Inland Water Transport |
| JICA | Japan International Cooperation Agency |
| KfW | Kreditanstalt fuer Wiederaufbau |
| km | kilometer |
| LCT | Low carbon transport |
| LIC | Low income Country |
| MIC | Middle Income Country |
| NDC | Nationally Determined Contributions |
| NHA | National Highway Authority |
| NHSO | National Highway Safety Ordinance (2000) |
| NISDG | National Initiative for Sustainable Development Goals |
| NTRC | National Transport Research Centre |
| NUST | National University of Science and Technology |
| OPM | Oxford Policy Management |
| PCD | Project Closing Date |
| PITCO | Pakistani Energy Sector Company |
| PPP | Public Private Partnership |
| PSDP | Public Sector Development Programme |
| RSPN | Rural Support Programmes Network |
| SASEC | South Asia Subregional Economic Cooperation |
| SDG | Sustainable Development Goals |
| TA | Technical Assistance |
| UET | University of Engineering and Technology |

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**Abstract**

The UK Department for International Development initiated under its Energy and Economic Growth and High Volume Transport applied research programmes scoping studies to determine research priorities in low-carbon transport in low- and middle-income countries in Asia and Sub-Saharan Africa, including Pakistan.

The overall objective of these scoping studies was to identify priority research projects that could help advance the transition to a low-carbon transport system in low-and middle-income countries, including Pakistan. The studies identified key challenges in transport and energy and research gaps in the target countries and determined a prioritised research agenda that can facilitate the transition to low-carbon transport.

| | |
|---|---|
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# EXECUTIVE SUMMARY

Pakistan has a population of approximately 210 million people, of which about 36% live in cities. Urbanisation is expected to reach 50% by 2050. Transport – both within and between cities – plays a significant role in the socio-economic development of the country. The transport sector is responsible for about 14% of Pakistan's gross domestic product and 5% of employment. In total, the sector handles an estimated 140 billion tonne-km of inland freight and 540 billion passenger-km. Due to rapid population growth, economic development and urbanisation, it is expected that annual passenger-km will raise to 1,000 billion passenger-km per annum by 2030.

The main transport modes available in the country are road and highways, urban multimodal, railways, marine transport and aviation. The 2018 National Transport Policy of Pakistan also identifies inland waterways as a transport mode. Non-motorised transport plays an important role in both urban local and rural transport. Roads are the predominant mode of transport in Pakistan, accounting for over 90% of passenger and freight traffic. In 2018, there were over 23.5 million registered vehicles in Pakistan, which is an increase of 170% over a five-year period. Insufficient investment in upgrading rail infrastructure, rolling stock, signalling and telecommunications has caused a significant decline in freight and passenger services.

GHG reduction is not yet the driving factor of transport related policies (other than climate change policies). However, reduction of air pollutant emission and improved air quality is generally part of such policies, as is climate resilient transport infrastructure.

The UK Department for International Development initiated under its Energy and Economic Growth and High Volume Transport applied research programmes a scoping study to determine research priorities in low-carbon transport in low- and middle-income countries in Asia and Africa, including Pakistan. The overall objective of the study was to contribute to the transition to a low-carbon transport system in low- and middle-income countries in Asia and Africa by meeting research needs and enhancing knowledge and capacity in the areas of transport and energy. The study identified key challenges in transport and energy, and research gaps in the target country, and determined a prioritised research agenda that can facilitate the transition to low-carbon transport.

This report relates to the low-carbon transport scoping carried out in Pakistan. From 8th to 13th December 2019, a scoping mission was undertaken to Islamabad to identify priority research areas related to low-carbon transport. The scoping exercise included semi-structured interviews, a workshop and literature review. In total 20 stakeholders were consulted, of which nine were from the government (including government-controlled research centres), five from international development partners (including implementing partners), one each from industry and NGOs, and three from other university research institutes.

Based on the scoping exercise, this report recommends five research themes, including relevant research questions:

**Building a credible transport emission baseline and identifying quick wins**

There is limited availability of actual emission data in Pakistan, or it is unreliable and at times unwanted if it does not support a specific agenda. An air quality monitoring system established in 2008 stopped functioning in 2012 due to a lack of funding. This combined with the absence of vehicle emission testing, results in a lack of baseline data to determine actual emission levels of vehicles types (often modified) and along transport routes, as well as actual (location-specific) impact on the ground of any measures taken.

Research to build a credible transport emission baseline could support the Government of Pakistan to update the GHG inventory, which was based on 2012 data, with more recent data and help standardise the methods for developing the inventory with international best practice. The research project could

also support the revival and/or introduction of an air quality monitoring system and vehicle emission testing.

- Compare the Government of Pakistan's current approach to developing a GHG inventory with international best practice.
- Using international best practice, measure transport-related emissions from vehicles, focusing on main routes, urban centres and the shipping industry.
- Based on transport and traffic models, and on economic development projections, build future transport emissions scenarios.
- Identify trends related to the transport sector and inform policy makers on the potential options to achieve significant reduction.

**Integrating the freight sector with rail**

Pakistan's freight industry is fragmented and unregulated, with many small operators and owners. It is dominated by old, locally produced trucks, which frequently do not comply with vehicle or emissions standards. Pakistan's railway system is poorly utilised, carrying only about 5% of goods and passengers.

- Explore options to integrate the freight sector with rail.
- What policies and investments are required to make the railway system a more attractive option?

**Transitioning to electric motorbikes**

Motorbikes are the most affordable and effective means of passenger transport, especially in rural areas. However, the low-cost/low-quality bikes on the road increase emission levels and road accidents. While some motorbikes are electric – converted by a locally available kit – most continue to use petrol. The high cost of electricity in Pakistan makes the conversion to electric bikes and vehicles less attractive. Electric buses are also not widely deployed, as they are seen as costly, and the lifetime costs and benefits are not fully understood by all local decision makers, including the transport private sector.

- What incentives and mechanisms are required to gradually replace motorbikes with electric motorbikes?
- Explore business opportunities for a local electric motorbike industry. What is the potential to expand the electric vehicle industry to 3-wheelers and small 4-wheelers? What technical skills, training and technological transfers are required?

**Fleet renewal and fuel quality improvements**

Pakistan has a large number of old vehicles on the road with high emissions, especially old buses and old trucks. Generally, bus fares (dictated by government) and cost of freight are too low to make investment into a more modern fleet viable. Enforcement is also a challenge. Compulsory technical inspections, which require a payment of an annual token (vehicle tax), are not enforced due to lack of capacity and testing facilities and equipment. However, a policy to address this issue is under development (DRAFT National Vehicle Licencing Guidelines).

Vehicle replacement would need to go hand-in-hand with fuel quality improvements. Pakistan has adopted Euro 2 emission standards, but implementation is still ongoing, especially on the diesel side (trucks and buses). The old vehicle fleet would not be compatible with higher-quality fuel, and the petroleum industry has barely achieved Euro 2 standard, and even that is compromised by (deliberate or accidental) contamination. There are plans to aim for the Euro 4 standard, but this will require significant investment into refining capacity and renewal of the aging fleet of vehicles. Currently, any imported Euro 4 or Euro 5 vehicles have issues with the quality of fuel, which clogs catalysts forcing their removal.

- Explore options to incentivise gradual fleet renewal, such as gradually increasing vehicles taxes for old vehicles and carbon taxes for high polluters, introducing Green Zones that are out of limits for high polluters, enforcing technical inspections and emission standards, and establishing incentives to buy lower-emission vehicles.
- Identify opportunities to revise and enforce the existing Trucking Policy to increase efficiency and reduce emissions in the freight sector.
- What is the potential for government – having a large fleet of vehicles – and schools to pilot modernization?
- What steps are required for fleet renewal to go hand-in-hand with upgrading to higher fuel standards (Euro 4), and to improve the capacity to test and enforce vehicle & emission standards?

**Converting to electric buses**

The public urban transport systems in Pakistani cities are inefficient or non-existent, relying on a system of low capacity (mini)buses inappropriate for a rapidly growing urban population. However, a number of bus rapid transit (BRT) and mass rapid transit (MRT) systems have been implemented in recent years, including Karachi Green Line, Multan Metrobus, Lahore Metrobus, Rawalpindi-Islamabad Metrobus, TransLahore BRT and Lahore Metro, which are all operational. Buses run predominately on diesel, which has higher emissions than other systems. Electric buses are perceived to be too expensive and inadequate for various reasons, most of them not backed by facts.

- Examine the costs and benefits of bulk purchasing electric buses, i.e. taking a broader look when purchasing or renewing buses across the country, rather than a project- or organisation-based approached to reducing unit costs.
- What technological upgrading and installations are required along BRT routes, motorways, schools and at government buildings to enable an electrified bus system?
- What incentives would be most effective in attracting private sector participation?

# 1. Introduction

## 1.1 Background

The United Kingdom's Department for International Development's (DFID) High Volume Transport (HVT) and Energy and Economic Growth (EEG) applied research programmes share common elements regarding transport and energy. IMC Worldwide (IMC) leads the HVT programme, while Oxford Policy Management (OPM) leads the EEG programme.

The EEG research programme examines links between energy and economic growth, working closely with policy makers in Sub-Saharan Africa and South Asia to build more sustainable, efficient, reliable and equitable energy systems. EEG research areas cover efficient and productive energy use, reliability, renewable energy and grid access.

In contrast, the HVT research programme aims to make transport safer, greener, more affordable, accessible and inclusive in low-income countries (LIC). The HVT research priority areas include climate mitigation and adaptation, inclusion, gender and road safety, policy and regulation, technology and innovation, fragile and conflict-affected states and research and uptake and capacity building.

The two programmes have joined forces to undertake a scoping exercise to examine low-carbon transport (LCT) and energy research priorities in the low- and middle-income (LIC/MIC) countries of Bangladesh, Nepal, Pakistan Uganda and Zambia. This joint IMC/OPM scoping exercise will maximise commonalities between the HVT and EEG programmes.

## 1.2 Objectives

The overall objective of the transport scoping exercise is to contribute to the transition to LCT in LIC/MIC in Asia and Sub-Saharan Africa by meeting research needs and enhancing knowledge and capacity in the areas of transport.

The transport scoping exercise will identify key challenges in transport and energy, and research gaps in the target country, and determine a prioritised research agenda that can facilitate the transition to LCT.

The follow key questions will guide the scoping exercise in each country.

1. What are the key challenges to LCT in each country?
2. What type of research activities are being undertaken to assist address these challenges?
3. Which actors/organisations/research institutes are best placed to undertake this research?
4. Who are the main beneficiaries of such knowledge/research?

## 1.3 Research needs matrix

Sustainable mobility can be defined as **Accessible, Affordable, Safe, Green and Inclusive (AASGI**). The HVT Programme developed a matrix based on these key elements of sustainable mobility which lists the main actions or 'enablers' that allow these key elements to be achieved in practice.

The AASGI matrix (see Table 1) is used in this scoping exercise to categorise transport knowledge gaps and prioritise transport research needs in the five countries. It identifies which key elements of sustainable mobility require further research and capacity building.

Table 1: AASGI Matrix

| Key Enablers | Accessible | Affordable efficient | Safe | Green | Inclusive |
|---|---|---|---|---|---|
| **Policy, planning and regulations**<br>*Evidence based policy formulation and promulgation. Proactive, equitable and informed planning, and regulation of transport services.* | | | | | |
| **Finance and economics**<br>*Access to infrastructure finance including private finance through Public-Private Partnerships (PPP) and similar structures. Understanding of economics around specific transport challenges* | | | | | |
| **Governance and Institutions**<br>*Institutional changes that lead to improved capacity and efficiency, understanding and improving governance structures, and influencing behavioural change e.g. through the anthropology perspective.* | | | | | |
| **Technology**<br>*Access to innovation and technology, and their impact on transport.* | | | | | |
| **Data**<br>*Application, sources, and importance of big data in providing evidence for improved transport services.* | | | | | |
| **Operations, service and management**<br>*Including day to day activities in public transport provision excluding construction of capital infrastructure.* | | | | | |
| **Infrastructure**<br>*Including provision of physical assets, construction and engineering.* | | | | | |

## 1.4 Country Focus

The HVT/EEG collaboration will focus on Pakistan, Bangladesh, Nepal, Uganda and Zambia. In addition, work will be undertaken in China and India that will complement this study.

