

# WP6 – Barriers to implementation

## 1.1 Introduction

Cities, and particularly megacities, play an important role in India's economic growth – more than 60 per cent of the Gross Domestic Product (GDP) is produced in urban areas (Singh, 2016). More than one third of India's population live in cities and the country has seven megacities (more than four million inhabitants). This chapter studies India's three largest cities: New Delhi, Mumbai, and Bangalore. The population of these cities have been growing rapidly over the last decade owing to in-migration from other parts of the country, posing immense pressure on the infrastructure including transportation, sewage and drainage and, healthcare. These cities are all facing similar problems in terms of rapid population growth, traffic congestion, and increasing GHG emissions and serious air pollution rates. Due to the sheer size of these cities, they can be expected to face enormous transport, environmental and climate related challenges as their large populations increase and gradually become more motorized due to economic development. Moreover, such large and complex transport systems are also particularly vulnerable in terms of transport infrastructure damage and breakdowns due to future climate change related weather events. In such instances, the cities could also be facing serious potential problems in case of, for instance, mass evacuations due to extreme weather such as heavy rainfall, floods, storms etc.

Since Indian cities are facing huge transport emissions as well as climate change adaptation challenges in the years to come, knowledge among stakeholders on the national and local level is important for how the society can and should adapt to these challenges. To gain knowledge on how different measures are promoted within and towards the urban areas, this chapter uses insights from interviews with stakeholders at the local and national level, as well as a stated preference survey and secondary literature.

As several scholars (Revi, 2007, Ahluwalia and Mohanty, 2014) have recognized, there are significant institutional barriers for an optimal design of policies and interventions. Different policy instruments are often under the control of different agencies or even different levels of government, and their actions are not being or cannot always be coordinated. Consequently, there is a need to strengthen vertical as well as horizontal institutional coordination. Furthermore, optimal application of policies and measures involves financial costs, and governments at all levels are subject to severe budgetary constraints.

The measures discussed, proposed; and in some cases; implemented in Indian cities, are have previously been implemented in other countries. Transferring experiences from one country to another does however imply a process in which knowledge about policies, administrative arrangements, institutions and ideas in one political system (past or present) is used in the development of policies, administrative arrangements, institutions and ideas in another (Dolowitz & Marsh, 2000). The background is usually decision makers believing that solutions successfully applied in one setting will also work well in their own country/district (Rose, 1993).

Success factors and barriers, respectively, contribute to or hinder the implementation of a measure or a package of measures. Since different countries and different policy

areas experience different success factors and barriers, a policy solution is normally not transferred directly. Instead, hybrid solutions occur, adjusted to the national context (OPTIC, 2011). Whether a funding scheme is transferable depends on whether it has sufficient acceptance politically and culturally and sufficient similarity, including legal and institutional factors, previous practices and geographic and demographic characteristics. It also requires sufficient resources, financially as well as cognitively.

## **1.2 Analytical perspectives on barriers**

This section provides analytical perspectives on policy barriers, derived from theoretical contributions. In section 1.5, this analytical framework will be applied for a discussion on empirical findings.

Whether a policy instrument; or a package of policy instruments, will be implemented depends on institutional capacity, and whether it has sufficient acceptance politically and culturally. Barriers to implementation can therefore be understood as any kind of factor that impede or hinder policy adoption and/or implementation of single policy measures or policy packages (OPTIC, 2011, Olsen and Fearnley, 2014).

Some transport policies encounter stronger barriers than others. It has been argued that policy measures or packages that are perceived as “radical”, e.g. aiming to enact fundamental changes in transport behaviour, will probably encounter stronger barriers than policy measures that are more in line with “business as usual” and the overall trend of “predict and provide”.

May et al (2003) identifies four broad categories of barriers:

1. *Coordination issues, legal and institutional barriers*
2. *Financial barriers*
3. *Political and cultural barriers*
4. *Practical and technological barriers*

A policy instrument, or a package of policy instruments, will induce specific political, institutional, communicative, etc. barriers in a country.

### **1.2.1 Coordination issues, legal and institutional barriers**

Legal and institutional barriers can be approached as a broad category, featuring existing national regulations, legislative- and administrative processes, and administrative costs. It includes including lack of legal powers, or unclear roles and responsibilities among key actors. Responsibilities may be split between agencies, which leads to complex coordination issues.

Many specialized and non-overlapping roles and functions are believed to hinder cooperation and coordination, which in turn may hinder public goal achievement (Boston and Eichbaum 2005). Coordination may take place vertically; through the

hierarchy (Bouckaert et al. 2010), horizontally; between units at the same organisational level, or both (Hill, 2009). Network theory, where coordination takes place through mutual dependence and trust among actors (Osborne 2010), might be useful for analysing horizontal as well as vertical coordination. Any measure of coordination holds a dual nature; Vertical coordination involves hard instruments (regulations and financial instruments) as well as soft instruments (information, communication) (Bouckaert et al. 2010), horizontal coordination can take the form of a beneficial trade or reflect inequalities (Hill, 2009), and network coordination always exists in “the shadow of hierarchy” (Scharpf, 1999).

Challenges to coordination include *intra-* and *inter- institutional incompatibilities*. Institutions consist of rules, norms, cognitive and other frameworks that stabilize social perception and interaction. Two implications can be drawn from this insight. *First*, that a well-established institutional arrangement, with standard operating procedures, will resist to ways of working with others that threatens stability (March and Olsen, 1989). *Second*, that the institutional frameworks of different agencies can be inherently contradictory. Different cultures or institutional norms, different mandates and different problem approaches pose challenges for institutions to work together (Campbell and Hartnett, 2005). When institutions are forced to cooperate, these contradictions may actually be highlighted.

### **1.2.2 Financial Barriers**

Financial barriers include restrictions in terms of budget and finance. Ensuring proper and sufficient financing mechanisms for the urban transport sector is vital for a sustainable development of urban areas. This motivates continuous improvements of the funding systems and a quest for best practices

While resources might always be scarce, new financing schemes affect investments. Olsen and Fearnley (2014) discusses the possibility of transferring financing experiences from one country to another, and the adoption of a wide range of funding schemes<sup>1</sup>.

### **1.2.3 Political and Cultural Barriers**

Political and cultural barriers may involve acceptability problems, strong pressure groups resisting the policy package, and other cultural attributes affecting the attitudes and actions among people involved in or affected by the policy in question.

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<sup>1</sup> Including subsidy schemes for operation and investment; different loan schemes; tax schemes, including regional petrol tax, corporation tax, tax on employer paid parking, and (local) personal taxation. The also assess property development as a way of funding (in the form of land value capture solutions), and, finally, Public Private Partnerships (PPPs) and similar solutions.

Policy- and implementation literature point to particular types of policies, which might encounter stronger barriers than other types of policies. Lowi (1985) distinguishes between four types of policies:

- Regulatory policies (e.g. road traffic acts)
- Distributive policies (e.g. infrastructure policy)
- Redistributive policies (e.g. taxes, duties), and
- Constituent policies (e.g. establishing a new transport agency).

In relation to this categorization, one could expect that public acceptability would be more likely in the case of adoption and implementation of distributive and constituent policies than regulatory and redistributive policies, because the former confers powers and privileges, while the latter imposes obligations or positions (see also Ripley & Frankling 1982: 81). On the other hand, constituent policies might be more likely than the other types of policies to experience resistance from public organizations, because this type of policy often change institutional frameworks of these organizations.

