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EMERGING URBAN MOBILITY

**A study of innovative mobility concepts
and international best practice in emerging markets**

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Contents

LIST OF FIGURE	4
SUMMARY.....	5
1. INTRODUCTION.....	6
1.1. Content framework and aim of the study	6
1.2. Methodology and approach	6
1.2.1. Quantitative research on mobility needs	7
1.2.2. Structured interviews	7
1.2.3. Best practice research and analysis	7
2. URBAN MOBILITY: STATUS QUO AND CHALLENGES IN EMERGING MARKETS.....	8
2.1. Political categorisation and relevance of the topic	8
2.2. Urban mobility in emerging markets.....	8
3. MOBILITY REQUIREMENTS AND NEEDS: AN INTERNATIONAL COMPARISON.....	10
3.1 Future modes of transport and satisfaction with mobility	10
3.2 Need for action in traffic planning	12
3.3 Mobility attributes and needs.....	13
3.4 Mobility requirements and needs compared.....	14
4. INNOVATION SHOWCASE.....	16
4.1. Mobility approaches for urban transformation	16
4.1.1. (Spatially) efficient mobility	17
4.1.2. Digitalisation and availability of data	19
4.1.3. Accessible mobility	22
4.1.4. Governance in urban mobility	25
4.2. Best practices: an overview.....	28
4.3. Excursus: Best practices in industrialised countries, using Germany as an example	29
4.3.1. Urban mobility challenges in industrialised countries, using Germany as an example.....	29
4.3.2. Exchange of best practice examples as an opportunity for industrialised and emerging economies	30
5. INTERNATIONAL TRANSFERABILITY OF INNOVATIVE MOBILITY APPROACHES.....	31
5.1. From good examples to successful transfers	31
5.2. Challenges in transferring innovative solutions.....	32
5.3. Transfer principles and tools	33
6. CONCLUSION AND OUTLOOK	35
7. LIST OF SOURCES	37

List of figures

Figure 1: Methodological design.....	6
Figure 2: Assessment of future satisfaction with mobility in the international comparison (N=550)	11
Figure 3: Evaluation of modes of transport considered to hold great potential for the future.....	11
Figure 4: Greatest need for action, by country	13
Figure 5: Preferred attributes of mobility in the focus countries.....	14
Figure 6: Areas of action relating to mobility solutions.....	16
Figure 7: Innovation radar for categorising best-practice examples	28
Figure 8: Assessment of satisfaction with existing mobility solutions compared to Germany.....	29
Figure 9: Preferred mobility attributes compared to Germany.....	29
Figure 10: Impact on scaling and transfer by	32
Figure 11: Design and impact criteria regarding the transferability of mobility solutions.....	33
Figure 12: Components of holistic urban mobility in emerging markets.....	35
Box 1: Country profile Mexico	10
Box 2: Country profile Indonesia.....	10
Box 3: Country profile Morocco	10
Box 4: Definition of needs for action in traffic planning.....	12
Box 5: Defining the attributes of future mobility solutions.....	13

Summary

Globally, urban spaces are facing numerous mobility challenges resulting from factors including competing policy objectives, demographic and economic developments, rising population densities and socially embedded inequalities. The resulting heterogeneous structures and related tensions and usage conflicts have to be addressed and managed to develop liveable, resilient, social and sustainable cities.

This study focuses on the complexity of the current mobility situation of urban centres in selected emerging markets. Spatial, social and cultural differences in the three focus countries of Morocco, Mexico and Indonesia are explored in greater detail. The study is based on an international survey of usage requirements in the participating countries (n=550 in each case) as well as five qualitative interviews with experts from Thailand, Indonesia, Morocco and Mexico. Furthermore, a comprehensive review of innovative mobility concepts was conducted to identify impulses for potential transformation paths (innovation showcases). These approaches are in the main directed at actors in emerging markets, but some examples also provide inspiration for cities in industrialised nations. These include achieving transport policy objectives – such as emissions reductions – as well as improvements in traffic safety for all user groups, the reduction of traffic loads and traffic jams, and improvements in the energy efficiency of vehicles and the transport infrastructure. Project examples showing new technological, entrepreneurial and town planning innovations or flexible regulatory frameworks are highlighted. The aim was to illustrate individual and context-specific solutions for traffic and infrastructure challenges that could become relevant for other international cities in future. Such “best-practice” solutions can serve as examples for further improvements in urban mobility if implemented successfully. The role-model function of best practices can help inspire diverse actors in the traffic-planning space to learn from traffic-management solutions adopted elsewhere.