The current report relates to the scoping carried out in Pakistan in December 2019.

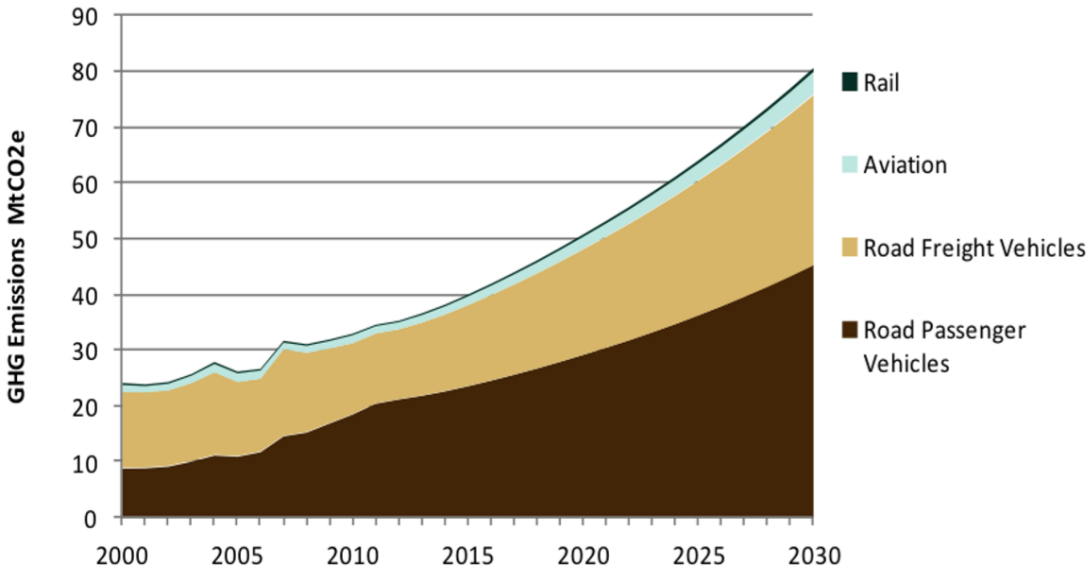
# 2. Transport Sector Context

Pakistan has a population of approximately 210 million people, of which 76 million live in cities. Transport both within and between cities therefore plays a significant role in the socio-economic development of the country (Ministry of Planning, 2018). The transport sector is responsible for about 14% of Pakistan's gross domestic product (GDP) and 5% of employment. In total, the sector handles an estimated 140 billion tonne-km of inland freight and 540 billion passenger-km (IISD, 2016).

The main transport modes available in the country are roads and highways, urban multimodal, railways, marine transport and aviation. Although the 2018 National Transport Policy of Pakistan identifies inland waterways as a transport mode with potential for development, this is currently limited to ferry crossings. Non-motorised transport plays an important role in both urban local and rural transport.

According to a study by the International Institute for Sustainable Development, the Centre for Climate Research & Development (COMSATS University), the Energy Research Centre of the Netherlands and PITCO Pakistan, the transport sector contributed to roughly 11% of Pakistan's emissions in 2012. **Error! Reference source not found.** presents projected transport GHG emissions b y source up to the year 2030. Emissions are expected to rise by 128% between 2012 and 2030 (IISD, 2016).

Figure 1: Transport Emissions by transport Mode (Mt CO2e) (IISD, 2016)




## 2.1 Key Trends

Pakistan has a growing semi-industrialised economy that relies on manufacturing, agriculture and remittances (i.e. money sent home by migrants from Pakistan working abroad). Since 2005, GDP has had an annual average growth of 5%, which could reach 5.5% in 2020 (Trading Economics, 2019). However, this is not enough to keep up with the rising number of people, which is expected to reach 300 million by 2050. Urbanisation has exceeded 35% and is expected to be 50% by 2050 (Ministry of Commmunications, 2018).

In 2018, there were over 23.5 million registered vehicles in Pakistan, which is an increase of 170% over a five-year period (2013 to 2018). The number of motorcycles increased by 190% in the same period, and motorcycle rickshaws by 200% (Minsitry of Communications, 2019).

## 2.2 Key Sector Entities

According to the National Transport Policy of Pakistan (2018), responsibilities for the planning and development of transport infrastructure are divided among several ministries. In addition, federal, provincial and municipal agencies are involved in the transport sector. While responsibilities are fragmented, some key actors with respect to LCT in Pakistan include:

On the federal side, the Ministry of Climate Change, including the Pakistan Environmental Protection Agency, is ultimately in charge of climate change policies in Pakistan. The Ministry of Planning Development & Special Initiatives is in charge of the National Initiative for Sustainable Development Goals, which has the mandate to ensure early institutionalisation of SDGs and to provide coordination and advisory to ministries and line departments. The Ministry of Planning also houses the Planning Commission of Pakistan, which is involved in in all planning in Pakistan, including LCT measures. The Ministry of Communications, under which, for example, the National Highway Authority falls, also incorporates the National Transport Research Centre, which carries out significant research with respect to LCT. The Engineering Development Board, under the Ministry of Industries and Production, is in charge of setting standards and ensuring the quality of vehicle technology. Pakistan Railways, which falls under the Ministry of Railways, is in charge of all rail initiatives.

On the provincial and territorial side, there are Departments responsible for Environment and Climate Change. Responsibility was moved to the provincial and territorial level only in recent years, and there is reportedly scope for improved coordination between the various agencies and the Federal level. Also, vehicle registrations fall under the provinces and territories, and it has been reported that standards across Pakistan vary significantly, allowing old and inefficient trucks to register in one province but operate also in provinces with higher (emission) standards. Provinces and territories are also in charge of Urban and Rural Development, as well as Works and Transport, and hence they lead the urban mass transport initiatives, including BRT and MRT schemes.

There are, however, several other actors that have a role either in implementation or implementation of transport – including LCT – projects. The longlist of stakeholders in LCT in Pakistan is as follows:

Federal:

- Cabinet Committee on Transport (relevant Federal Ministries, chaired by the Prime Minister)
- Advisory Committee on Transport (relevant Federal, Provincial & Territorial Ministries and Divisions)
- National Trade and Transport Facilitation Committee
- Cabinet Secretariat
    - Civil Aviation Authority
- Ministry of Climate Change
    - Pakistan Environmental Protection Agency
- Ministry of Communications
    - Construction Technology Training Institute
    - National Highway Authority
    - 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
  - Capital Development Authority (Islamabad)
- Ministry of Maritime Affairs
  - Government Shipping Office
  - Port Authorities
  - Pakistan National Shipping Corporation
- Ministry of Planning Development & Special Initiatives
  - On behalf of GOP in charge of the China-Pakistan Economic Corridor
  - National Initiative for Sustainable Development Goals
  - Planning Commission of Pakistan
  - Public Sector Development Programme
- Ministry of Railways
  - Pakistan Railways
- Ministry of Science & Technology
  - Pakistan Standards and Quality Control Authority

Provincial & Territorial:

- Departments Responsible for:
  - Environment and Climate Change
  - Urban and Rural Development
  - Works and Transport
- Municipal and Metropolitan Authorities

## 2.3 Policy context

GHG reduction is not a significant element of most of the policies affecting the transport sector, other than climate change policies. However, air pollutant emission reduction and improved air quality is part of these policies (especially recent policies), as is climate resilient infrastructure.

The National Climate Change Policy (2012) addresses the impact of climate change by promoting the development and adoption of environmentally friendly transport technologies and fuels, as well as other carbon reduction strategies. The National Transport Policy of Pakistan (2018) guides the overall development of the transport sector in the mid- to long-term. Boxes 1 and 2 below provide relevant excerpts from these policies.

The National Environment Policy (2005) seeks the reduction of emission levels, including from the transport sector, especially improving the ambient air quality in urban air-sheds. However, as a result of the eighteenth amendment to the Constitution of Pakistan, the subject of the environment was devolved to the provinces. The constitution, however, provides that the laws in force before the commencement of the amendment shall continue to remain in force until they are altered, repealed or amended by the competent authority. This has created the evolvement of different standards and levels of enforcement across Pakistan, as further elaborated below.

There are numerous policies aiming to regulate vehicle licencing and (emission) standards, some with greater and some with lesser levels of implementation. As mentioned earlier, the fragmented responsibilities for vehicle registrations and licencing across the country (a provincial and territorial

responsibility) creates significant differences in standards. Vehicles registered in one province of Pakistan with lower standards (or lower enforcement) may still operate across the country. The main documents include the DRAFT National Vehicle Licencing Guidelines (2019), Automotive Development Policy (2016), the National Environmental Quality Standards for Motor Vehicle Exhaust and Noise (2009), the National Trucking Policy (2007), Motor Vehicles Rules (1969), the Provincial Motor Vehicle Ordinance (1965)and several provincial and territorial documents, including the Punjab Environmental Quality Standards for Motor Vehicle Exhaust and Noise (2016), which are some of the strictest and best implemented standards.

In general, policies affecting transport development of Pakistan include:

- DRAFT National Vehicle Licencing Guidelines (2019)
- National Transport Policy of Pakistan (2018)
- National Road Safety Strategy (2018-2030), (2018)
- Pakistan Railway Strategic Plan (2018)
- National Trade and Transportation Facilitation Strategy (2016)
- Automotive Development Policy (2016)
- Punjab Environmental Quality Standards for Motor Vehicle Exhaust and Noise (2016)
- National Aviation Policy (2015)
- National Climate Change Policy (2012)
- National Policy for Persons with Disabilities (2012)
- National Environmental Quality Standards for Motor Vehicle Exhaust and Noise (2009)
- National Trucking Policy (2007)
- National Environment Policy (2005)
- National Maritime Policy (2002)
- National Policy for Development and Women's Empowerment (2002)
- National Highway and Safety Ordinance (2000)
- Pakistan Environment Protection Act (1997)
- Motor Vehicles Rules (1969)
- Provincial Motor Vehicle Ordinance (1965)
- Urban Transport Master Plans
- Other Provincial Vehicle Standards Gazette

As mentioned above, the National Transport Policy of Pakistan (2018) guides the overall development of the transport sector in the mid- to long-term. Regarding transport sector pollutant emissions, it states the following:

**Box 1: Transport related excerpts from the National Transport Policy of Pakistan (2018)**

- ***Need for a master plan: […]*** *Contribution to sustainable development goals: […] Climate action: Strengthening the resilience of transport infrastructure and services as well as reducing the greenhouse gas emissions is a core of any future developments to adapt and mitigate climate change. […]*
- ***Vision:*** *"Provide safe, affordable, efficient, durable and environmentally friendly means of transport, ensuring reliable access to jobs, markets, education and other services for all. Annotation: […] Friendly: Reduces the environmental impact of the transport system as well as able to adapt to climate change.*
- ***Principles: […]*** *Principle 9: Transport prices shall reflect their true costs. The price of transport services shall reflect the true costs including environmental and social externalities. […]*
- ***Objectives: […]*** *Objective 3: Foster sustainable Urban Development. […] Sub objective 3e: […] implementation of cleaner fuels to reduce air pollution. […] Objective 8: Preserve and conserve the environment the transport system will minimise adverse effects on the environment. […] Sub Objective 8b: Reduce transport emissions (air, noise and vibration) from vehicle by improving*

*emissions and fuel standards. […] Sub Objective 8d: Mitigate the impact of natural disasters by taking preventions and adaptability measures as well as improve climate change resiliency.*

- ***Policy directions speak of environmentally friendly transport.*** *They promote non-motorised transport, public transport and transport integration. They aim to reduce negative impacts of road, rail and air transport on the environment including addressing emissions and noise. Under urban transport, the policy directions specify that: Electric and other low carbon transport will actively be pursued to reduce greenhouse gas emissions phasing out of the internal combustion engine.*

The National Climate Change Policy (2012) addresses the impact of climate change by promoting the development and adoption of environmentally friendly transport technologies and fuels and other carbon reduction strategies. It states with respect to carbon reductions within the transport sector the following. Excerpts are provided in Box 2.