The extent of likely success or failure for implementation of a policy or package can also be seen as depending on whether advantages and disadvantages of the policy are concentrated to a small group or divided among a larger population. A number of studies have been investigating whether advantages and disadvantages of a policy are spread among large groups or focused on a specific group. This results in four policy types, where client policy (e.g. infrastructure projects funded by tax, thus focused advantages and spread disadvantages) is most likely to be decided and implemented, while entrepreneur policy (e.g. heavy vehicle fee, with spread advantages and focused disadvantages) is least likely to be decided and implemented. Wilson (1980) and Winter (1991) have hence outlined four combinations of advantages and disadvantages distribution:

- Majority Policy (scattered advantages- scattered disadvantages), such as environmental tax measures to reduce CO2 emissions in the transport sector
- Entrepreneur Policy (focused disadvantages- scattered advantages), such as corporate tax for a general upgrading of public transport
- Client Policy (scattered disadvantages - focused advantages), such as road construction financed from the state budget
- Interest Group Policy (focused disadvantages- focused advantages), such as building bridges financed with high road toll collection

The relationship between the various policies is illustrated in the table below.

|               |  | Advantages |         |
|---------------|--|------------|---------|
| Disadvantages |  | Scattered  | Focused |

|  |                  |                     |                       |
|--|------------------|---------------------|-----------------------|
|  | <b>Scattered</b> | Majority Policy     | Client Policy         |
|  | <b>Focused</b>   | Entrepreneur Policy | Interest Group Policy |

ons of Advantages and Disadvantages Distribution

The introduction of a Majority Policy is not likely to stir much public attention or enthusiasm, since no group in the population have a strong incentive to advocate or oppose it. The introduction of an Entrepreneur Policy will motivate the group bearing the burden of financing to mobilize strongly against the policy, while no group will have strong incentives to advocate it. Consequently, the Entrepreneur Policy is least likely to be implemented. Conversely, the costs of a Client Policy are widely distributed, while the benefits will be apparent to a particular group and the Client Policy hence holds the greatest likelihood of being implemented. The introduction of an Interest Group Policy can result in strong mobilization both for and against it, and the outcome will often depend on the relative strength of each group.

#### 1.2.4 Practical and technological barriers

Practical and technological barriers may include practical aspects like possibilities for land acquisition for infrastructure projects, administrative solutions, information, available technology etc.

### 1.3 Data and method

In order to get information about the challenges of urban transport in Indian cities, we gathered qualitative data in May and June 2017. We conducted semi-structured interviews with stakeholders in two global organizations involved in transport projects in Indian cities, three national government organizations, five local government organizations and two local transport service organizations – in total 12 interviews. Three of the interviews were conducted over telephone, while nine were conducted face-to-face. One interview was conducted as a group interview.

We used open-ended questions to let the interviewees themselves elaborate on specific transport measures that have already been implemented, or that are yet to be implemented. It was important to let the stakeholders speak freely to share their perception on the situation. The main topic in the interview guide was the implementation of specific measures and barriers/opportunities for implementation. Because the three cities have different challenges and have adopted different measures, the measures we asked about somewhat differed, depending on the city or government level. Typically, however, measures such as Electronic Congestion Pricing, Car Sharing, Bike Sharing, Information Technology for Traffic Management, Electric vehicles, Bus Rapid Transit, Freight Restriction Policies and Advance Climate Warning System were addressed. The stakeholders were also asked to elaborate on the

institutional framework in the cities as well as the need for involvement by national authorities.

We also used insight from a Delphi-study, conducted by the CLIMATRANS project in 2016. The Delphi-study was conducted as a two round survey, with responses from experts in New Delhi, Bangalore, and Mumbai.

## **1.4 Institutional framework for urban transport**

India has a federal system of government with a national government and several regional state governments. Urban transport was not recognized as a separate subject at the national government level until 1986, when the Ministry of Urban Development (MoUD) was given the responsibility of integrated planning of transport services in cities (Agarwal and Chauhan 2011, p. 112).

In regional state governments, the responsibility for urban transport remain confusing, with different components of the transport system handled by multiple agencies (Agarwal and Chauhan 2011, p. 112-3). Urban development authorities have an important role in coordinating and providing infrastructure and channeling investments in cities. These organizations are under direct control of the regional state government and report to the national government (Gandhi and Pethe 2017, p. 58; Agarwal and Chauhan 2011, p. 113). At the local level, basic goods and services are provided by urban local bodies (ULBs), which are municipal corporations, municipal councils and nagar panchayats (Gandhi and Pethe 2017, p. 58). The Indian railway including both long-distance and suburban rail systems, is owned and operated by the national government through the Ministry of Railways.

According to the constitutional amendment act, metropolitan regions in India are 'areas with more than one million citizens, comprised in one or more districts, consisting of two or more municipalities, specified by the Governor by public notification to be a Metropolitan area'. This means that it does not exist a directly or indirectly elected government at the metropolitan level (Gandhi and Pethe 2017, p. 57). Metropolitan regions in India can be characterized as 'ostensibly' polycentric governance systems: Multiple organizations operate at different levels and have overlapping functions and jurisdictions. However, as 'true' polycentric systems allow for cooperation between organizations and encourages competition, the Indian system lacks cooperation and competition between the numerous agencies (Gandhi and Pethe 2017, p. 56).

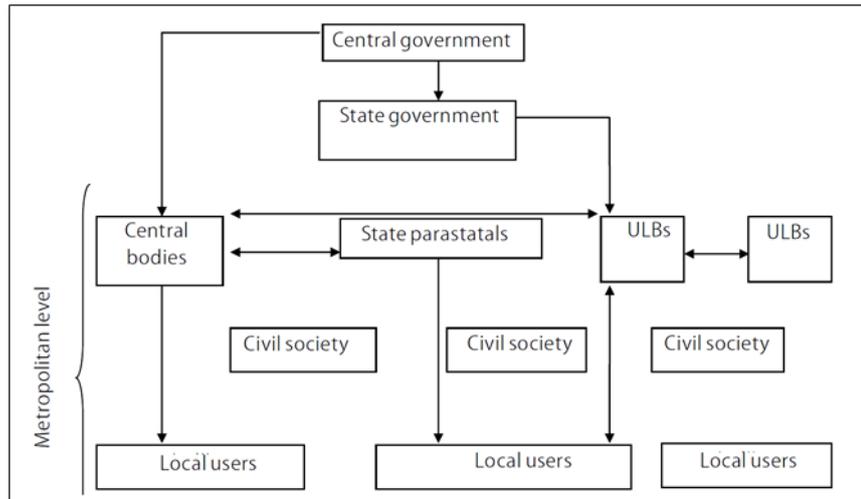


Figure 1 Actors in the Governance of Metropolitan Regions in India (Pethe et al. 2012)

In 2006, the ‘National Urban Transport Policy’ plan recommended to establish Unified Metropolitan Transport Authorities (UMTAs) for cities with a population of more than a million to ensure coordinated transport planning (Agarwal and Chauhan 2011, p. 112). In Bangalore, an UMTA was established in 2007 named Bangalore Metropolitan Land Transport Authority. In Mumbai, the Unified Mumbai Metropolitan Transport Association (UMMTA) was established in 2008. In Delhi, the government also proposed the establishment of an UMTA. However, since Delhi is a city-state, the transport system is one of the principal responsibilities of the state government. Due to the political importance of the transport system, the chief minister wanted to head the UMTA. In other cities, this role has usually been assigned to the chief secretary. Furthermore, since multiple levels of government is involved in the Delhi transport system, it was necessary to plan the UMTA in Delhi as a statutory authority (Agarwal and Chauhan 2011, p. 115). Today, an UMTA in Delhi is still not established. Delhi has however established the umbrella body “Unified Traffic and Transportation Infrastructure (Planning & Engineering) Centre” (UTTIPEC); to provide technical inputs on major transport development matters for approval by Lt. Governor of Delhi.