Such potential solutions can be identified based on traffic and town-planning needs, scientific studies, and the preferences, behaviours and needs of urban populations. User

satisfaction is a critical factor determining the adoption of urban mobility services and contributes to anchoring urban offerings and their acceptance. Individual and location-specific requirements were identified in the respective focus countries by means of a survey conducted for this study. Many of the survey participants in the focus countries displayed a high degree of optimism when asked about the future of urban mobility. Respondents expected private passenger cars, public transport, bicycles and walking to play an important role in future. In all the countries covered, the surveys showed that participants cared strongly about the attributes “safe”, “affordable”, “comfortable”, “fast” and “flexible” in their transport choices. The survey found a need for improvements mainly in the creation of new mobility products and access to mobility.

The deeper analysis of mobility needs and challenges – and of mobility innovation in emerging markets – contributes significantly towards understanding the current situation of the transport sector in these countries. This helps create an awareness of frequently divergent social mobility needs and identifies opportunities to overcome existing barriers. Cities each have their own unique characteristics and circumstances, but often face similar challenges to other cities^[1]. Transferring solutions between jurisdictions is often made challenging by the fact that cities and countries display different geographical, socio-economic, historical and cultural features.

Urban spaces serve as innovation labs and trendsetters in societal transformation processes. Understanding such change processes makes it possible to reproduce, optimise and disseminate innovative approaches to develop liveable, resilient, sustainable cities with a long-term future. The purpose of the study is to generate intense engagement with a broad-based and international diffusion of solutions and technologies. The research – in particular in the focus countries – shows that there are few knowledge gaps when it comes to solution concepts. Instead, there are barriers to implementation. This means that the challenge lies in identifying innovative approaches, narratives and logics in support of the transferability of socially relevant mobility concepts.

1. Introduction

1.1. Content framework and aim of the study

Worldwide, mobility represents an essential and fundamental social need. It enables social participation, access to education and to economic opportunity. Planning and configuring mobility products and infrastructure thus has a direct impact on individual experiences. Large-scale social changes through innovation and new concepts can mainly be achieved in areas where there is a considerable need for interventions, but also where large sections of the population can be reached. This is especially true of major cities in global emerging markets.

The urban spaces of newly industrialising economies are characterised by high population densities, rapid economic growth, and historical social differences. Mobility-related demands and aspirations typically increase rapidly within this context, leading to an overload of the existing infrastructure, usage conflicts and a worsening quality of life.

In this paper, we analyse this broad and complex topic from the perspective of the following research question: how is the urban mobility of the future evolving in emerging markets?

Methodologically, this best-practice analysis is based on an international survey of usage requirements and qualitative interviews with experts. Numerous project examples serve as inspiration for transformation pathways that become accessible through the bold and creative use of technological, entrepreneurial and town-planning innovations, alternative financing instruments as well as flexible regulatory conditions.

The content in overview:

- Analysis of the mobility situation and of current challenges in emerging markets
- Identification, analysis and comparison of current mobility needs in selected focus countries (Morocco, Indonesia, Mexico)
- Identification and illustration of international urban mobility best practice through an innovation showcase
- Description of approaches to facilitate the international transfer of knowledge and technology between emerging markets
- Implications for international cooperation at the political, institutional and economic level