***Box 2: Transport related excerpts from the National Climate Change Policy (2012)***

- ***Climate Change Adaptation: Disaster Preparedness:*** *[…] Policy Measures: […] Ensure that infrastructure, including telecommunication, power, utilities and transport are resilient to the impact of climate change, particularly to extreme weather events.*
- ***Climate Change Mitigation: Energy****: […] Policy Measures: […] Give priority to the import of natural gas, Liquefied Natural Gas (LNG) and Liquefied Petroleum Gas (LPG) over import of oil and coal, except for meeting specific fuel requirements, e.g. liquid fuel for transportation, cooking coal for the steel industry.*
- ***Climate Change Mitigation:*** *Transport*
    - *Transport sector has the highest emission growth rate of all sectors and accounts for about a quarter of carbon dioxide emissions in Pakistan*
    - *Managing emissions in the transport sector is crucial for tackling climate change.*
    - *Obstacles: Limited scope for technical improvement, transport volumes are closely linked to economic growth*

*Policy Measures related to transportation include:*

- *Road Transport*
    - *Sensitise the public to the importance of proper vehicle maintenance for fuel efficiency enhancement and reduction of emissions;*
    - *Ensure the provision of a fuel-efficient public transport system in the country;*
    - *Set up and strictly enforce vehicle emission standards;*
    - *Examine and implement actions required for the use of biofuel for local transport;*
    - *Plan and develop mass transit systems in metropolitan cities;*
    - *Promote the scope of CDM projects in the transport sector;*
    - *Support the private transport sector by providing incentives for reducing emissions and environmentally friendly transport services;*
    - *Promote the development and adoption of environmentally friendly transport technologies and efficient management techniques;*
    - *Promote greater use of Compressed Natural Gas (CNG) in the transport sector to the extent consistent with the availability of CNG in the market;*
    - *Secure financing for technology innovations for urban planning and the transport sector, specifically to address mitigation issues;*
    - *Promote the development of new pipelines for efficient transport of oil in the country;*
    - *Encourage non-motorised modes of travel, such as bicycle and walking for shorter distances.*
- *Aviation*
    - *Encourage the national airline to give due consideration to new fuel efficient aircrafts, causing minimum carbon emissions, while planning fleet upgradation;*

- *Support the International Civil Aviation Organization's (ICAO's) initiative for carbon emission reduction through improved air traffic management, which includes improved weather services and free flight air routes, instead of defined routes, that hold the potential for reduced flight time and thus fuel consumption;*
- *Participate actively in ICAO's activities and initiatives and ensure that new strategies and policies of ICAO do not hurt the economic interests of developing countries' aviation industries.*

- *Railway*
  - *Ensure the provision of an efficient railway system in the country;*
  - *Upgrade and expand the railway network in the country, as the advantages of railway over road travel in terms of carbon emissions are well recognised.*
- *Inland Waterways Transport*
  - *Develop and promote inland waterways transportation.*

On 24th October 2019, the Government of Pakistan suspended implementation of Highway Safety Ordinance (NHSO-2000) for another year. Overall, implementation of NHSO-2000 had been pending for the past 19 years (Global Village Space, 2019). This has an indirect effect on GHG emissions in the transport sector as the enforcement would prevent the current significant overloading of old vehicles. This would lead to either more (perhaps almost double) trips, leading to higher congestion and more emissions, or to more modern vehicles. Both would lead to significantly higher haulage cost and therefore the industry – but not the transport operators – object to the implementation of NHSO-2000. The freight transport providers on their own would also not be able to finance fleet modernisation.

# 3. Transport Supply

The transport system in Pakistan is in poor condition, with an estimated cost to the economy of 8.5% of GDP. Upgrading Pakistan's transport system is therefore critical to competitiveness and economic growth (ADB, 2015).

Roads are the predominant mode of transport in Pakistan, accounting for over 92% of passenger and 96% of freight traffic (2010). Pakistan's road network of 263,000 km consists of 12,000 km of national highways and 93,000 km of provincial highways, with the remainder classified as either district or urban roads. The national highways (5% of the total road network) cater for 80% of commercial traffic. Despite this, in 2015 only 56% of the national highway network was assessed as being in good or fair condition. The road sector faces a number of challenges, including overloaded, old and outdated trucks; inadequate highway network infrastructure; inefficient transport operation and maintenance; and inconsistent policy and institutional development and capacity constraints (ADB, 2015).

NMT is important for both urban and rural local transport, but especially in rural areas where motorised vehicle ownership and accessibility to all-weather roads is low.

The Pakistan railway network comprises of 7,791 route km (Ministry of Finance, 2013). Pakistan Railway is enduring the worst crisis since its formation. Insufficient investment in upgrading rail infrastructure, rolling stock, signalling and telecommunications has caused a significant decline in freight and passenger services. Between 2010 and 2015 the number of daily passenger services declined from 230 to 92 and the number of freight train services from 96 to 1. Falling revenues and increased operating costs have led to a deterioration in the financial position of Pakistan Railways, which can make it difficult to respond to market demand (ADB, 2015).

There are five major international airports in Pakistan and three seaports that cater for passenger and freight movement. Port operational performance is improving, but further improvements are needed to ensure the medium-to-long-term viability of the sector. Post-customs delays at ports, and the lack of integrated services and logistical facilities to remove containers from ports, are major impediments. In addition, the limited depth (10–12 metres) of the ports prevents their use by larger, more efficient ships. Inland waterway transport facilities have not been developed, but the potential to do so in the near future exists. Both aviation and port infrastructure require upgrading (ADB, 2015).

Oil pipelines carry 37% of all petroleum products. The remainder is carried by road and rail. Oil pipeline connections exist to ports and refineries; however, they are not yet fully utilized. Several gas pipeline connections are currently under development (Ministry of Planning, 2018).

Urban transport systems in major cities have not kept pace with increasing demand, resulting in congestion, road crashes and air pollution. In Lahore, 13.5 million trips are undertaken daily, while in Karachi this number is higher, at 20 million (ADB, 2015). The public urban transport systems in Pakistani cities are inefficient or non-existent, relying on low-capacity (mini)buses, inappropriate for a rapidly growing urban population. However, a number of bus rapid transit (BRT) and mass rapid transit (MRT) systems have been implemented in recent years, including Karachi Green Line, Multan Metrobus, Lahore Metrobus, Rawalpindi-Islamabad Metrobus, TransLahore BRT and Lahore Metro, which are all operational. Additional systems are planned or under construction including Karachi Metrobus, Peshawar BRT, Faisalabad Metrobus and Karachi Circular Railway (Wikipedia, 2019).

# 4. Transport Demand

Due to rapid population growth, economic development and urbanisation, it is expected that annual passenger-km will rise to 1,000 billion passenger-km per annum by 2030.

Since rural accessibility remains low, with only 53% of rural populations living within 2 km of an all-weather road (Ministry of Planning, 2018), the road network will be expanded further. According to ADB's Pakistan Country Partnership Strategy (2015-2019), already 60% to 70% of the urban population own vehicles, but with vehicle ownership in rural areas being low, there will likely be an increase of vehicle ownership in the future as the country develops.

Continuing urbanisation (50% in 2030 as per Pakistan's National Transport Policy, 2018) will increase the demand not only for rapid urban transport systems such as BRT and MRT, but also for the related integrated multi-modal transport, including feeder bus schemes and NMT. In 2015, 13.5 million trips were undertaken daily in Lahore and 20 million in Karachi (ADB, 2015).

According to a *Business Recorder* article (6 February 2019), Karachi's current public transport system represents only 4.5% of the total vehicle fleet but serves about 42% of commuters. The majority of people use private vehicles for their daily commute, which is estimated to be 36% of the total vehicle traffic, representing 21% of the passengers. Another mode is paratransit (rickshaw, taxis), responsible for 10% of vehicles on road and 8% of total customers, which is a good number of customers given its size (The Business Recorder, 2019). This highlights the significant demand for increased public transport in Pakistan's largest city, which is equally the case in other urban centres of the country.

Freight transport will grow in line with population and economic development. However, with the planned China-Pakistan Economic Corridor (CPEC) freight (and passenger) transport is expected to increase significantly within the entire region.

Road transport will remain the main mode of transport in Pakistan. Even with considerable effort and investment into rail, rail freight would only reach 3.5% by 2025 and 7% by 2030 (IISD, 2016). Nevertheless, the country aims to rehabilitate and extend their rail system to previous levels and beyond. Also, a shift to inland shipping is anticipated, but currently this mode of transport is insignificant.

According to the National Transport Policy of Pakistan (2018), which refers to an ADB study of 2015, arranging transport to access health services is for many women in Pakistan a problem. Vehicle ownership levels are much lower than for men, hence women rely on family members, neighbours or public transport to access services and economic opportunities. This highlights the significant demand for inclusive and safe transport in Pakistan.

# 5. Key International Development Programmes

Several internationally and bilaterally funded development programmes are currently underway in Pakistan affecting the transport sector, albeit the focus on climate change and transport-related carbon reduction is limited or a secondary objective. Emission reductions and improved air quality are objectives in an urban context, but the main the driver is the provision of improved transport to enhance urban economic development and reduce congestion. A longlist of transport-related development programmes is provided in the Appendix. The main active programmes that relate to LCT are considered to be as follows:

The **China-Pakistan Economic Corridor (CPEC)** is a framework of regional connectivity. It focuses on enhancing geographical linkages to improve road, rail and the air transport system. Under CPEC various large transport infrastructure projects will be implemented including several highway and railway projects as well as urban mass transport projects. It also includes capacity building elements.

While LCT and GHG emissions is not a main objective of CPEC, its interventions will have a significant impact on transport and transport-related GHG emissions in Pakistan. While trade and hence trade-related transport will increase, the investment into rail will also ensure that portions of both freight and passenger transport will shift to rail. However, what overall impact this has on transport-related GHG emissions in Pakistan is unclear at this stage.

The **Central Asia Regional Economic Cooperation (CAREC) Programme** is a partnership of 11 countries and development partners working together to promote development through cooperation, leading to accelerated economic growth and poverty reduction. The programme is a proactive facilitator of regional projects and policy initiatives including multimodal transport networks and facilitated free movement of people and freight (Governments, ADB, WB, EBRD, IsDB, DfID & others) (CAREC, 2020).

Under CAREC, for the longlist of transport projects please refer to the appendix. Projects with an LCT element are considered to be the following:

- CAREC Railway Connectivity Investment Program.
- The project preparatory technical assistance will (i) develop an MFF and tranche projects bankable by ADB loan; (ii) conduct due diligence for technical, economic, financial, social, and environmental viability of the first tranche project; (iii) and prepare required due diligence documents. ADB (PCD Aug 2020).
- Enabling Economic Corridors through Sustainable Transport Sector Development.
- The technical assistance is in line with the Country Partnership Strategy for Pakistan 2015-2019, which, in turn, is aligned with the Government of Pakistan's national strategy (Pakistan Vision 2025). ADB (PCD Dec 2020).

Other **regional initiatives with LCT elements** include:

- Supporting Environmental Safeguards in the Central and West Asia Region. ADB (PCD Mar 2020).
- Implementation of Sustainable Transport for All. ADB (PCD Dec 2020).
- Promoting Urban Climate Change Resilience in Selected Asian Cities. ADB (PCD not available).

Various **Bus Rapid Transit projects** are being planned or implemented, including:

- Karachi Metro Bus Rapid Transit
    - Green Line Extension Project. Government of Pakistan (PCD not available)
    - Orange Line Project CPEC (PCD estimated 2020)
    - Blue Line Project Private Financing / PPP (PCD not available)
    - Yellow Line Project IBRD (PCD estimated 2024)
    - Red Line Project. ADB (PCD estimated 2024).
- Peshawar Sustainable Bus Rapid Transit Corridor Project. ADB (PCD Dec 2021).

- Karachi Circular Railway. CPEC, possibly Japanese financing (PCD not available).
- Greater Peshawar Region Mass Transit. CPEC (PCD not available).
- Quetta Mass Transit. CPEC (PCD not available).
- Orange Line – Lahore. CPEC (PCD not available).