The ‘National Urban Transport Policy’ plan 2014 states that the current institutional framework in cities is not equipped to deal with the problems of urban transport. In many Indian cities, there is still no dedicated organization with a comprehensive responsibility for urban transport, and city administrations lack transport planning expertise (MoUD 2014, p. 28). The national government urges all states with cities of more than a million to set up a UMTA. The UMTA should include representatives from all city agencies and stakeholders, and the entire funding for urban transport should be routed through this organization. As there is no legislation that covers urban transport comprehensively, the national government will work to promote such legislation (MoUD 2014, p. 29).

The institutional set-up differs in the three cases Delhi, Bangalore and Mumbai. Delhi has an institutional set-up characterized by a lack of a transport-focused organization that holds coordinative responsibilities. The city of Bangalore has established two units that are working to make the urban transport sector more comprehensive and sustainable. The city of Mumbai has established one unit for urban transport. However, this organization has been largely ineffective.

## **Delhi**

Delhi seems to lack an institution that holds an overarching responsibility of managing and coordinating the entire transport sector. The Delhi Development Authority holds a coordinative responsibility; but it covers a vast array of sectors (business, water, electricity, etc.) in addition to transport. The Delhi Transport Department deals with tax collection and vehicle control, but does not address other transport sector issues such as infrastructure, public transport, etc. The responsibility of the Unified Traffic and Transportation Infrastructure Centre Delhi on the other hand, is to oversee infrastructure development, but it apparently holds a limited possibility of linking infrastructure development with developments in e.g. the vehicular population. With the given institutional structure, there is a need to establish well-functioning governance networks that enables the Delhi Transport Department the Unified Traffic and the Transportation Infrastructure Centre Delhi to work closely together. Informants in the introductory stakeholder's meeting also pointed out this need, but so far, initiatives seem to be scarce.

Delhi also has yet to establish an UMTA, but informants expressed some skepticism towards this institutional arrangement, arguing that prevailing experiences in other Indian cities has not been successful due to the absence of adequate powers and financial resources. Delhi has however established the umbrella body "Unified Traffic and Transportation Infrastructure (Planning & Engineering) Centre" (UTTIPEC); to provide technical inputs on major transport development matters for approval by Lt. Governor of Delhi. With the lack of an UMTA, along with only one operating corporation within each mode of transport (the Delhi Transport Corporation and the Delhi Metro Rail Corporation), these public transport operators are likely to hold great autonomy, as monopolist providers. Both corporations are owned by the government of Delhi (and in the case of the Delhi Metro Rail Corporation; also by the Government of India). The vast responsibilities of the Government of Delhi might reduce its capabilities of performing active ownership management. Consequently, a transference of ownership to a transport related ministry/agency might strengthen ownership involvement.

In the organization of transport infrastructure, the responsibilities of the Public Works Department (PWD) seem to partially overlap with the Unified Traffic and Transportation Infrastructure Centre Delhi; which is an agency that provides and approves standards, and partially with the Delhi Integrated Multi-Modal Transit System, which is a corporation that provides building and maintenance of infrastructure. Establishing responsibilities and tasks that are more clear-cut, along with principles for infrastructure operations subject to tender, might be desirable.

## **Bangalore**

Bangalore has established two land use and development coordinative authorities; the Bangalore Metropolitan Region Development Authority (BMRDA), and the Bangalore Development Authority (BDA). These agencies do not solely focus on land use for transport purposes, but the development of the city as a whole. The jurisdiction, as well as some of the tasks of the BDA seem to overlap with that of the BMRDA. The BMRDA does however hold a wider jurisdiction, and accordingly a more comprehensive view of the entire Bangalore Metropolitan region. It is unclear whether these agencies have established well-functioning governance networks that enables them to work closely together. The Centre for Infrastructure, Sustainable Transport and Urban Planning (CiSTUP) formed under Government of Karnataka for providing scientific decision support and does not hold decision-making powers. Also, due to various reasons, it has not been performing effectively.

Similar to the institutional set-up in Delhi, the Transport Department holds quite limited responsibilities; dealing with tax collection and vehicle control.

Bangalore has also established an UMTA; the Bangalore Metropolitan Land Transport Authority (BMLTA), that comes under the Department of Urban land transport (DULT). According to CLIMATRANS (2015), these agencies are contributing towards making the urban transport sector more comprehensive and sustainable. With limited powers of the UMTAs and the transport department however, prime responsibility of the transport sector is not vested in one institution.

Bangalore has only one operating corporation operating within road infrastructure operation and maintenance (the Greater Bangalore City Corporation) and one corporation within each mode of transport (Bangalore Metropolitan Transport Corporation and Bangalore Metro Rail Corporation). Like in Delhi, then, these public transport providers are likely to hold great autonomy, as monopolist providers. The corporations are owned by the government of Karnataka (and in the case of the Bangalore Metro Rail Corporation; also by the Government of India). The vast responsibilities of the Government of Karnataka might reduce its capabilities of performing active ownership management, and transferring ownership to a transport related ministry/agency might strengthen ownership involvement.

In general, traffic police act as a stakeholder in decision making with respect to traffic management in urban transport but with no in-house technical expertise required for such decisions. The decision of traffic management measures should be done by separate body consisting of people with right skill set to provide scientific analysis and solutions. The traffic police role should be more focused on traffic law enforcement rather than traffic management.

The BMLTA was formed as a committee of stakeholders. Committee meetings were organized until 2010 to discuss urban transport issues. Since 2010, the committee has been inactive. According to informants, the main reason for the failure of the BMLTA was the lack of a legal mandate to coordinate transport issues. A plan of action or description of how such an organization was supposed to work did not exist (Interview 1). The stakeholders were resistant to transfer decision-making power to the committee because the individual organizations wanted to keep their powers. For example, when the plans for the metro was decided on, they did not want to present

the plans for the committee, afraid that their organization was to lose their power to make future decisions for the metro (Interview 1).

In contrast to BMLTA that was formed as a committee, DULT was formed as a directorate under the State government with qualified personnel trained in urban transport planning. The staff has slowly expanded from four planners in 2012 to 25 planners in 2017, and the budgets have grown (Interview 1). DULT was formed with a clear mandate to administer state urban transport. Despite the limited legal powers assigned to DULT, their success relies on their expertise and work they have been doing to solve urban transport issues. As a government funded organization they can advise other stakeholders without claiming payment. The organization has funding that they can use administer to urban transport projects and through that influence stakeholders (Interview 1).

Informants all agree with the statement in the ‘National Urban Transport Policy’ 2014, that cities are not equipped to deal with the problems of urban transport (Interview 1, 2). Informants point at the fact that there is no overarching policy or common goal that all stakeholders are working towards (Interview 1). The organizations involved in urban transport have overlapping responsibilities and their mandates are unclear. Until the tasks of each government level become “crystal clear”, solving the transport problems in the city will be difficult (Interview 2). One informant emphasizes the need for expertise in urban transport in other organizations: “As the cities have become more complicated, we need more specialized or skilled people to deal with those issues. [...] Technical decisions are often made by non-technical administrative people” (Interview 1). Another challenge for inter-agency cooperation is to get familiar with the vast amount of different procedures required, even if it is only to address another stakeholder (interview 1). One informant believes that DULT should have a key role in implementing policies and the appropriate legal basis to act (Interview 2)

To sum up, the BMLTA had an unclear mandate and seems to be inactive while DULT was assigned a clear mandate and resources to act as an independent organization. DULT has been able to build a specialized work force and seems to have an important role in advising and influencing stakeholders and projects. However, the coordination problems in urban transport in Bangalore is still present because there is no common goal or vision for urban transport that the stakeholders can comply with and responsibilities and mandates of the different agencies are still unclear and overlapping. The institutional design of the Bangalore transport policy sector is likely to benefit from less institutional diversity at the strategic overarching level, and more diversity at the operating level.