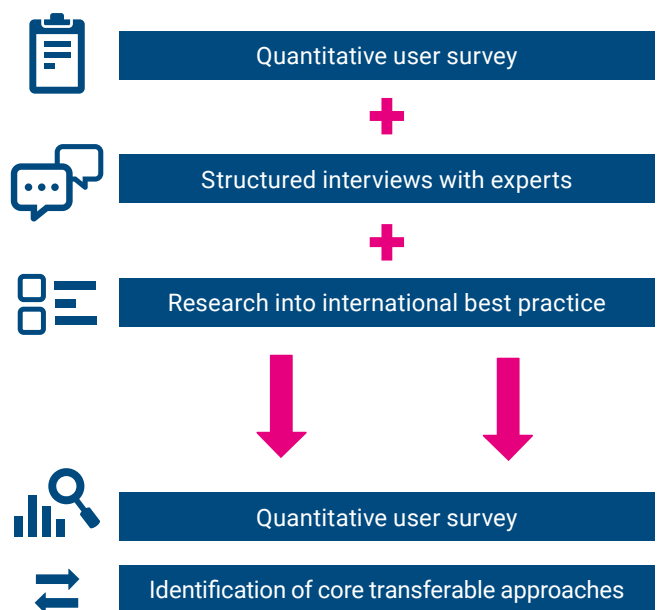
This study is aimed at political decision makers, (international) town planning and traffic management experts, and at the representatives of development agencies and relevant associations. The study also serves as a source of inspiration for research and can help to initiate a media discourse among expert audiences.

The transport and infrastructure challenges faced by the urban centres included in this study also show social, technological and space-usage trends that other international metropolitan areas will have to address in the coming decades. At the same time, some approaches and solution strategies can also provide insights that can be applied in industrialised countries. The study thus has relevance beyond its core focus.

1.2. Methodology and approach

The study combines three research methods: a quantitative user survey of mobility needs in the countries reviewed; structured interviews with experts; and research into best practice. Key urban mobility developments and needs were identified and structured based on expert insights. In addition, innovative mobility approaches worldwide were analysed, and core transferable approaches were identified based on the research findings.

Figure 1 | Methodological design



1.2.1. Quantitative research on mobility needs

To identify social needs in urban mobility, a questionnaire was developed that allowed participants to express their preferences and visions for the mobility of the future in their respective countries.

In addition to demographic information, the survey asked about privately used modes of transport, distances covered, and existing mobility solutions as well as desirable attributes of mobility. The survey also enquired into areas requiring intervention from a traffic management perspective and the potential of various means of transport of the future.

The survey was conducted online in December 2022 in the focus countries of Indonesia, Mexico, Morocco and Germany, and covered a sample of 550 participants per country. Respondents were able to participate using an app or after accepting an e-mailed invitation. The survey showed country-specific differences in the metadata (e.g. in terms of the demographic structures). As the samples were aligned with the census data of the respective country, generalised conclusions can be drawn regarding the individual mobility situation in each country. The quality of the survey sample was ensured by multiple techniques including profiling and identifying questions, geo-IDs and the use of automated sample checks.

The survey allowed the perspectives of urban mobility users in the focus countries to be described. The findings represent the current perception of the traffic situation and of various modes of transport as experienced by the participants. The survey results represent a component of the findings, which were enriched with expert insights and then positioned within the current scientific debate and state of knowledge. The findings are described, compared and contrasted in Chapter 3. They also form the basis of the areas of action and mobility concepts highlighted in the innovation showcase (*Chapter 4*).

1.2.2 Structured interviews

In the context of this study, interviews were conducted with mobility experts from academia, business and development cooperation to identify mobility challenges in emerging markets and determine how they might develop in future. The following experts were consulted:

- **Achmad Zacky Ambadar**,
GIZ Project Manager, Indonesia
- **Faela Sufa**,
Director for South-East Asia, Institute for Transportation and Development Policy, Indonesia
- **Kawtar Benabdelaziz**,
GIZ Project Manager, Morocco
- **Marco Martinez O'Daly**,
freelance political adviser and project manager, Mexico
- **Tomasz Mazur**,
Managing Director, Siemens Mobility Thailand

The interview findings are reflected in the form of selected quotation in the other chapters. The insights are also used to describe urban mobility challenges and needs (*Chapters 2 and 3*) as well as the best practice analysis and transferability concepts (*Chapters 4 and 5*).

The interviews provide a more detailed overview of current developments in the respective countries. The conversations were not exclusively focused on current challenges, but also covered innovative local and international solution concepts and examples as well as the relevance of exchanges of experience and the transferability of such examples.

1.2.3. Best practice research and analysis

A comprehensive analysis of urban mobility usage cases and reference projects in emerging markets globally was used to develop an innovation showcase. Four different areas of action were identified and described for this purpose (*Chapter 4*). The innovation showcase is not limited to technological examples of best practices. Social and regulatory innovation was also taken into consideration, as were new urban mobility business models.