Various **Urban Development** projects having a LCT element, including:

- Provincial Strategy for Inclusive and Sustainable Urban Growth which has an urban / public transport component. ADB (PCD Dec 2020).
- Capacity Building for Structural Transformation, Country Programming, and Portfolio Management which has an urban public transport element. ADB (PCD Dec 2021).
- Karachi Mobility Project which not only includes the BRT system along the yellow corridor but also a multitude of other initiatives improving urban infrastructure and transport, including capacity building (PCD estimated 2024).

Other **national LCT related initiatives** include:

- Punjab Green Development Program. IDA (PCD Jun 2023).
- Sindh Resilience Project. IDA (PCD Feb 2022).
- Disaster and Climate Resilience Improvement Project (IDA).
- Technical Cooperation for Establishment of Environmental Monitoring System (JICA).

# 6. Challenges and Opportunities

The following challenges and opportunities were identified, relating to the transport sector in general and the possibility of reducing the transport-related carbon emissions more specifically:

**Lack of measured emission baseline data**. National GHG inventories are calculated based on fuel consumption, as is internationally accepted practice. There is limited availability of actual emission data in Pakistan, or it is unreliable and at times unwanted if it does not support a specific agenda. An air quality monitoring system established in 2008 stopped functioning in 2012 due to a lack of funding. This combined with the absence of vehicle emission testing, results in a lack of baseline data to determine actual emission levels of vehicles types (often modified) and along transport routes, as well as actual (location-specific) impact on the ground of any measures taken. Participants felt very strongly that this issue needs urgent attention.

**Large number of old vehicles on the road with high emissions**, especially old busses and old trucks – on the road using Euro 0 or Euro 1 diesel and, hence, having high emissions. Modernisation would be a mammoth task requiring substantial investment. Generally, bus fares (dictated by government) and the cost of freight are too low to make investment into a more modern fleet viable. Compulsory technical inspections, which require a payment of an annual token (vehicle tax), are not enforced due to lack of capacity and testing facilities. However, a policy to address this issue is under development (DRAFT National Vehicle Licencing Guidelines). Even when inspections are undertaken, in most cases emission testing is not possible due to lack of equipment. Only in Punjab Province is the situation better, but as a result especially truck owners register their vehicles in other provinces. Some owners do not pay their token (vehicle tax), especially if a vehicle is very old. Therefore, there is uncertainty over the actual number of vehicles on the road, their technology and their emission levels. The identification of such vehicles only occurs when there is an infringement of traffic regulations. In addition, current tax laws do not penalise old, highly polluting vehicles, as is the case in other countries; vehicle tax for old vehicles is nominal and much lower than for new low-emission vehicles.

**Poor quality of fuel and low achievement of emission standards**. While this issue is closely linked to the above, it is still different and needs to be addressed by different stakeholders. Pakistan has adopted Euro 2 emission standards, but implementation is still ongoing especially on the diesel side (trucks and buses). The old vehicle fleet would not be compatible with higher quality fuel, and the petroleum industry has barely achieved Euro 2 standard, and even that is compromised by (deliberate or accidental) contamination. There are plans to aim for the Euro 4 standard, but this will require significant investment into refining capacity and the renewal of the aging fleet of vehicles. Currently, any imported Euro 4 or Euro 5 vehicles have issues with the current quality of fuel, which clogs catalysts, forcing their removal. Vehicle replacement would be an enormous undertaking, and would have to be supported by the Government, as most vehicle owners would not be able to finance this themselves. It would need to go hand-in-hand with fuel quality improvements.

**Inability to enforce axle load control on highways and motorways**. Overloading of trucks is a common problem, which causes pavements and roads to deteriorate rapidly. The Highway Safety Ordinance (NHSO-2000) addresses this but its implementation has again been suspended by one year (Global Village Space, 2019). While this time the freight industry would welcome the controls put in place by the NHSO 2000, the industry now objects, as the measures would increase the cost of freight if implemented. Implementation (now delayed by 19 years) would not necessarily lead to the use of modern and larger vehicles, but simply to more trips that would cause additional congestion and emissions and a higher overall freight cost.

**The freight industry is fragmented and unregulated** with many small operators and owners. Vehicles are old and have often been tampered with. Locally produced trucks do not comply with adequate vehicle or emission standards. Low prices and requirement for substantial investment make the renewal of the fleet a challenge for small owners/operators to achieve on their own.

**Lack of implementation/enforcement of existing laws, policies and implementation plans in place within the transport sector**. Obstacles include lack of capacity or resources, poor implementation planning, lack of coordination or lack of will. As an example, see the issues related to NHSO (2000), the implementation of which been delayed for 19 years (Global Village Space, 2019).

**Multiple institutions with a stake in (urban) transport operate independently, with little coordination.** This highlights the opportunity for improved institutional arrangements. Coordination between federal and provincial/territorial, and inter-provincial especially requires improvement.

A **capacity gap was reported between research available in Pakistan and translating the findings of such research into specific action plans**. Many (institutional) stakeholders complained that research is often not accessible to them or, if they do receive it, is not applied enough, or not understood well enough by them to allow these institutions to base their policy, planning and actions on it.

**Increasing number of (poor quality) motorbikes which are the most affordable means of transport.** The availability of cheap and low-quality imported motorbikes leads - especially in rural areas - to many low-cost/low-quality bikes on the road, increasing emission levels and road accidents. In many cases, motorbikes are the only means of transport available (apart from NMT which has limited range), as public transport does not cover all areas. While some motorbikes are electric – converted by a locally available kit – most bikes run on petrol. The high cost of electricity in Pakistan also makes the conversion to electric bikes less attractive.

**Shortage of adequate (urban) mass transit**. Most public transport is provided by ordinary bus services using old vehicles. While route franchising is in place and works, not all areas are covered, and the system is not integrated and/or aligned enough with actual transport needs. While there are several mass transit systems (BRT, MRT, etc.) operating, under execution or planned, these are largely limited to metropolitan areas. There is need for more mass transit also in other urban centres. There is also a need for better integration of such systems with feeder buses, adequate access via footpaths, proper parking facilities, etc. There are concerns over the capital cost of trunk systems. Buses run predominately on diesel, which has higher emissions than other systems. Electric busses are perceived to be too expensive and inadequate for various (alleged) reasons, most of them not backed by facts.

**Poor urban planning and zoning** led to poorly planned horizontal developments which increase the need for transport and hence affect traffic. Well-planned cities, as was the case in Islamabad, reduce the need for travel by shortening or optimising routes. This is no longer the case even in Islamabad, where previous concepts have been discontinued in recent years. There is lack of capacity to prepare and/or implement adequate urban plans. It was stated that proper urban planning and zoning can accommodate growth while minimizing the requirement for related additional transport.

**Poor utilisation of railway system** that carries only about 5% of goods and passengers. Making it attractive again requires substantial investment, multimodal integration, better management and further commercialisation. Locomotives run on diesel and hence add to carbon emissions. There was only one electrified line, but the use of the electric locomotives stopped in 2011 and these locomotives were subsequently decommissioned. There are plans to reconstruct and extend the main railway lines under CPEC, but this is a long-term action. Meanwhile, localised investments such as branch-lines, better management and further commercialisation of services (not of infrastructure) could lead to increased use. There is little railway engineering capacity remaining in Pakistan.

# 7. Methodological Approach

## 7.1 Overview

This study consisted of three key steps:

1. Stakeholder interviews with 8-12 key stakeholders to collate contextual information on low-carbon transport and identify key research areas of importance.
2. A stakeholder workshop where participants discussed, developed, categorised and prioritised key research areas/knowledge needed to facilitate the transition to low-carbon transport.
3. Survey of current literature relevant to the target country.

## 7.2 Stakeholder Interviews

The objective of the stakeholder interviews was to identify key barriers to low-carbon transport in the target country, and to determine a provisional list of research needs/projects that would enable the country to make the transition to low-carbon transport.

Interviews were undertaken with senior individuals from five stakeholder groups: (i) government; (ii) international organisation, (iii) industry and industry association; (iv) NGOs; and (v) research institutes. The output of the interviews provided a list of research themes with examples of research questions that were discussed at a stakeholder workshop. The interviews took approximately 60-75 minutes and were, where possible, recorded. The interviews also provided an opportunity to obtain local knowledge and key publications relevant to the target country (e.g. policies, national level studies, etc.).

Interview questions were as follows:

1. *What are the key challenges that are making the implementation of LCT difficult to achieve, and what research is needed to overcome these challenges?*
2. *What priority is given to reducing GHG emissions in national/local decisions that affect transport?*
3. *How desirable is it to promote LCT over the coming years? Why is it important (or not) to promote this?*
4. *What knowledge is needed to overcome these challenges (e.g. developing capacity, and sharing knowledge/good practice/tools)?*
5. *How can research and knowledge play a role in removing barriers? If so, what knowledge?*

## 7.3 Stakeholder Workshop

The objective of the stakeholder workshop was to elaborate the list of research projects that could facilitate the transition to an LCT system in Pakistan and to gain input for a capacity research strategy.

The workshop was divided into the following sessions:

- Introduction to the HVT/EEG study its objectives and structure.
- An exercise to discuss the identified (during the interviews) challenges and research needs to validate them and identify additional LCT challenges. Challenge- Research Project/methodology – Research Actor – Beneficiaries). Also, participants were asked to state if they were aware of someone already addressing any issue.
- A second exercise to categorise the selected questions according to the ASSGI matrix and to prioritise them, followed by which actors should/could undertake such research.

# 8. Overview of Process

From 9th to 13th December 2019, a scoping mission to Pakistan was carried out to identify priority research areas related to low-carbon transport. The methodology outlined in Section 7 above was followed including literature review, semi-structured interviews, followed by a workshop.

During the scoping exercise in Pakistan 20 stakeholders were consulted in interviews/ workshop. Nine were from the government (including government-controlled research centres), five from international development partners (including implementing partners), one each from industry and NGOs, and three from other research institutes.

The semi-structured interviews identified key challenges for the implementation of low-carbon transport in the country and the research needed to overcome these challenges. They also highlighted opportunities and scope for intervention.

The workshop verified research needs identified through the interviews and identified additional research needs, categorized them into the AASGI Matrix (see **Error! Reference source not found.**3) a nd then prioritized them. In the AASGI Matrix participants have attempted to allocate the identified research topics to key enablers (rows) and general requirements transport must comply with (columns). The result provides a snapshot of priority areas to look into. The participants have also prioritized the specific research topics identified. Those topics that received high-priority points from the participants have been grouped into Higher and Medium Priority Research Areas in Section 9.

Following the workshop, the interim findings were summarised, and a brief review of relevant literature and policies undertaken before writing this final report. The team converted the themes identified in the workshop into more specifically researchable questions. Duplicates were removed, as were topics that did not fit with the priorities of EEG, CCG or HVT. Questions covering similar thematic areas were amalgamated where possible. The main objective of this exercise was to finalise the thematic areas and sub-questions, striking a balance between researchable topics and adequately reflecting the questions identified by the main stakeholders. This resulted in four proposed research topics to take forward, outlined in Section 10.

An evaluation exercise was carried out at the end of the workshop. Seven forms were submitted which are shown in Appendix D. The feedback is summed up in **Error! Reference source not found.**2 below.

Most participants indicated their research interests, which relate to data collection on emissions and pollution, impact assessments, urban mass transport & planning, research into the trucking industry and refitting of vehicles.

Table 2: Summary of Workshop Feedback

| | | |
|---|---|---|
| Usefulness | 4.6 | Poor: 1; 5: Excellent |
| Relevance | 4.7 | Poor: 1; 5: Excellent |
| Methods | 4.3 | Poor: 1; 5: Excellent |
| Value of Learning | 3.9 | Much less than expected: 1; As expected:3; Much more than expected: 5 |
| Likely to submit a research proposal | 4.0 | Never: 1; 5: Guaranteed |
| Likelihood to continue relationship with HVT | 4.4 | Never: 1; 5: Guaranteed |

Available research capacity in Pakistan has been identified, which include universities and government research centres, including but not limited to CCRD, CDKN, COMSATS, EDB, GCISC, IISD, NUST, RSPN and UET, but also NGOs such as NTRC or companies such as PITCO.