### **1.4.1 Mumbai**

Mumbai, like the two other cities, lacks an institution that holds an overarching responsibility of managing and coordinating the entire transport sector. Two land use and development coordinative authorities has been established; the Mumbai Metropolitan Region Development Authority (MMRDA) and the Mumbai Transformation Support Unit. The former is involved in long- termed planning of regional development, while the latter coordinates and monitors projects undertaken

by agencies such as the World Bank and Cities Alliance. The tasks and responsibilities undertaken by these two agencies hence seem to be more clearly differentiated than what is the case in the development institutions in Bangalore (see section above). The informants did however identify differences between regional planning authorities (unelected) and local authorities (elected) as a barrier for policy making and implementation.

Similar to the institutional set-up in Delhi and Bangalore, the Motor Vehicles Department holds quite limited responsibilities; dealing with tax collection and vehicle control.

Mumbai has also established an UMTA; the Unified Mumbai Metropolitan Transport Authority. Informants did however find that the forming of the UMTA has largely been ineffective, possibly due to the local legislative powers residing with the local authorities and the resultant policy lethargy. Informants also suggested that the failing of proposed initiatives, e.g. a ticketing initiative, was due to disagreement in revenue sharing between the different transport agencies.

At the operational level, Mumbai has established two road construction and maintenance operators (Municipal Corporation of Greater Mumbai– Roads Department and the Maharashtra State Road Development Corporation), as well as two bus operators (Brihanmumbai Electricity Supply and Transport and Maharashtra State Road Transport Corporation). The institutional set-up in Mumbai is hence designed in a way that may reduce potential negative effects of monopolist behavior. Further studies are however required to establish whether de facto competition and tendering is in place.

In Mumbai, the Unified Mumbai Metropolitan Transport Association (UMMTA) was established in 2008. The goal of the organization was to gather all stakeholders on one platform to discuss and facilitate decision making. However, it seems that the organization has not managed to coordinate the numerous entities that operate in the urban transport area. The urban transport area in Mumbai is still very fragmented and coordination between the organizations is weak. One informant states: “There are so many pieces, that bringing those pieces together is a challenge in itself” (interview 7).

According to informants, a key challenge is that the UMMTA does not have any legal powers or a strong mandate to be able to fulfill their tasks (Interview 7, 8). One informant emphasizes the biggest barrier as the multiplicity of organizations on different government levels who are engaged in urban transport (Interview 7). There is currently no coordination between the railways and the state government and no coordination between the railway and the local bus system. As one informant explains: “There are some railway officers in the state government who are supposed to be coordinating the meetings between western and central railways and state officials, but it is not happening” (Interview 10). This is confirmed by another informant, who explains that the bus company BEST has approached the railways for integration between buses and railways: “[...] But it’s just not happening. That conversation isn’t moving”. Informants also questions the reason why Indian railways as a central body are operating local trains. They are suggesting that local trains should be operated by a local unit (Interview 7, 10).

Another challenge is the lack of common plans and visions for urban transport (Interview 8, 10). One informant explains that there should not be any duplication of responsibilities: “For example if MMRDA is suggesting metro, somebody is suggesting a flyover [...]. There is no integration, every institution has their own mandate and budgets and set up problems. Every municipal corporation has jurisdiction in their area only and do not have knowledge of the total area” (Interview 8). Another challenge is that many agencies lack transport expertise (Interview 8). One informant explains that lack of resources makes it more difficult to coordinate: “There are so many problems with the railways itself that our entire effort goes into that only. Plus, there is no vision how are you going to design the transport” (Interview 10).

Informants all agree with the statement in the ‘National Urban Transport Policy’ 2014, that cities are not equipped to deal with the problems of urban transport (Interview 7, 8, 9, 10). They find it important to establish a central coordinating authority (Interview 7, 8, 10). Some informants are not sure exactly how the UMMTA functions, what tasks they have or what powers they hold (Interview 7, 10). One informant says: “The structure and the role of the body is not clear to me. I have no idea. Anyway, it is just a platform for the issues to be discussed” (Interview 10). One informant explains that there have been regular meetings and discussions, and that the stakeholder awareness is slowly increasing (Interview 8).

In conclusion, Mumbai has a fragmented transport policy sector, and lacks an institution that holds the overarching responsibility of managing and coordinating the sector. There does however seem to be a smaller degree of responsibility overlap at the strategic level, and more diversity at the operational level, than what is the case in the other two cities.

## **1.5 Implementation of climate policy measures – barriers and opportunities**

Climate policy measures are diverse, and include an integrated land use and transport planning, adaptive policy measures, and mitigation policy measures. All categories of measures include actors and stakeholders from various sectors, potentially involving challenges of vertical and horizontal coordination.

This chapter will focus on the implementation of mitigation policy measures, a category of policies that have not previously been studied in great detail in Indian megacities<sup>2</sup>. We asked the stakeholders to elaborate on the implementation of various measures: Electronic congestion pricing, information technology for traffic management, electric vehicles, Bus Rapid Transit, freight restriction policies, advance climate warning system, car sharing. Some of the measures have already been implemented in the case-cities, some measures have been encouraged by the national government but not yet implemented at the local level.

The chapter will also, but more briefly, address adaptation policies and land-use policies.

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<sup>2</sup> Climate adaptation policies has for example been studied by ICLEI South Asia.

### **1.5.1 Majority Policies**

Majority Policies have scattered advantages and scattered disadvantages

#### **Information Technology for Traffic Management**

The national government is financially encouraging the cities to use information technology to increase the efficiency of the urban transport network (MoUD 2014, p. 25). When interviewing the informants, the concept of information technology has been widely interpreted. This means that informants are bringing up different initiatives and challenges.

In the Delphi study, respondents recognized institutional and political barriers as most prominent for the introduction of information technology for traffic management by 2030.

The technology for traffic management is already available, but it is still at a nascent phase in Indian cities. Electronic signs are not present in a large scale (Interview 11). There are for example digital boards for location and guidance at some highways, but now they are used for advertisement (Interview 4). In Delhi, a system for the management of bus services exists, initiated by the traffic police for enforcement and management. However, there is a need to initiate a public information system to enhance reliability and last mile connectivity (Interview 6). In Mumbai, a bus company wants to put Wi-Fi in the buses to track them along the route (interview 9). The railway has a system for train management. It consists of different IT systems and few are connected to each other. There is no actual real-time information for trains that is accurate and reliable (interview 10). One informant explains that a project for a common ticketing card in public transport is underway. The goal is to make it possible to use the same ticket on all transport modes in the next two years (interview 8).

The informants hold that the biggest challenges are funding (interview 3, 4, 10), technological issues (interview 4, 5, 6), political will (Interview 3, 4) and the fragmented institutional framework (Interview 11). A challenge is that no organization is responsible for traffic management systems (interview 11).

To sum up, there are a lot of initiatives related to information technology for traffic management. However, multiple barriers also have to be overcome to implement information technology in urban transport systems in Indian cities.

### **1.5.2 Entrepreneur Policies**

Entrepreneur policies have focused disadvantages and scattered advantages.

#### **Electronic congestion pricing**

Electronic congestion pricing (ECP) is a method to reduce traffic by charging a user fee to road users during rush hours. The user fee varies by the time of day and day of the week, being highest during periods of peak demand and lower at less-popular hours. ECP can be applied on the basis of many factors depending upon the context.

This can be applied not only on the basis of peak day/ peak hour but also on the basis of vehicle occupancy, vehicle size, vehicle age, emissions etc.