The purpose of the analysis was to identify significant mobility solutions that can help address challenges in emerging markets. The solutions ranged from recently introduced projects to others that had already been transferred. The best practice examples relate to the focus countries, but also refer to other emerging markets facing similar challenges.

2. Urban mobility: status quo and challenges in emerging markets

Varied mobility patterns in metropolitan areas, which result from the interaction of multiple interests and offerings, place high demands on mobility planning. Rapid urbanisation means that cities all over the world are confronted with similar mobility and transport challenges. In emerging markets with fast-growing urban centres, but with low or medium economic growth rates, there is a lack of comprehensive, reliable and ecological mobility solutions. Such solutions should also be customised to match different urban structures as well as the various socio-economic and socio-cultural attributes of urban residents^[2]. The core urban mobility challenges in emerging markets identified in the context of this chapter of the study are influenced by the interplay between fundamental mobility challenges on the one hand and participation in the global competition to identify innovative infrastructure and technological solutions on the other hand.

2.1. Political categorisation and relevance of the topic

In 2015, the United Nations adopted 17 Sustainable Development Goals (SDGs) in an effort to address large-scale global challenges at a supranational level that included countries at all stages of development – developing, emerging and developed. The goals are embedded in an overarching framework that seeks to advance prosperity in all countries and for all population groups while protecting the planet at the same time.

In this context, sustainable development is viewed as an opportunity to understand factors such as poverty and rapid urbanisation, features which are commonly found in emerging markets. Taking a holistic perspective, the interaction between the impact of the various measures in different areas is recognised with the aim of achieving a balance between the social, economic and ecological dimension. Urban mobility is anchored as a core target under SDG 11 (Sustainable Cities and Communities). The target provides for the general expansion of public transport by 2030; the provision of access to safe, affordable, inclusive, efficient and sustainable transport systems; and improvements in road safety, all while taking into account the needs of all users, in particular those representing marginalised and vulnerable groups^[3]. Sub-goal SDG 11.2 refers directly to the responsibilities of regional and municipal authorities as well as of public transport. The text emphasises that this should be combined with effective awareness-raising aimed at increasing citizen involvement and creating acceptance and appreciation.

Because of its socially important role, mobility makes an important contribution to realising Agenda 2030 and achieving many SDGs. The positive influence of effective mobility planning is reflected in many areas, for example when young people are provided with access to educational institutions

by means of reliable, safe and just mobility solutions and traffic system (SDG 4) or when expanding public transport contributes to a global lowering of greenhouse gas emissions (SDG 13)^[4].

The essential relevance of mobility and transport for realising sustainable cities and towns is also manifested in the New Urban Agenda (NUA), adopted by the UN member states at the Habitat III summit in 2016^[5]. The Paris Climate Accords, the first binding agreement designed to limit global warming to below 2°C compared to the pre-industrial era, made it possible to achieve significant progress towards a global consensus on defining a common, overarching agenda, including for development policy.

Against the background of this broad consensus on the relevance and urgency of the topic, cities worldwide are faced with the challenge of implementing safe, accessible, inclusive traffic management and mobility solutions at a local level.

2.2. Urban mobility in emerging markets

Emerging markets are also described as middle-income countries and generally include countries that cannot clearly be classified as developing or developed nations because of the current state of their transformation processes. The high levels of dynamism in such countries mean that there is currently no internationally accepted definition of the term. Germany's Federal Agency for Civic Education and the Federal Ministry for Economic Cooperation and Development refer to characteristic features commonly found in emerging markets. They include above-average economic growth rates, particularly in industrial sectors, as well as rising per capita incomes, which are often accompanied by increasing levels of income inequality. Social development often falls behind compared to the progress made in industrialisation. Indicators such as average life expectancy, education levels or the level of political development are often below average when comparing democratic structures to the pace of economic development. Depending on how you measure it, over 40 countries are currently classified as emerging markets or middle-income countries. In this paper, we make use of those definitions and the classification applied by the Organisation for Economic Co-operation and Development (OECD), under which the three focus countries of Indonesia, Morocco and Mexico are listed as middle-income countries showing the attributes described above.^[6-8]

Because of their high and rapidly rising population numbers, emerging markets play an important role in efforts to combat climate change to achieve the Agenda 2030 goals. In this context, urban mobility represents a complex challenge for political decision makers, town planners as well as citizens. Certain recurring problems are found in middle-income

countries. Often, there is no comprehensive or unified administrative structure responsible for traffic management. The existing infrastructure and available mobility solutions are often organically grown rather than strategically developed. Combined with current trends in urban development, this often means traffic jams, longer travel times and an overloading of the means of transport.