Figure 2: Photos from scoping workshop in Pakistan



Table 3: AASGI Matrix completed during scoping in Pakistan

| AASGI Matrix | Accessible | Affordable & efficient | Safe | Green | Inclusive |
|---|---|---|---|---|---|
| Policy, planning and regulations | ●● | ● | | ●●●●● | |
| Finance and economics | ●● | ● | ● | | |
| Governance and Institutions | | ●●●● | | ● | ● |
| Technology | ●● | ● | ● | ●● | ● |
| Data | ●● | | | ●● | ● |
| Operations, service and management | ●● | ●● | | ●● | ● |
| Infrastructure | ●●● | ●●● | | ●● | |

Table 4: Details of Participating Stakeholders

| Sector | No | Organisation | Name | Position | E-mail | Inter-viewed | Work shop |
|---|---|---|---|---|---|---|---|
| Government (both transport and non-transport, such as energy and environment) | 1 | Ministry of Climate Change | Azeem Khoso | Chief | mazeemkhoso@gmail.com | √ | x |
| | 2 | Ministry of Climate Change | Muhammad Saleem | Deputy Director | saleemzeal@gmail.com | x | √ |
| | 3 | Pakistan Environment Protection Agency | Ahsan Kayani | Director | dg@environment.gov.pk | √ | |
| | 4 | National Transport Research Centre | Hameed Akhtar | Chief | hameed.akhtar@yahoo.com | √ | x |
| | 5 | National Transport Research Centre | M Sayyar | Deputy Chief | sayyarntrc@gmail.com | x | √ |
| | 6 | Capital Development Authority | Azam Lodhi | Director Traffic En. & Transp. Planning | azlodhi@hotmail.com | √ | x |
| | 7 | National Highway Authority (NHA) | Dr Asif | Deputy Director | butt.nousheen@gmail.com | √ | x |
| | 8 | National Highway Authority (NHA) | Nousheen Yaqub Butt | Deputy Director Environment | butt.nousheen@gmail.com | √ | x |
| | 9 | Engineering Development Board | Nasir Beg | Chief Executive Officer | mnasirbaig@edb.gov.pk | √ | x |
| International development organisation | 10 | World Bank | Hasan A Zaidi | Sr. Transport Specialist | hzaidi@worldbank.org | √ | x |
| | 11 | ADB Pakistan Resident Mission | Md Bilal Paracha | Transport Specialist | bparacha.consultant@adb.org | √ | x |
| | 12 | ADB Pakistan Resident Mission | Khurram Ghafoor | Project Officer (Infrastructure) | khurramg@adb.org | √ | x |
| | 13 | ADB Project TA 8990-PAK | Khushkhal Khan | Deputy Team Leader Road Safety Policy Specialist | kk@ntu.eu; khankhushal17@gmail.com | √ | x |
| | 14 | Mott Macdonald / ADB Sust Transport Dev Project | Mahboob Elahi | Deputy Team Leader | elahimahboob@hotmail.com | √ | x |
| | 15 | IMC worldwide | Samantha Passmore | Senior Consultant | samantha.passmore@imcworldwide.com | x | √ |
| Industry and industry association | 16 | Pak Gulf | Awais Jalali | Chief Engineer | awais.jalali@gmail.com | √ | √ |
| NGOs, CBOs & Civil Society Organisations | 17 | Rural Support Programmes Network | Khaleel Tetlay | Chief Operating Officer | khaleel.tetlay@rspn.org.pk | √ | x |
| Research institutes or universities | 18 | UET Taxila | Dr Jawad Hussain | Associate Professor | jawad.hussain@uettaxila.edu.pk | √ | √ |
| | 19 | Centre for Climate Research and Development COMSATS University Islamabad | Dr. Anjum Rasheed | Assistant Professor | anjum.rasheed@comsats.edu.pk | √ | √ |
| | 20 | National University of Science and Technology | Dr Kamran Ahmed | Assistant Professor | buet99@hotmail.com | x | √ |

# 9. Long-list of Research Topics

The below research themes were highlighted by participants during the scoping exercise for further investigation. The highest priority interventions – as per the prioritisation exercise carried out during the workshop – are also indicated:

## 9.1 Higher Priority Research Topics

**What are the actual transport and vehicle emissions in Pakistan, especially in population centres and along main transport routes?**

Part of the exercise should be the updating of the current (transport-related) GHG inventory, which was based on 2012 data. More recent data and an improved methodology should be used. Assumptions, approaches and parameters used by government and research institutions when preparing the GHG inventory are to be agreed, to avoid divergence as was previously the case. Significant current divergences should be investigated, and recommendations provided. Provincial-level GHG inventories should be considered in the approach and compared to national-level GHG inventory.

Trends related to transport sector GHG emissions should be identified, policy makers informed, and recommendations given, in order to achieve meaningful transport related GHG reduction. The 2018 National Transport Policy of Pakistan recommends that the actual cost of transport, including the cost of carbon credits, should be used when determining the feasibility and viability of measures. In this respect it is expected that the research will provide recommendations on the cost of carbon credits.

The research shall be backed up by actual emission measurements along main routes and in population centres. Emission models shall be based on transport and traffic models, allowing for the modelling and forecasting of emissions and the determination of impact of emission-reducing measures (low-carbon transport). It is noted that current GHG inventory does not consider other climate-forcing agents, such as black carbon and others, which require emission testing.

Vehicle emissions are to date generally not tested; hence it is unknown what the actual emissions of vehicles and vehicle groups or models are, considering that they may have been modified locally and often do not run on the intended fuel quality. Ideally the research would lead to the implementation of an air quality monitoring system and enforcement of vehicle emission testing.

**What are the issues affecting the freight transport sector that prevent it adopting lower emission technology and in general becoming greener, improving and modernising?**

The freight transport sector is currently fragmented and largely unregulated. The research shall also investigate the current structure of the sector and options to restructure. It shall research the limiting factors that prevent better integration of the various transport modes, or modernization of the aging fleet of trucks. Overall, the sector struggles to improve efficiency and reduce emission levels and axle loads. The research shall also investigate constraints impeding the implementation of the current trucking policy in place and recommend improvements, and it shall investigate the economic cost (for a determined period) of enforcing axle load controls versus continuing to tolerate overloading.

## 9.2 Medium Priority Research Topics

**What are the factors that influence consumers' decision making regarding vehicle purchase and ownership? What measures would have to be put in place to make lower- emission technology attractive to consumers?**

Investigate the possibilities to incentivise fleet renewal via gradual fiscal and other mechanisms such as increasing vehicles taxes for old vehicles, carbon taxes for high polluters, green zones that limits high polluters, enforcement of technical inspections and emission standards and incentives to buy lower emission vehicles. Any such measures must be complimented with higher fuel standards (Euro

4) and increased capacity to test and enforce vehicle and emission standards, an improved central database recording vehicle registration, technical details, status of token payments and technical inspections accessible to traffic police and monitored also by cameras along highways and motorways.

**What are the factors that influence consumers' decision making regarding motorcycle purchase and ownership? What measures would have to be put in place to promote electric motorbikes?**

Investigate the potential of, and requirement for, incentives and mechanisms to support the replacement of combustion engine motorbikes with electric motorbikes. Identify business opportunities for the local motorbike and vehicle industry, mechanics and technicians, and determine capacity gaps and required training and technology transfer. Consider the potential to extend to 3-wheelers and small 4-wheelers.

**What are the constraints preventing fleet renewal in the public and commercial sectors? What are the factors that influence businesses decision making regarding procurement of vehicles? Both questions shall focus on the potential for carbon emission reduction.**

This is particularly relevant for the bus transport sector, the trucking sector (covered above), and public and private institutions operating a large fleet of vehicles. As above, investigate the possibilities to incentivise fleet renewal via gradual fiscal and other mechanisms, such as increasing vehicles taxes for old vehicles, carbon taxes for high polluters, introducing green zones that limit high polluters, enforcing technical inspections and emission standards, and establishing incentives to buy lower emission vehicles.

Research the potential for government – having a large fleet of vehicles – and other institutions such as schools to pilot modernisation.

Could fleet renewal be achieved by pooling the purchasing power (group buying power) of different bus mass transport systems under development or renewal, other (long-distance) bus operators, school buses and government (fleet replacement) to reduce the unit cost of electric buses for BRT, long-distance travel and government buses? This needs to be undertaken with research into adequate technology of renewable energy charging stations along BRT routes, motorways, schools and at government buildings. Determine potential incentives required to attract private sector participation. Current BRT busses could be used for feeder bus systems and sold to private bus operators (hence replacing old buses). Due to the high carbon footprint of batteries, not all conversion to electric might result in GHG reduction.

Any such measures must be complimented with higher fuel standards (Euro 4) and increased capacity to test and enforce vehicle and emission standards, an improved central database recording vehicle registration, technical details, status of token payments and technical inspections accessible to traffic police and monitored also by cameras along highways and motorways.

**What are the institutional arrangements that affect or constrain inclusive transport and urban planning and the implementation of urban and transport projects, especially with respect to transport related GHG reductions?**

The research should also investigate current institutional arrangements and determine any gaps or overlaps in responsibility. It should look into the issues affecting coordination between federal and provincial administrations, especially on the environment, which is now a provincial/territorial responsibility. Currently the cooperation between federal and provincial/territorial administrations shows significant scope for improvement.

Investigate whether the Ministry of Climate Change and the Ministry of Interprovincial Coordination need to be empowered. It is noted that several current initiatives have institutional and capacity building elements, but few (if any) have GHG reduction as an objective.

**How can urban planning be improved to reduce transport related GHG emissions?**

Investigate the factors influencing urban planning and the available urban planning capacity in Pakistan. Would the creation of development hubs with mixed land use lead to any significant reduction of GHG emissions while fostering economic growth? Such hubs would intensify land use, foster economic growth, provide better living conditions, shorten transport routes, minimize/optimise travel, ensure improved transport, segregate modes, etc.

**What are the factors and issues limiting the provision of improved public (mass) transport in urban centres outside the metropolitan areas?**

Current development programmes already cover the metropolitan areas, but the "smaller" urban centres are struggling to provide adequate urban mass transport. The research shall investigate potential transport (business) models and transport system study for "smaller" cities and improved bus route planning based on proper origin-destinations surveys and potential for regularization of the largely informal and private sector dominated bus transport sector. Can carbon credits or other measures be used to make some of these initiatives more viable?

**What are is the capacity of the local industry, businesses, mechanics and technicians to carry out repairs and maintenance of newer low emission vehicles including electric & hybrid? What are the opportunities for local vehicle industry with respect to fleet modernisation?**

## 9.3 Lower Priority Research Topics

**What are the factors that make some LCT initiatives less attractive to consumers in Pakistan? These include but are not limited to NMT, public mass transport, rail and ride sharing or hailing.**

What are the factors that influence people's choice of transport? Do they have a choice? What are the prejudices and misconception people have with respect to these alternatives? What measures or policies are required (or in place and not implemented) to increase the market share of such LCT? If the issue is lack of implementation, the research shall identify the reasons and make recommendations. Can carbon credits or other measures be used to make some of these initiatives more viable, i.e. urban mass transport or ride sharing?

**What are the factors that currently make the railways an unattractive choice in transport and what is needed to increase the market share of the railways?**

Investigate the potential for further improvements to railways by localised investments, better management and selected commercialisation, to increase use, especially within the freight sector, and the required multimodal integration. The ADB Railway Connectivity Investment Programme addresses this.

**What is the potential for mass-electrifying buses** by pooling the purchasing power (group buying power) of different bus mass transport systems under development or renewal, other (long-distance) bus operators, school buses and government (fleet replacement) to reduce the unit cost of electric buses for BRT, long-distance travel and government buses. This needs to be undertaken with research into adequate technology of renewable energy charging stations along BRT route, motorways schools and at government buildings. Determine potential incentives required to attract private sector participation. Current BRT busses could be used for feeder bus systems and sold to private bus operators (hence replacing old buses). Due to the high carbon footprint of batteries, not all conversion to electric might result in GHG reduction.