Many of the stakeholders perceive electronic congestion pricing as one of the best measures to control congestion during peak hours (interview 3, 4, 6, 11). However, there are multiple barriers to implement it in Indian urban areas. Some of the interviewees are also questioning the fact that very few cities around the world have managed to implement this measure – it is a measure that is challenging to implement in any city (interview 8, 11). In the Delphi study, respondents recognized institutional and political barriers as most prominent for the introduction of electronic congestion charging by 2030.

Metropolitan cities in India have concentrated employment opportunities and are regional financial hubs which draw large passenger and freight traffic from suburbs and surrounding regions. One informant points out the need for land use planning with decentralized employment opportunities before charging people for entering in the cities. (Interview 7)

In the interviews, the most prominent barrier to implement congestion pricing was recognized as the lack of other viable alternatives to car transport. Several of the informants explain that car users are not willing to change from car to public transport, and that it is crucial to improve public transport first. Public transport in Indian cities today is not reliable, and it is uncomfortable and overcrowded (interview 2, 7, 8, 10, 11). In India, car use is a lot dependent on a person's socioeconomic status. When a person can afford a car, she would switch from public transport to the car. This means that public transport lacks legitimacy among the middle and upper class of the population. An interviewee elaborates on the fact that car users will protest congestion charging because they are already paying higher taxes than others. They will not be accepting to pay more (interview 2, 12). Others argue that it is a cultural problem that wealthy people don't want to use public transport (Interview 8, 10). Improvement of public transport to make it a viable alternative to car transport is probably the most important barrier to the implementation of congestion charging. Without sufficient public transport quality, congestion pricing will not be perceived as a legitimate measure among politicians.

The stakeholders perceive that there will be technical challenges when implementing congestion charging. However, such challenges can be overcome if the political will to implement the scheme is strong enough (interview 2, 3, 4, 11). One interviewee exemplifies this with the odd and even number plate system scheme that politicians managed to implement in Delhi on days with extreme levels of pollution: It was a success, but before it was implemented, nobody thought it would work (interview 3, 12).

There are several technical and practical barriers if electronic congestion charging were to be implemented in Indian cities. Every car would need a chip, and today there is no uniform car register system in India. It can be possible to track the cars, but how would one charge cars that lack a chip? Enforcement of congestion charging would be a challenge (interview 3, 4, 6). Another issue is related to the many varieties of vehicles on Indian roads, which vehicles would be subject to congestion charging? One interviewee claims that it would be challenging to charge two-wheelers due to the

riders' economic position (interview 2). Another informant questions whether buses would be exempted from the tolls, and worries that it would lead to an increase in the fares and a potential loss of customers (Interview 9). Other informants point at economical barriers such as potential losses for businesses in central areas, because the measure could impact their income (Interview 5, 6).

To sum up, the stakeholders did not believe that electronic congestion pricing will be implemented in the coming years. The most prominent barrier to implement the measure in India is the quality and legitimacy of public transport. Furthermore, there are various technical and practical barriers, but the stakeholders in general believe that they can be overcome if the political will is persistent.

### **Electric vehicles**

Electric buses, cars, two-wheelers and rickshaws are slowly increasing in Indian cities. While electric vehicles reduce dependence on petroleum fuel, however, the impact on total emissions depends on whether the batteries used are powered by electricity based on conventional fossil fuels, in particular coal, or clean energy, such as solar power (Ahluwalia and Mathur, 2014). While electric vehicles would improve emissions from vehicles in urban areas, resulting in reducing mortalities due to improvements in air quality, the reduction in CO<sub>2</sub> emission depends on how electricity is generated. Generation of electricity by coal would not result in reduction of CO<sub>2</sub> emission.

The national government is encouraging the implementation of electric vehicles, and has provided some financial support already (MoUD 2014). Electric mobility policy initiatives of GOI have been stated in various policy documents reports, such as Niti Aayog (2017) and the National Electric Mobility Mission Plan 2020. Accordingly, one informant stated that electric vehicles “are the future” (interview 3). Several informants pointed at the fact that e-rickshaws have been introduced and the number is increasing (Interview 2, 4, 6). However, 60 per cent of the energy in India is coal based. This implies that the policy of electric vehicles in India also needs to consider questions related to the energy sector and use of energy.

Many of the informants believe electric vehicles must be subsidized and facilitated to be attractive for private car owners (Interview 1, 3, 4, 5, 7, 11, 12). First, for personal vehicles infrastructure such as charging points need to be implemented by the government (Interview 1, 4, 7, 8, 11, 12). Furthermore, some stakeholders hold that it is important to make it affordable for commuters to purchase electric vehicles, for example via subsidies funded by taxes (Interview 2, 3, 12). For buses and larger vehicles, the technology still needs to be developed (interview 11). One informant points at the fact that the cost of batteries is too high (Interview 2). One informant emphasizes the need for developing the knowledge base for infrastructure, policy and legislation on electric vehicles rather than basing the decision only on the new investments available for the deployment of electric vehicles in the Indian market. (Interview 7)

Electric vehicles are fueled by electricity. Therefore, it is important to consider the broader implications for the energy sector and the Indian society when implementing electric vehicles. Alternatively, charging the electric vehicle with solar panels could be

an alternative to electricity based charging. While this may have high capital costs, it will also have notable environmental benefits and will be financially viable in the long term. Some informants explain that many citizens in villages today do not have access to electricity. There is no surplus electricity in the country, and it is questionable whether energy from coal should be used for transport in urban areas (Interview 1, 7). Related to equity, one informant questions whether subsidies to wealthy car owners is a good way to spend government funds (Interview 1).

Electrification of public transport is less developed. The national railway network is not electrified. However, the national government is putting it on the agenda (interview 10). In the bus industry, the first electric buses are being tested. One informant reports that the bus company is buying six electric buses (interview 9). However, the lack of funding is the most prominent barrier for further development (Interview 9).

In the Delphi study, respondents recognized technological and economical barriers as most prominent for the introduction of electric buses by 2030.

To sum up, the stakeholders are divided regarding the future implementation of electric vehicles in Indian urban areas. On the one side, there are practical and financial barriers related to charging infrastructure and purchase of electric vehicles. On the other side, there is a debate regarding where the energy used for electric vehicles should come from and the consequences of widespread use. Last, electrical vehicles will not solve one of the most important challenges in Indian urban areas: Lack of road capacity and traffic management issues.

### **1.5.3 Freight Restriction Policies**

To reduce traffic, it is important to use off-peak passenger travel times to move freight in Indian cities. Many cities have already ear-marked late-night hours for the movement of freight and restricted the entry of heavy vehicles during daytime. Many cities have also established by-passes that enable traffic to go around cities and not through them. The national government encourages all these initiatives (MoUD 2014, p. 8). One informant finds that more freight should be moved by the railway instead of trucks. However, the challenge is that freight needs to be unloaded from the railway to the truck (Interview 3).

In the Delphi study, respondents recognized institutional, political and economic barriers as most prominent for the introduction of freight restriction policies by 2030.

Freight restriction policies has been implemented in all the case cities. In Delhi, freight trucks cannot enter the city from 9 am to 9 pm. However, the regulation is limited to goods truck movement within the city borders, an area that is too small to restrict pollution. It has been suggested to bypass freight traffic away from the urban region (Informant 6). Another informant argues that the check post should be located at distance from the city border, so that trucks cannot enter the greater urban area, to reduce emissions in the region (Interview 4). In Mumbai, freight trucks are only allowed to enter the city between 9 pm and 6 am (Interview 8). In Bangalore, there are restrictions on trucks entering the Bangalore city also during day time. The regulation schemes with respect to the freight movement in BMR are listed below:

- Autos, goods vehicles, buses not allowed on Commercial Street, Brigade Road, MG Road, Avenue road and all roads inside Cubbon Park
- Trucks restricted from 7:30am to 11:30am and 4:30pm to 8:30pm
- Trucks are not allowed in CBD at any time of the day. Special permissions need to be taken in rare cases

To sum up, freight restriction policies are already on the agenda and is implemented in some Indian cities. However, there is room for improvement, for example by establishing by-passes so that trucks can move around cities instead of through them.

#### **1.5.4 Client Policies**

Client Policies have scattered disadvantages and focused advantages

#### **Bus Rapid Transit**

Bus Rapid Transit (BRT) has been implemented in many Indian cities and has been promoted as a cost-efficient measure for urban transportation. Of the three case cities however, BRT has been implemented only in Delhi. The 5.8 km long BRT line has not been perceived as successful by the public. Although BRT users were satisfied and the project managed to maximize passenger trips along the corridor, the project created heavy traffic jams and got massive media critique (Rizvi and Sclar 2014). In Bangalore, BRT has been discussed for a decade, however in 2016 the project was cancelled. In Mumbai, one line is planned.

Some stakeholders are positive towards BRT, and refer other cities where BRT has been a huge success (interview 3, 4, 6, 7, 11). BRT is an effective low cost option for cities that cannot afford metro (interview 3, 7, 11). It is especially important in smaller cities and should be adapted before metro (Interview 12). However, according to many of the informants, the major barrier to implement BRT is land acquisition and already limited and congested road space (interview 2, 3, 5, 7, 9, 10, 11). One informant argues: “When you see the traffic [in Mumbai] it just doesn’t make sense to have BRT. In Ahmedabad<sup>3</sup>, more land spaces are available, you can dedicate a lane for it” (interview 10). Other operational problems like not having suitable exits for BRT as the roads are heavily populated on both sides and insufficient ridership on express highways lead to financial unviability in some cases.

Solutions to the dilemma of limited road space are suggested by some informants. One suggests establishing bus priority lanes, so that it is possible for other vehicles to use the lane when the buses are not going (interview 9). Another proposes to construct viaducts so that the bus lane is elevated over the ground (interview 4). One informant emphasizes that bus companies are recurrently facing losses in normal operations therefore funding for special initiatives like BRTS has to come from parent government organizations. (Interview 9). However, the political will is largely influenced by the need to give road space of cars for buses.

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As BRT in Delhi has come forward as a failure, politicians may fear that BRT will not succeed. In addition to this, many interest groups are opposing BRT. Currently the politicians are not willing to implement it (interview 7). Lack of training and capacity building for the operation partners or bus company staff is also mentioned as an important concern.

The BRT in Delhi is often mentioned as a bad example. Even though the Delhi BRT followed internationally accepted BRT standards (Rizvi and Sclar 2014), the line was limited to a short line of almost six kilometers. Many of the informants perceive that the main barrier for BRT in Delhi was that it lacked comprehensive planning and acceptance across the community (interview 3, 4, 6). Connectivity to other transport modes was another issue (interview 6), as well as the lack of emphasis on non-motorized vehicles (interview 5).

To sum up, the biggest challenge to implement BRT is for the politicians to sacrifice road space in Indian urban areas. To cope with this challenge, metro has become a popular among citizens and politicians. Metro does not take space on the road, but it is a far more expensive public transport system compared to BRT.

### **Metro Rail Transport**

The national government encourages all state capitals and cities with a population of more than a million to start planning for MRT network (MoUD 2014). Most of the funds from the Urban Ministry is spent on metro systems and there is plans for metro in 50 cities (interview 11). Research does however show that while metros reduce road congestion, they are typically much more expensive than other forms of public transport, e.g BRT (Ahluwalia and Mathur, 2014). Consequently, one informant questioned the priorities of the National government: “Is it a good use of the money? Does every city require a metro system?” (interview 11). Another informant states: “Metro has become fashion among the citizens” (interview 3).

Of the three case cities, metro systems exist in Delhi and Mumbai. Bangalore presently has an operational metro system since 2017 having a network length of 42.3 km with 5 operational lines. The local government in Bangalore has also decided to abandon the plans for BRT in favor of a metro system. The planning of a BRT system in Bangalore was far ahead: A detailed project report had been prepared for a 30-kilometer-long network and funds had been secured to implement it (interview 1). As a reason why the local government decided to build a metro instead of BRT, one informant explains: “BRT is seen as a lower step towards metro and light rail. If the government doesn’t have funding but want to prioritize public transport, they build a BRT first and then light rail or metro” (Interview 1). Another informant emphasizes that metro is more successful than BRT (Interview 12). One informant suggests that BRTS and metro should be prioritized based on the specific requirements of the location. Both of them are parts of collective public transport and shouldn’t be competing against each other. (Interview 7)

The first line of the Mumbai metro entered operation in 2014. It is being built in three phases over a period of 15 years, with completion of eight lines expected in 2021. In general, the stakeholders find that the metro is working well (Interview 7, 8). One of

the informants explain that the suburban rails are overcrowded and is very glad that the metro will complement the railway (Interview 10). However, one challenge is the increase in fare costs that has reduced ridership (Interview 7, 8). One informant says: “I am not sure how many people can afford it” (interview 7). The Mumbai metro project is a Build-Operate-Transfer (BOT) project which implies that a private actor finance, construct, own and operate a facility stated in his concession contract. As the project was transferred from the railway act to the metro act, the private company had the opportunity to set the fares (Interview 8). One of the informants is confident that the car use will decrease when the metro network is completed due to improved travel times and comfort (Interview 8). Another informant is calling for improved collaboration between the public transport agencies to decrease car ridership, as he feels that the metro is competing with the buses (interview 7). The need for ensuring access for people with disabilities is also mentioned (interview 7). In Delhi, the metro system is well established. The first line opened in 2002, and the system has been heavily expanded since. Today, Delhi’s metro system is the world’s 12th longest in length and new lines are already planned and are under construction. The stakeholders find that the metro system has been a positive development for public transport in Delhi. One states that it has been a ‘success story’ (Interview 5). The other informants are more restrained: One holds that pollution has been reduced visibly after the implementation of the metro (Interview 4), another claims that congestion and air pollution is still growing due to vehicular growth (Interview 6). However, it seems that the metro has not attracted many car users. There has been a shift from public bus-based transport to rail, keeping the modal share the same (Interview 4, 5, 6). One of the reasons is that travelling by public transport in Delhi is equated with social stigma and low economic status (Interview 4, 6).

To sum up, metro rail transport is a measure that is encouraged by the national government and prioritized by local governments. Even though metro systems are far more expensive than BRT-networks, the conflict for road space is avoided. One can question whether the funds could have been used on other more effective measures to improve public transport. In Mumbai and Delhi, the stakeholders are content with the metro system, despite some challenges. One important barrier for changing the modal share in Delhi is the social acceptance of public transport over private transport among the middle and upper class of the population.

### **Public private partnership**

Public private partnership projects have been increasing in the Indian transport sector. The national government encourages involvement of the private sector in urban transport activities, such as operation and maintenance of parking facilities, certification facilities, repair facilities, construction and management of terminal facilities (MoUD 2014, p. 27). As recognized by Sahasranaman and Kapur (2014), however, historical experiences of PPP projects in India has been mixed. While technically simple projects with short gestation periods and low degrees of demand estimation uncertainties generally have been successful, projects with greater management and technical complexity have faced problems.