**What is the potential and technical, economic and environmental feasibility to develop an inland waterway system and related shipping capacity?**

While specifically listed as a goal in the 2018 Transport Policy of Pakistan and mentioned as a research theme by some of the interviewees, the majority of consulted stakeholders did not see this an area where quick gains in reducing GHG emissions could be made because there is no real history in inland

waterway transport in Pakistan and no historic infrastructure. New infrastructure would require significant investment and time to construct.

# 10. Final Priority Research Themes

## 10.1 Building a credible transport emission baseline and identifying quick wins

There is limited availability of actual emission data in Pakistan, or it is unreliable and at times unwanted if it does not support a specific agenda. An air quality monitoring system established in 2008 stopped functioning in 2012 due to a lack of funding. This, combined with the absence of vehicle emission testing, results in a lack of baseline data to determine actual emission levels of vehicles types (often modified) and along transport routes, as well as actual (location-specific) impact on the ground of any measures taken.

Research to build a credible transport emission baseline could support the Government of Pakistan to update the GHG inventory, which was based on 2012 data, with more recent data and help standardise the methods for developing the inventory with international best practice. The research project could also support the revival and/or introduction of an air quality monitoring system and vehicle emission testing.

- Compare the Government of Pakistan's current approach to developing a GHG inventory with international best practice.
- Using international best practice, measure transport-related emissions from vehicles, focusing on main routes, urban centres and the shipping industry.
- Based on transport and traffic models, and on economic development projections, build future transport emissions scenarios.
- Identify trends related to the transport sector and inform policy makers on the potential options to achieve significant reduction.

## 10.2 Integrating the freight sector with rail

Pakistan's freight industry is fragmented and unregulated, with many small operators and owners. It is dominated by old, locally produced trucks, which frequently do not comply with vehicle or emissions standards. Pakistan's railway system is poorly utilised, carrying only about 5% of goods and passengers.

- Explore options to integrate the freight sector with rail.
- What policies and investments are required to make the railway system a more attractive option?

## 10.3 Transitioning to electric motorbikes

Motorbikes are the most affordable and effective means of passenger transport, especially in rural areas. However, the low-cost/low-quality bikes on the road increase emission levels and road accidents. While some motorbikes are electric – converted by a locally available kit – most continue to use petrol. The high cost of electricity in Pakistan makes the conversion to electric bikes and vehicles less attractive. Electric buses are also not widely deployed, as they are seen as costly, and the lifetime costs and benefits are not fully understood by all local decision makers, including the transport private sector.

- What incentives and mechanisms are required to gradually replace motorbikes with electric motorbikes?
- Explore business opportunities for a local electric motorbike industry. What is the potential to expand the electric vehicle industry to 3-wheelers and small 4-wheelers? What technical skills, training and technological transfers are required?

## 10.4 Fleet renewal and fuel quality improvements

Pakistan has a large number of old vehicles on the road with high emissions, especially old buses and old trucks. Generally, bus fares (dictated by government) and cost of freight are too low to make investment into a more modern fleet viable. Enforcement is also a challenge. Compulsory technical inspections, which require a payment of an annual token (vehicle tax), are not enforced due to lack of capacity and testing facilities and equipment. However, a policy to address this issue is under development (DRAFT National Vehicle Licencing Guidelines).

Vehicle replacement would need to go hand-in-hand with fuel quality improvements. Pakistan has adopted Euro 2 emission standards, but implementation is still ongoing, especially on the diesel side (trucks and buses). The old vehicle fleet would not be compatible with higher-quality fuel, and the petroleum industry has barely achieved Euro 2 standard, and even that is compromised by (deliberate or accidental) contamination. There are plans to aim for the Euro 4 standard, but this will require significant investment into refining capacity and renewal of the aging fleet of vehicles. Currently, any imported Euro 4 or Euro 5 vehicles have issues with the quality of fuel, which clogs catalysts forcing their removal.

- Explore options to incentivise gradual fleet renewal, such as gradually increasing vehicles taxes for old vehicles and carbon taxes for high polluters, introducing Green Zones that are out of limits for high polluters, enforcing technical inspections and emission standards, and establishing incentives to buy lower-emission vehicles.
- Identify opportunities to revise and enforce the existing Trucking Policy to increase efficiency and reduce emissions in the freight sector.
- What is the potential for government – having a large fleet of vehicles – and schools to pilot modernization?
- What steps are required for fleet renewal to go hand-in-hand with upgrading to higher fuel standards (Euro 4), and to improve the capacity to test and enforce vehicle & emission standards?

## 10.5 Converting to electric buses

The public urban transport systems in Pakistani cities are inefficient or non-existent, relying on a system of low capacity (mini)buses inappropriate for a rapidly growing urban population. However, a number of bus rapid transit (BRT) and mass rapid transit (MRT) systems have been implemented in recent years, including Karachi Green Line, Multan Metrobus, Lahore Metrobus, Rawalpindi-Islamabad Metrobus, TransLahore BRT and Lahore Metro, which are all operational. Buses run predominately on diesel, which has higher emissions than other systems. Electric buses are perceived to be too expensive and inadequate for various reasons, most of them not backed by facts.

- Examine the costs and benefits of bulk purchasing electric buses, i.e. taking a broader look when purchasing or renewing buses across the country, rather than a project- or organisation-based approached to reducing unit costs.
- What technological upgrading and installations are required along BRT routes, motorways, schools and at government buildings to enable an electrified bus system?
- What incentives would be most effective in attracting private sector participation?

# 11. Summary of Key Findings

The UK Department for International Development initiated this study to determine research priorities in low-carbon transport in low- and middle-income countries, including Pakistan. The overall objective of the study was to identify key challenges in the transport sector in Pakistan and research gaps related to the transition to low-carbon transport.

A scoping mission to Pakistan consulted 20 stakeholders across various sectors. Numerous challenges were identified, including lack of measured emission baseline data; large number of old vehicles on the road with high emissions; poor quality of fuel and low achievement of emission standards; inability to enforce axle load control on highways and motorways; fragmented and unregulated freight industry; lack of implementation/enforcement of existing laws, policies and implementation plans in place within the transport sector; multiple institutions with a stake in (urban) transport operate independently with little coordination; capacity gap between available research and applying it to specific problems; large and increasing number of motorbikes; shortage of adequate (urban) mass transit; poor urban planning and zoning, and poor utilisation of railway system.

The study identified five priority research themes, where DFID research funding could help facilitate the transition to low-carbon transport:

1. Building a credible transport emission baseline and identifying quick wins
2. Integrating the freight sector with rail
3. Transitioning to electric motorbikes
4. Fleet renewal and fuel quality improvements
5. Converting to electric buses

Available research capacity in Pakistan has been identified which include universities and government research centres, including but not limited to CCRD, CDKN, COMSATS, EDB, GCISC, IISD, NUST, RSPN and UET, but also NGOs such as NTRC or companies such as PITCO.

Once research funding is secured, it is proposed that a second visit is undertaken ahead of a procurement process and the implementation of research projects. The purpose of the second visit will be to finalise these themes and questions and raise further awareness within the Pakistan research community and stakeholders.

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# Appendix A: List of workshop attendees

| Sector | No | Organisation | Name | Position | E-mail | Inter-viewed | Work shop |
|---|---|---|---|---|---|---|---|
| Government (both transport and non-transport, such as energy and environment) | 1 | Ministry of Climate Change | Azeem Khoso | Chief | mazeemkhoso@gmail.com | √ | x |
| | 2 | Ministry of Climate Change | Muhammad Saleem | Deputy Director | saleemzeal@gmail.com | x | √ |
| | 3 | Pakistan Environment Protection Agency | Ahsan Kayani | Director | dg@environment.gov.pk | √ | |
| | 4 | National Transport Research Centre | Hameed Akhtar | Chief | hameed.akhtar@yahoo.com | √ | x |
| | 5 | National Transport Research Centre | M Sayyar | Deputy Chief | sayyarntrc@gmail.com | x | √ |
| | 6 | Capital Development Authority | Azam Lodhi | Director Traffic En. & Transp. Planning | azlodhi@hotmail.com | √ | x |
| | 7 | National Highway Authority (NHA) | Dr Asif | Deputy Director | butt.nousheen@gmail.com | √ | x |
| | 8 | National Highway Authority (NHA) | Nousheen Yaqub Butt | Deputy Director Environment | butt.nousheen@gmail.com | √ | x |
| | 9 | Engineering Development Board | Nasir Beg | Chief Executive Officer | mnasirbaig@edb.gov.pk | √ | x |
| International development organisation | 10 | World Bank | Hasan A Zaidi | Sr. Transport Specialist | hzaidi@worldbank.org | √ | x |
| | 11 | ADB Pakistan Resident Mission | Md Bilal Paracha | Transport Specialist | bparacha.consultant@adb.org | √ | x |
| | 12 | ADB Pakistan Resident Mission | Khurram Ghafoor | Project Officer (Infrastructure) | khurramg@adb.org | √ | x |
| | 13 | ADB Project TA 8990-PAK | Khushkhal Khan | Deputy Team Leader Road Safety Policy Specialist | kk@ntu.eu; khankhushal17@gmail.com | √ | x |
| | 14 | Mott Macdonald / ADB Sust Transport Dev Project | Mahboob Elahi | Deputy Team Leader | elahimahboob@hotmail.com | √ | x |
| | 15 | IMC worldwide | Samantha Passmore | Senior Consultant | samantha.passmore@imcworldwide.com | x | √ |
| Industry and industry association | 16 | Pak Gulf | Awais Jalali | Chief Engineer | awais.jalali@gmail.com | √ | √ |
| NGOs, CBOs & Civil Society Organisations | 17 | Rural Support Programmes Network | Khaleel Tetlay | Chief Operating Officer | khaleel.tetlay@rspn.org.pk | √ | x |
| Research institutes or universities | 18 | UET Taxila | Dr Jawad Hussain | Associate Professor | jawad.hussain@uettaxila.edu.pk | √ | √ |
| | 19 | Centre for Climate Research and Development COMSATS University Islamabad | Dr. Anjum Rasheed | Assistant Professor | anjum.rasheed@comsats.edu.pk | √ | √ |
| | 20 | National University of Science and Technology | Dr Kamran Ahmed | Assistant Professor | buet99@hotmail.com | x | √ |

# Appendix B: Workshop invitation & agenda

## Invitation to Low Carbon Transport Workshop

**Date:** **Friday, 13 December 8:30 a.m. to 1:30 p.m.**

**Location:** SCBAP Complex,
56 A, Ataturk Avenue, Near State Bank Building, Islamabad
https://goo.gl/maps/kxgMYa9uxFMFkW1z5

IMC Worldwide (IMC) is pleased to invite you to attend the Low Carbon Transport Workshop on Friday, 13 December 2019 at SCBAP Complex, Islamabad. Kindly confirm attendance through email amina.nasim@humqadam.pk by **9 December 2019**.

### Background

The UK Department for International Development (DfID) is assessing the need for a research programme on low-carbon transport in Pakistan and other countries. Under its High-Volume Transport (HVT) and Energy & Economic Growth (EEG) Programmes, it intends to undertake a scoping exercise to determine research priorities in such countries to inform its funding for low carbon transport research in the selected countries.

IMC is undertaking stakeholder consultations in Pakistan during the second week of December to identify challenges to implementing low carbon transport, determine research needs to overcome these, and to identify the potential beneficiaries of such research. **A workshop on low-carbon transport will be held with key stakeholders from government, public & private sector, donor agencies, industry, NGO & research institutes**.

### Your Opportunity

The workshop provides stakeholders with the opportunity to:

- learn more about DFID's HVT Programme, its focus on Low Carbon Transport, and potential future funding opportunities on Low Carbon Transport;
- influence DFID research priorities on Low Carbon Transport and learn at an early stage about possible DfID funded future research opportunities in Low Carbon Transport in Pakistan;
- to assist in identifying information requirements and challenges to implementing Low Carbon Transport in Pakistan and hence be at the forefront of potential future shift in the transportation sector in Pakistan towards Low Carbon Transport.