These mixed experiences were also observed by the informants, who stated that their success were dependent on the characteristics of the projects (Interview 2, 8). One

informant perceives that PPP will be more successful in small projects than in bigger infrastructure projects, because the private actor wants to gain profit faster than such big projects allow (Interview 8). Another argues that the nature of transport is that it will always go in loss. PPP can be a success for infrastructure projects, but not for operations and services (Interview 6, 10). One informant holds that PPP can be successful only if the government manages to negotiate the contract well and is able to closely manage and monitor the project (Interview 1, 5).

The informants come up with several examples of successful and less successful PPP-projects. One holds that the computerization of the transport department has been successful with a PPP-model (Interview 2). However, for metro and bus transport the projects have been less successful: The company that runs the Mumbai metro is in loss (Interview 10). Another explains that PPP as a way of financing public transport in Delhi has been unsuccessful. The contracts have not been flexible enough to adapt to potential changes in the project (Interview 4). Another explains that the challenge to use PPP for investments in bus transport is that it is not profitable and need government subsidies (Interview 6).

PPP in transport projects is mostly used because the government does not have enough funds to invest (Interview 1, 2, 6, 7). One informant explains: “If money is coming from the private sector, the question is how much of the funds are going back in their pockets” (Interview 7). When a private partner has invested money, the goal is to profit from the investments. In many projects, for the private company to gain profit, high costs are put on the users (Interview 2, 4, 7). The Mumbai metro project is an example of a private investor that increased the fares to the extent that the ridership decreased (Interview 8).

To sum up, PPP can work if contracts are adequate and the plan for how the private investor will gain profit is credible, without putting untenable costs on the user. Operation of public transport is rarely profitable and it is important that the government holds responsibility in this area so that the cost for the users are not too high.

### **1.5.5 Interest Group Policies**

Interest Group Policies have focused disadvantages and focused advantages.

#### **Car sharing**

Car sharing is a measure to exploit the empty space in private cars by connecting people that are traveling in the same direction. This measure could reduce the number of cars on the road and make it possible for people to share travel costs. In India, car sharing is not common, although some apps are available (Interview 1).

In the Delphi study, respondents recognized cultural barriers as most prominent for the introduction of car sharing by 2030.

In the interviews, many informants find car sharing a positive measure (Interview 1, 4, 5, 7). One informant believes that mostly the younger generation will take advantage of this measure, to reduce travel costs (Interview 4). However, the informants point at

three key challenges that must be solved to make car sharing a viable measure to reduce traffic in Indian cities: Inconvenience of sharing your car, regulation and incentives.

Many people find it inconvenient to share their car due to privacy and freedom to go when and where you want. One informant explains: “I don’t think our society is ready for it. Because we have problems with strangers, people are afraid” (Interview 1). Inconvenience of trip changes can be a challenge. When people are driving their car, they are used to go when they want, where they want. Car sharing deprive them from the freedom of going by car (Interview 1). Car sharing in the morning is probably more manageable for people compared to the afternoon when people leave their offices at different times to pick up kids, groceries etc. (Interview 1, 7).

Regulation of car sharing is important to ensure safety of the users and that car sharing doesn’t cross the boundaries of the taxi market. The users will have to know that they are safe and that there will be consequences if a crime occurs (Interview 1). Furthermore, there are numerous challenges related to regulation that must be solved. Car sharing needs to be defined and it cannot compete with the taxi market. It is important to ensure and monitor fair pricing for example (Interview 1).

For car sharing to increase among citizens in Indian urban areas, some informants point at the need for incentives. The government should provide benefits to increase the use of car sharing (Interview 2, 5). One informant refers to the policy in the US where dedicated lanes for cars with more than two people are implemented. As the road space is already scarce in Indian cities, it is however challenging to establish such dedicated lanes (Interview 2).

To sum up, car sharing is a welcome initiative among many of the informants. However, there are several obstacles to encourage users to share cars: Inconvenience of sharing your car, regulation and incentives. (Interview 4, 5, 6). One of the reasons is that travelling by public transport in Delhi is equated with social stigma and low economic status (Interview 4, 6).

## 1.6 Implementation of transport measures - discussion

The table below summarizes main elements of the discussion on climate mitigation policy measures.

|  | Type of policy | Barriers, Delphi             | Barriers, interviews  |
|--|----------------|------------------------------|---|
| <b>Information technology for traffic management</b> | Majority       | Institutional and Political  | Funding, Technological issues, political will, the fragmented institutional framework |
| <b>Electronic congestion pricing</b>                 | Entrepreneur   | Institutional and Political  | Political will, the quality and legitimacy of public transport                        |
| <b>Electric vehicles</b>                             | Entrepreneur   | Technological and Economical | Practical and financial barriers, energy source for electricity                       |

|                                     |                |                                       |  |
|-------------------------------------|----------------|---------------------------------------|--|
| <b>Freight restriction policies</b> | Entrepreneur   | Institutional, Political and Economic | Establishment of by-passes                                   |
| <b>Bus Rapid Transit</b>            | Client         | Not examined                          | Connectivity to other transport modes, road space            |
| <b>Metro Rail Transport</b>         | Client         | Not examined                          | Social acceptance  |
| <b>Public Private Partnership</b>   | Client         | Not examined                          | Outlining adequate contracts, costs for users                |
| <b>Car Sharing</b>                  | Interest group | Cultural                              | Inconvenience of sharing your car, regulation and incentives |

Table x.x. Summary of measures and barriers

## 1.7 Climate adaptation policy measures

Adaptive policy measures include (Lim et al, 2005);

- Adaptation to short-term climate variability and extreme events serves as a starting point for reducing vulnerability to longer-term climate change;
- Adaptation occurs at different levels in society, including the local level;
- Adaptation policy and measures should be assessed in a development context; and
- The adaptation strategy and the stakeholder process by which it is implemented are equally important.

It hence includes vulnerable systems such as agriculture, water resources, public health, and disaster management.

Nair (2009) finds that Indian megacities are urban infrastructure is quite inadequate to face the challenges to provide necessities such as water and power; which have become expensive and the supply is unreliable. Changing climate patterns; such as the intensity and frequency of tropical storms, and the changing sea level, also pose challenges. Current strategies and policies for climate change impact mitigation and control of environmental degradation are not efficient, according to Nair (ibid.). In particular, lack of adequate funds is a major hurdle in implementing climate change adaptation strategies. At the central government level, the Ministry of Urban Development has initiated institutional, fiscal and financial reforms. One of the key elements in the policy is enhancing the productivity of urban sector, and to place urban development plans and projects on a commercial format and to collect additional taxes to minimize the difference in cost of operation and income.

The table below shows results from the Delphi survey on the implementation of adaptive policy measures in Indian megacities.

| Adaptation Policy:              | city      |       |       |           |           | Total |
|---------------------------------|-----------|-------|-------|-----------|-----------|-------|
|                                 | Bangalore | Delhi | Mumba | Hyderabad | Ahmedabad |       |
| No of respondents               | 7         | 4     | 4     | 1         | 1         | 17    |
| Experience with extreme climate | 3         | 2     | 4     | 1         | 1         |       |
| Implemented policies in place   |           |       |       |           |           |       |
| Drainage Capacity               | 1         | 1     | 1     | 0         | 0         | 3     |
| Early Warning                   | 0         | 0     | 0     | 0         | 0         | 0     |
| Evacuation plan                 | 0         | 0     | 1     | 0         | 0         | 1     |
| Others                          | 0         | 0     | 0     | 0         | 0         | 0     |
| Effective policies              |           |       |       |           |           |       |
| Early Warning system            | 5         | 3     | 1     | 1         | 1         | 11    |
| Drainage Capacity               | 5         | 4     | 4     | 1         | 1         | 15    |
| Evacuation                      | 4         | 3     | 0     | 0         | 1         | 8     |
| Other suggestions               |           |       |       |           |           |       |
| relation to paved surfaces      | 1         | 0     | 0     | 0         | 0         | 1     |
| Management of lakes             | 1         | 0     | 0     | 0         | 0         | 1     |
| Cleaning drainage               | 0         | 0     | 1     | 0         | 0         | 1     |
| Urban agriculture               | 1         | 0     | 0     | 0         | 0         | 1     |
| Plastic free to stop drainage   | 0         | 0     | 1     | 0         | 0         | 1     |
| and water bodies                | 1         | 0     | 0     | 0         | 0         | 1     |
| Management of groundwater       | 1         | 0     | 0     | 0         | 0         | 1     |
| to 30% non-motorised means of   | 1         | 0     | 0     | 0         | 0         | 1     |

Table 2. Implementation of adaptive policy measures. The values indicate the number of respondents recognizing that the policy is in place.

As we can see, early warning systems and drainage capacity are regarded as the most effective policies in these cities.

While respondents in the Delphi survey did not regard “advanced” warning systems to be in place, the informants in the interviews apparently had a different interpretation on this issue. They held that the technology for advanced climate warning systems is already available, and that climate warning systems are already in place and works well. In Bangalore, FM radio is currently in use (Interview 2). In Delhi, there are warning systems in place, however a comprehensive system is still absent (Interview 6). In Mumbai FM radio is in use, even with traffic updates (Interview 8). These systems could however probably be improved and more comprehensive, informants found.

## 1.8 Land-use policies

The transportation problem in Indian cities has been recognized as being partly due to traditional urban planning based on top-down master plans with separate residential areas for business districts, generating large transportation needs as a consequence (Ahluwalia and Mathur, 2014). Furthermore, average Floor space indexes (FSIs) regulating the floor area available on a plot of land permitted for building, are low in Indian cities (Ahluwalia and Mathur, 2014). In addition, the FSIs do not vary much within a city, and consequently do not reflect accessibility on account of proximity to public transportation or other city level assets. As a consequence, urban sprawl has been a major feature of Indian urban development. Finally, land use plans have by and large been independent of transport plans (Ahluwalia and Mohanty, 2014). More

recently, however, integrated land use planning and transport planning is emerging, e.g. in major highway projects in a number of cities.

Mixed land use can be derived if the population can move closer to their jobs. However, rigid urban land markets inhibit easy sale and purchase of property, while rental laws inhibit easy rental for the fear that the tenant will not vacate at the end of the lease period (ibid.). Reforming urban land and rental markets is therefore critical for sustainable urban development.

Land use policies are meanwhile of great importance in the context of adaptation

## **1.9 Recommendations**

### **1.9.1 Combine measures**

As **table xx** shows, the different emissions policies encounter different types of barriers. This indicates that overcoming barriers such as lack of political and cultural acceptance, would most likely require a careful combination of measures. Specifically, distributive elements would increase public acceptance. This can be organized in different ways. For example, the introduction of congestion charging can be introduced in an area where public transport is to be improved significantly, or it can be combined with offering company discounts on public transport.

Also, as observed by Ahluwalia and Mathur (2014), in order for a strategy of sustainable development in an area to be successful, a combination of interventions is paramount. They hence suggest to combine regulatory interventions, price interventions, and public investments.

### **1.9.2 Strengthen vertical and horizontal coordination**

As pointed out in the introduction, the policies in Indian megacities are poorly coordinated (Revi, 2007, Ahluwalia and Mohanty, 2014). In this study, a fragmented institutional framework has been recognized as a major barrier to implement policies such as Information Technology for Traffic Management, BRT, and Car sharing.

Informants strongly emphasized how urban transport policies are fragmented, with no organization holding an overarching responsibility, and accordingly, a lack of coordination. The current organizations hence result in have duplication, overlapping responsibilities, etc. For example, no city in India has an integrated smart card solution for ticketing on urban transport. The involved agencies have limited fora for and practices of communications, and they do not have the mechanisms to bring them on the same page. The variety of agencies and actors was recognized as being part of the problem. Some cities have created UMTAs, and this have been of some use in order to bring stakeholders together to talk. There is however no legislative backing for creating UMTAs. (interview 11). One informant did however point out that while the UMTAs in Bangalore and Mumbai have not been that successful, the provision of a platform for discussion was nonetheless valuable. (Interview 12)

On adaptation, a lack of horizontal coordination between the different agencies involved has been particularly emphasized. This lack of coordination concerned preventative measures as well as the handling of unforeseen events.

### **1.9.3 Strengthen institutional competence**

An almost equally strong recommendation put forward by the informants seemed to be the need to strengthen institutional competence. Informants held that the institutional framework in cities is not equipped to deal with the problems of urban transport, and that the institutional capacity is not there. They recognized a lack of urban planners, as well as transport planners.

The need to strengthen institutional competence, particularly legal and regulatory competence, has also been recognized by Baud et al (2015) and Nacer (2007). In this study, strengthened institutional competence seems particularly important in the policy fields of Public Private Partnerships and Bus Rapid Transit. Strengthening institutional competence would most likely enable more coherent and appropriate policies and regulations.

### **1.9.4 Strengthen the local level**

According to the principle of subsidiarity, a policy area should be addressed at the lowest efficient administrative level of government (Macrory, 2008). This approach is held to provide flexible solutions, adjusted to the specific needs of each region.

This principle is supported by informants, who states that transport is a part of the local issues of each city. Consequently, the involvement of Central Government should be limited, according to these informants. Informants did however welcome the idea of funding provided by the central government. Some informants also welcomed the idea of expertise provided by the Central government, but the local area must also be equipped with considerable expertise. Local authorities should hence be empowered with governance and resources. A decentralized approach was found to be better than a national one, and local leadership is imperative. They [the megacities] need to be masters of their own planning, as stated by one informant (Interview 12).

In conclusion, a delegation of responsibilities seems to have taken place; this delegation has however not been coupled with a delegation of authority. There is hence a need for a clarification on responsibilities and authority.

## **1.10 Literature**

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## 1.11 List of interviews\*

| Interview no | Organisation   | Type of organisation   | Interview    | Date       |
|--------------|--|--|--------------|------------|
| 1            | Department of Urban Land Transport (DULT)                          | Local government organisation attached to the local authority in Bangalore     | Face-to-face | 25.05.2017 |
| 2            | Regional Transport Office  | Local level Bangalore  | Face-to-face | 08.06.2017 |
| 3            | Ministry of Railways   | National authority   | Telephone    | 10.06.2017 |
| 4            | Delhi Development Authority (DDA)                                  | Local authority in Dehli   | Face-to-face | 12.06.2017 |
| 5            | Town and Country Planning Organisation (TCPO)                      | National government organisation attached to the Ministry of Urban Development | Face-to-face | 13.06.2017 |
| 6            | Unified Traffic and Transportation Infrastructure Centre (UTTIPEC) | Local government organisation attached to DDA                                  | Face-to-face | 14.06.2017 |
| 7            | World Resources Institute  | Global organisation  | Face-to-face | 15.06.2017 |
| 8            | Mumbai Metropolitan Region Development Authority (MMRDA)           | Local authority in Mumbai  | Face-to-face | 19.06.2017 |
| 9            | The Brihanmumbai Electric Supply & Transport Undertaking           | Bus service organisation in Mumbai   | Face-to-face | 19.06.2017 |
| 10           | Western Railway  | Rail service organisation in Mumbai  | Face-to-face | 21.06.2017 |
| 11           | The World Bank   | Global organisation  | Telephone    | 23.06.2017 |
| 12           | National institution for transforming India (Nitiayog)             | National authority   | Telephone    | 29.06.2017 |

\* Please note that some of the interviewees have elaborated on their personal views, which do not necessarily correspond with the view of their affiliated organization.