**IMC Worldwide Ltd**

http://www.imcworldwide.com/project/hvt

64 – 68 London Road
Redhill
RH1 1LG
United Kingdom

Tel: +44 (0) 01737 231400
Email: imc@imcworldwide.com

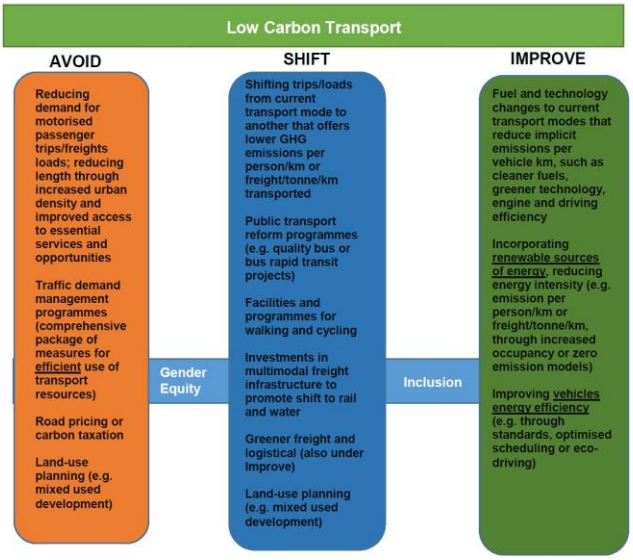
**Workshop's Agenda**

| |
|---|
| 8:30 a.m.: Registration |
| 9:00 a.m.: Introductions |
| 10.00 a.m.: Session I: Briefing & validation of identified research scope |
| 11.30 a.m.: Tea break |
| 12.00 a.m.: Session II: Prioritisation of identified research scope |
| 13.30 a.m.: Lunch and Close |

## Consultation to Determine Research Requirements

### Low Carbon Transport

Low carbon transport will emit less carbon than in the business-as-usual (BAU) scenario. Measures to promote **low carbon transport** include: reducing the need and demand to travel; providing alternatives to the motorised vehicle; improving efficiency of transport, fuel and technologies (including electric cars); providing alternatives to the private car such as high volume public transport (i.e. buses, trolleybuses, trams/light rail, trains, rapid transit [BRT/metro/subway/underground, etc.], ferries and cable-based systems); and improving driver behaviour; etc. The figure to the right provides an overview of the range of measures that may be applied to **AVOID** polluting emissions, **SHIFT** to alternative transport modes and **IMPROVE** the existing vehicle fleet.




### Identifying Research Needs to Promote Low Carbon Transport

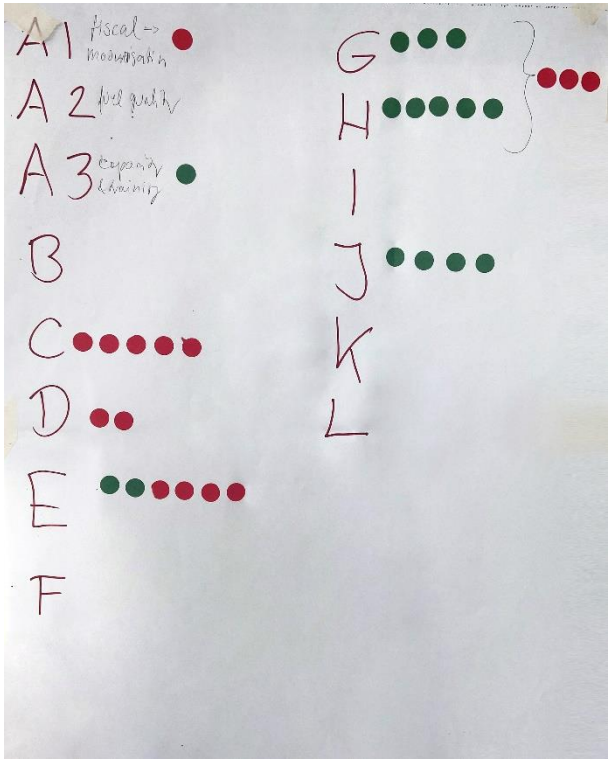
IMC Worldwide is undertaking stakeholder consultations in your country to identify **challenges** to implementing low carbon transport, determine **research needs** to overcome these challenges, and to identify the potential **beneficiaries** of such research.

In preparation for the consultation process, we would like you to think about the following questions. The information gathered in the scoping study will be used to inform a proposal for a potential research programme on low carbon transport in your country funded by the UK Department of International Development.

1. What are the key challenges to low carbon transport in your country?
2. What type of knowledge/research (e.g. developing capacity, and sharing knowledge/good practice/tools) could be undertaken to assist in overcoming these challenges?
3. Which actors/organisations/research institutes are best placed to undertake this research?
4. Who could be the main beneficiaries of such knowledge/research?

# Appendix C: Workshop documents


AASG1
Accessible
Affordable & efficient
Safe
Green
Inclusive
Policy, planning & regulations
Finance & Economics
Governance & Institutions
Technology
Data
Operation, Service & Management
Infrastructure


A1 fiscal -> modernisation
A2 fuel quality
A3 capacity & training
B
C
D
E
F
G
H
I
J
K
L

# Appendix D: Workshop evaluation forms

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# HVT Low Carbon Transport Scoping Study

## Workshop Evaluation Form

| | | | |
|---|---|---|---|
| **Male:** | | | |
| **Female:** | ✓ | | |
| **Workshop location** | SCBAP Complex - Islamabad | **Date:** | 13/12/2019 |
| **Name of workshop:** | LOW CARBON TRANSPORT SCOPING STUDY - PAKISTAN | | |

*This form is intended for internal use within the HVT programme. The data provided in this form will be treated with strict confidentiality and will be analysed purely towards improving the programme's provision of validation workshops activities.*

1. **Reaction**

How would you rate the overall content of the workshop in the following areas?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.1. Usefulness: | Poor | 1 | 2 | 3 | 4 | 5 ✓ | Excellent |
| 1.2. Relevance: | Poor | 1 | 2 | 3 | 4 | 5 ✓ | Excellent |
| 1.3. Methods: | Poor | 1 | 2 | 3 | 4 | 5 ✓ | Excellent |

2. **Learning**

Thinking about the overall topic of the workshop how much have you learned about understanding the research gaps in low carbon transport in your country?

| | | | | |
|---|---|---|---|---|
| Much less than expected | Less than expected | As expected ✓ | More than expected | Much more than expected |

Do the outputs from the workshop address low carbon transport needs and priorities in your country?

If yes briefly explain: Yes, all research gaps have been highlighted and the Need assessment to introduce low-carbon transport was also carried out.

3. **Behaviour**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| How likely are you to submit a research proposal for any of the suggested topics | Never | 1 | 2 | 3 | 4 | 5 ✓ | Guaranteed |

If yes, please provide any information on particular area of interest (optional)

- ~~Air Quality~~ Contribution of transport sector to air pollution
- Climate impact assessment of Gawadar Port (shipping)
- GHG Emission Assessment & future projections

How likely are you to continue your relationship with the HVT programme in your research proposal/work (optional)

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | 3 | 4 | 5 ✓ | Guaranteed |

4. **Reflection**

What can we improve to make this process better in the future research scoping? (optional)

Strengthen coordination with relevant stakeholders including public & private sector

***Thank you for taking the time to provide this valuable feedback!***

HIGH VOLUME TRANSPORT APPLIED RESEARCH

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# HVT Low Carbon Transport Scoping Study

## Workshop Evaluation Form

| | | | |
|---|---|---|---|
| **Male:** | | | |
| **Female:** | ✓ | | |
| **Workshop location** | SCBAP Complex - Islamabad | **Date:** | 13/12/2019 |
| **Name of workshop:** | LOW CARBON TRANSPORT SCOPING STUDY - PAKISTAN | | |

*This form is intended for internal use within the HVT programme. The data provided in this form will be treated with strict confidentiality and will be analysed purely towards improving the programme's provision of validation workshops activities.*

**1. Reaction**

How would you rate the overall content of the workshop in the following areas?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.1. Usefulness: | Poor | 1 | 2 | 3 | (4) | 5 | Excellent |
| 1.2. Relevance: | Poor | 1 | 2 | 3 | 4 | (5) | Excellent |
| 1.3. Methods: | Poor | 1 | 2 | (3) | 4 | 5 | Excellent |

**2. Learning**

Thinking about the overall topic of the workshop how much have you learned about understanding the research gaps in low carbon transport in your country?

| | | | | |
|---|---|---|---|---|
| Much less than expected | Less than expected | As expected | (More than expected) | Much more than expected |

Do the outputs from the workshop address low carbon transport needs and priorities in your country?

If yes briefly explain:

I don't know if we sufficiently covered ways to overcome challenges. We identified challenges & research areas, but not ideas

**3. Behaviour**

How likely are you to submit a research proposal for any of the suggested topics

It's not really my field.

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | (2) | 3 | 4 | 5 | Guaranteed |

If yes, please provide any information on particular area of interest (optional)

How likely are you to continue your relationship with the HVT programme in your research proposal/work (optional)

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | (3) | 4 | 5 | Guaranteed |

**4. Reflection**

What can we improve to make this process better in the future research scoping? (optional)

I think there was too much text on each issue - should have been done in presentation. Also it limited us to those issues

***Thank you for taking the time to provide this valuable feedback!***

HIGH VOLUME TRANSPORT APPLIED RESEARCH

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# HVT Low Carbon Transport Scoping Study

## Workshop Evaluation Form

| | | | |
|---|---|---|---|
| **Male:** | ✓ | | |
| **Female:** | | | |
| **Workshop location** | SCBAP Complex - Islamabad | **Date:** | 13/12/2019 |
| **Name of workshop:** | LOW CARBON TRANSPORT SCOPING STUDY - PAKISTAN | | |

*This form is intended for internal use within the HVT programme. The data provided in this form will be treated with strict confidentiality and will be analysed purely towards improving the programme's provision of validation workshops activities.*

**1. Reaction**

How would you rate the overall content of the workshop in the following areas?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.1. Usefulness: | Poor | 1 | 2 | 3 | (4) | 5 | Excellent |
| 1.2. Relevance: | Poor | 1 | 2 | 3 | (4) | 5 | Excellent |
| 1.3. Methods: | Poor | 1 | 2 | (3) | 4 | 5 | Excellent |

**2. Learning**

Thinking about the overall topic of the workshop how much have you learned about understanding the research gaps in low carbon transport in your country?

| | | | | |
|---|---|---|---|---|
| Much less than expected | Less than expected | (As expected) | More than expected | Much more than expected |

Do the outputs from the workshop address low carbon transport needs and priorities in your country?

If yes briefly explain: Yes, specially related track & mass transit industry.

**3. Behaviour**

How likely are you to submit a research proposal for any of the suggested topics

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | (3) | 4 | 5 | Guaranteed |

If yes, please provide any information on particular area of interest (optional)

Truck industry & Mass Transit in Pakistan.

How likely are you to continue your relationship with the HVT programme in your research proposal/work (optional)

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | 3 | 4 | (5) | Guaranteed |

**4. Reflection**

What can we improve to make this process better in the future research scoping? (optional)

—

***Thank you for taking the time to provide this valuable feedback!***

HIGH VOLUME TRANSPORT APPLIED RESEARCH

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# HVT Low Carbon Transport Scoping Study
## Workshop Evaluation Form

| | |
|---|---|
| **Male:** | ✓ |
| **Female:** | |

| | | | |
|---|---|---|---|
| **Workshop location** | SCBAP Complex - Islamabad | **Date:** | 13/12/2019 |
| **Name of workshop:** | LOW CARBON TRANSPORT SCOPING STUDY - PAKISTAN | | |

*This form is intended for internal use within the HVT programme. The data provided in this form will be treated with strict confidentiality and will be analysed purely towards improving the programme's provision of validation workshops activities.*

1. **Reaction**

How would you rate the overall content of the workshop in the following areas?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.1. Usefulness: | Poor | 1 | 2 | 3 | 4 | (5) | Excellent |
| 1.2. Relevance: | Poor | 1 | 2 | 3 | 4 | 5 | (Excellent) |
| 1.3. Methods: | Poor | 1 | 2 | 3 | (4) | 5 | Excellent |

2. **Learning**

Thinking about the overall topic of the workshop how much have you learned about understanding the research gaps in low carbon transport in your country?

| | | | | |
|---|---|---|---|---|
| Much less than expected | Less than expected | As expected | (More than expected) | Much more than expected |

Do the outputs from the workshop address low carbon transport needs and priorities in your country?

If yes briefly explain: Yes, Most of the aspects are recorded and addressed

3. **Behaviour**

How likely are you to submit a research proposal for any of the suggested topics

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | 3 | 4 | 5 | (Guaranteed) |

If yes, please provide any information on particular area of interest (optional) Enviromt monitoring, data collection, retro fitting of cars/bikes, fesibilites etc.

How likely are you to continue your relationship with the HVT programme in your research proposal/work (optional)

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | 3 | 4 | 5 | (Guaranteed) |

4. **Reflection**

What can we improve to make this process better in the future research scoping? (optional) Time was very short I will suggest that more time be given to record and exract more from the various heads of workshop.

***Thank you for taking the time to provide this valuable feedback!***

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# HVT Low Carbon Transport Scoping Study

## Workshop Evaluation Form

| | | | |
|---|---|---|---|
| **Male:** | ✓ | | |
| **Female:** | | | |
| **Workshop location** | SCBAP Complex - Islamabad | **Date:** | 13/12/2019 |
| **Name of workshop:** | LOW CARBON TRANSPORT SCOPING STUDY - PAKISTAN | | |

*This form is intended for internal use within the HVT programme. The data provided in this form will be treated with strict confidentiality and will be analysed purely towards improving the programme's provision of validation workshops activities.*

1. **Reaction**

How would you rate the overall content of the workshop in the following areas?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.1. Usefulness: | Poor | 1 | 2 | 3 | 4 | 5 ✓ | Excellent |
| 1.2. Relevance: | Poor | 1 | 2 | 3 | 4 | ✓5 | Excellent |
| 1.3. Methods: | Poor | 1 | 2 | 3 | 4 | 5✓ | Excellent |

2. **Learning**

Thinking about the overall topic of the workshop how much have you learned about understanding the research gaps in low carbon transport in your country?

| | | | | |
|---|---|---|---|---|
| Much less than expected | Less than expected | As expected | More than expected | Much more than expected ✓ |

Do the outputs from the workshop address low carbon transport needs and priorities in your country?

If yes briefly explain: Yes Because, there is a Years of Gap of research on Low Carbon Transport in Pakistan

3. **Behaviour**

How likely are you to submit a research proposal for any of the suggested topics

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | ✓ 3 | 4 | 5 | Guaranteed |

If yes, please provide any information on particular area of interest (optional)

Enhanced Air pollution Monitoring, sustainable urban planning

How likely are you to continue your relationship with the HVT programme in your research proposal/work (optional)

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | ✓ 3 | 4 | 5 | Guaranteed |

4. **Reflection**

What can we improve to make this process better in the future research scoping? (optional)

***Thank you for taking the time to provide this valuable feedback!***

HIGH VOLUME TRANSPORT APPLIED RESEARCH

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Do the outputs from the workshop address low carbon transport needs and priorities in your country?

If yes briefly explain: Off course it will help the GoA have more rationalized decisions

3. **Behaviour**

How likely are you to submit a research proposal for any of the suggested topics

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | 3 | 4 | 5 ✓ | Guaranteed |

If yes, please provide any information on particular area of interest (optional)

GHG and Urban Transport -

How likely are you to continue your relationship with the HVT programme in your research proposal/work (optional)

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | 3 | 4 | 5 ✓ | Guaranteed |

4. **Reflection**

What can we improve to make this process better in the future research scoping? (optional)

I think proposal to be submitted at the scoping by individual Pr or organizations then to discuss it in the groups.

***Thank you for taking the time to provide this valuable feedback!***

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**2. Learning**

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| | | | | |
|---|---|---|---|---|
| Much less than expected | Less than expected | As expected ✓ | More than expected | Much more than expected |

Do the outputs from the workshop address low carbon transport needs and priorities in your country?

If yes briefly explain: After discussion it is more clear than before.

**3. Behaviour**

How likely are you to submit a research proposal for any of the suggested topics

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | 3 | 4 | 5 | Guaranteed ✓ |

If yes, please provide any information on particular area of interest (optional)

Public mass transport.

How likely are you to continue your relationship with the HVT programme in your research proposal/work (optional)

| | | | | | | |
|---|---|---|---|---|---|---|
| Never | 1 | 2 | 3 | 4 | 5 | Guaranteed ✓ |

**4. Reflection**

What can we improve to make this process better in the future research scoping? (optional)

- Ensure more participation.
- Invite private sector.

***Thank you for taking the time to provide this valuable feedback!***

# Appendix E: Longlist of International Development Programmes

The below projects are all ACTIVE unless specifically stated that they are PROPOSED or COMPLETED. Project Closing/Completion Dates (PCD) are given for each project where available.

The **China-Pakistan Economic Corridor (CPEC)** is a framework of regional connectivity. It focuses on enhancing geographical linkages to improve road, rail and the air transport system with frequent and free exchanges of growth and people to people contact. This is expected to enhance understanding through academic, cultural and regional knowledge and culture. A higher volume of flow of trade and businesses which will produce and move energy to have more optimal businesses and enhance co-operation (Governments of Pakistan and China). (CPEC, 2020)

Under CPEC various large transport infrastructure projects will be implemented including several highway and railway projects as well as urban mass transport projects. It also includes capacity building elements. Main transport infrastructure projects include:

Road Sector Projects:

- KKH Phase II (Thakot -Havelian Section) (PCD Mar 2020)
- Peshawar-Karachi Motorway (Multan-Sukkur Section) (Inaugurated on 05 November 2019)
- Khuzdar-Basima Road N-30 (110 km) (Procurement of Civil Work is under process; project has been taken up through PSDP)
- Upgradation of D.I.Khan (Yarik) - Zhob, N-50 Phase-I (210 km) (Land acquisition in Progress.
- Accorded highest priority in 8th JCC)
- KKH Thakot-Raikot N35 remaining portion (136 Km) (Procedural to be completed shortly)

Rail Sector Projects:

- Expansion and reconstruction of existing Line ML-1 (Project will be completed in 2 phases
- PC-1 of Phase-1 approved by CDWP in May 2018)
- Havelian Dry port (450 M. Twenty-Foot Equivalent Units) (Project to be put on fast track
- Framework agreement signed in May 2017)
- Capacity Development of Pakistan Railways (Focus groups be established for effective training and capacity enhancement)

The **Central Asia Regional Economic Cooperation (CAREC) Programme** is a partnership of 11 countries and development partners working together to promote development through cooperation, leading to accelerated economic growth and poverty reduction. The programme is a proactive facilitator of regional projects and policy initiatives including multimodal transport networks and facilitated free movement of people and freight (Governments, ADB, WB, EBRD, IsDB, DfID & others). (CAREC, 2020)

Under CAREC, several transport or transport related projects are being implemented including:

- Supporting Economic Corridor Development through Strategic Planning Frameworks
- The technical assistance (TA) aims to assist Pakistan to realize the potential of economic corridor development (ECD) to boost industrial productivity, exports, and job creation and thereby contribute to sustained, increased and equitable economic growth. ADB (PCD Dec 2020)
- CAREC Corridor Development Investment Program, Tranche 1
- The project proposed for financing is building an additional 2-lane carriageway of 66 kilometres (km) along the existing 2-lane carriageway of Petaro–Sehwan road; an additional 2-lane carriageway of 43 km along the existing 2-lane carriageway of Ratodero–Shikarpur road; rehabilitating the existing 34-km 4-lane carriageway of Dara Adamkhel–Peshawar road; and developing the capacity of the National Highway Authority through due diligence advisory services and assistance with project implementation. ADB (PCD Dec 2022)
- CAREC Railway Connectivity Investment Program
- The project preparatory technical assistance will (i) develop an MFF and tranche projects bankable by ADB loan; (ii) conduct due diligence for technical, economic, financial, social, and

environmental viability of the first tranche project; (iii) and prepare required due diligence documents. ADB (PCD Aug 2020)

- National Motorway M-4 Gojra–Shorkot–Khanewal Section Project, Additional Financing
- The additional financing will support an increase in the scope of the current project by constructing a 64-kilometer (km) four-lane, access-controlled motorway connecting Shorkot and Khanewal in Punjab Province, which is the last missing section of the national motorway M-4 to be constructed. ADB (PCD Mar 2020)
- Enabling Economic Corridors through Sustainable Transport Sector Development
- The technical assistance is in line with the Country Partnership Strategy for Pakistan 2015-2019, which, in turn, is aligned with the Government of Pakistan's national strategy (Pakistan Vision 2025). ADB (PCD Dec 2020)
- National Motorway M-4 Gojra–Shorkot Section Project
- The proposed project will construct a 62-kilometer (km) four-lane, access-controlled motorway connecting Gojra and Shorkot in Punjab Province. ADB (PCD May 2020)
- Pakistan Economic Corridors Programme
- Improved transport infrastructure in Pakistan along with enhanced private sector involvement in infrastructure financing, road safety interventions and support to regulatory environment, leading to increased trade and economic growth in Pakistan. DfID co-financing (PDC Dec 2022).

Other **regional initiatives with transport or related climate change elements** include:

- Supporting Environmental Safeguards in the Central and West Asia Region. ADB (PCD Mar 2020)
- Implementation of Sustainable Transport for All. ADB (PCD Dec 2020)
- Promoting Urban Climate Change Resilience in Selected Asian Cities. ADB (PCD not available)
- Khyber Pass Economic Corridor Project which includes among other expressway development and capacity building (IBRD) Peshawar-Torkham (KPEC) Pending ECNEC approval World Bank approved 2018.

Various **Bus Rapid Transit Projects** are being panned or implemented including:

- Karachi Metro Bus Rapid Transit
    - Green Line Extension Project. Government of Pakistan (PCD not available)
    - Orange Line Project CPEC (PCD estimated 2020)
    - Blue Line Project Private Financing / PPP (PCD not available)
    - Yellow Line Project IBRD (PCD estimated 2024)
    - Red Line Project. ADB (PCD estimated 2024)
- Peshawar Sustainable Bus Rapid Transit Corridor Project. ADB (PCD Dec 2021)
- Karachi Circular Railway. CPEC, possibly Japanese financing (PCD not available)
- Greater Peshawar Region Mass Transit. CPEC (PCD not available)
- Quetta Mass Transit. CPEC (PCD not available)
- Orange Line – Lahore. CPEC (PCD not available)

Various **Urban Development** Projects having a transport element, including:

- Provincial Strategy for Inclusive and Sustainable Urban Growth which has an urban / public transport component. ADB (PCD Dec 2020)
- Capacity Building for Structural Transformation, Country Programming, and Portfolio Management which has an urban public transport element. ADB (PCD Dec 2021)
- Karachi Mobility Project which not only includes the BRT system along the yellow corridor but also a multitude of other initiatives improving urban infrastructure and transport, including capacity building (PCD estimated 2024)
- Karachi Neighbourhood Improvement Project. IDA (PCD Nov 2021)

Various **Provincial Road** Projects

- Khyber Pakhtunkhwa Provincial Roads Improvement Project. ADB (PCD Jun 2023)
- Sindh Provincial Road Improvement Project. ADB (PCD Jun 2020)
- Rural Roads Construction Project (Sindh) (JICA)

Other **national transport or related climate change related initiatives** include:

- Punjab Green Development Program. IDA (PCD Jun 2023)
- Sindh Resilience Project. IDA (PCD Feb 2022)
- Disaster and Climate Resilience Improvement Project (IDA)
- Indus Highway Construction Project (JICA)
- Highway Research and Training Center (JICA)
- East-West Road Improvement Project (JICA)
- Khyber Pakhtunkhwa Emergency Rural Roads Rehabilitation (JICA)

Technical Cooperation for Establishment of Environmental Monitoring System (JICA)

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