There is often a lack of available traffic management data as well as information for users. Without reliable data, it is difficult to canvas mobility needs and develop suitable solutions. This results in less attractive urban transport solutions for the users.

Social exclusion represents a further urban mobility challenge in emerging markets. Many people do not have access to mobility solutions because of their income, age, physical disability, gender or location. This can have an enormous impact on social participation. In some regions or cities, for example, women do not feel safe using public transport, which restricts their movements.

General urban mobility challenges in emerging markets include rapid urban growth and the resulting higher need for mobility solutions. Often the governments of such countries and regions prioritise motorised private transport in urban traffic management without providing the required infra-

structure.^[9] Socio-spatial and socio-cultural aspects as well as specific government and administrative structures also impact on the planning and development of urban mobility solutions and transport systems. Environmental problems, such as bad air quality, are a further aspect to consider. To master these challenges requires integrated town planning and development as well as a transport policy with a long-term focus.

Three focus countries that have certain features in common were chosen for the study: Mexico, Indonesia and Morocco. All three countries are emerging markets undergoing rapid urbanisation and fast-rising demand for transport infrastructure and services. The geographic distribution of the countries across different continents ensures diversity in terms of the criteria under consideration while also emphasising the need for a global perspective on urban mobility. At the same time, the research design aims to highlight the importance of the local context. The goal is to illustrate the relevance of the relationship between a global perspective that takes into account overarching, supranational sustainable development objectives, but also acknowledges site-specific contexts and socio-cultural influences. Understanding both individual and overarching urban mobility problems and needs makes it possible to identify framework conditions and factors that favour a goal-oriented international exchange.

3. Mobility requirements and needs: an international comparison

Designing a sustainable and efficient urban mobility system required careful consideration of various factors including population density, road infrastructure, public transport, and the environmental impact of deployed solutions. Urban residents also play a critical role in designing urban mobility. Their preferences, behaviours and needs shape a city's mobility requirements and should therefore be at the heart of transport and mobility systems.^[9] This means that it is necessary to gain an understanding of individual and location-specific urban mobility requirements. To identify them, an international user survey was conducted in the three focus countries of Mexico (*country profile in Box 1*), Indonesia (*country profile in Box 2*) and Morocco (*country profile in Box 3*), the main findings of which are described in the following.

Mexico

With its 127 million inhabitants (as of 2021),^[10] Mexico is one of the world's most populous countries. Although the country has recorded significant economic progress in recent years, it faces social and ecological challenges that also manifest themselves in the mobility sphere. The development of urban mobility envisages a transformation of the hitherto strong emphasis on motorised individual transport towards local public transport and lower-emission forms of mobility, such as bicycle and pedestrian transport, even outside the capital Mexico City, where this development is already further advanced.^[11]

Mexican cities display a high dependency on private vehicles because of how their urban spaces are structured, which often resemble the structure of North American cities. A functional differentiation in downtown (with a high density of workplaces and offices), industrial parks, supply centres and residential areas means a high degree of urban sprawl and suburbanisation. This development is reinforced by cultural values that emulate the "American Dream" – meaning that private cars and single-family homes with large living areas represent relevant status symbols. Of the respondents in the representative poll, 82.7% have a driver's licence and 79.2% own a private car. This illustrates the dominant role of private transport in Mexican cities. The primary daily transits involve commuting from home to work or school and back.

Box 1: Country profile Mexico

Indonesia

With its almost 273 million inhabitants (as of 2021),^[12] Indonesia is the world's largest island state. In the past twenty years the country has undergone rapid socio-economic development with a significant impact on urban mobility. The transition from fossil fuels to renewables in the mobility sector is a priority topic in the country and plays an important role in the context of Indonesia's goal of reducing greenhouse gas emissions by 29% by 2030.^[13] With 86.3% of respondents saying they had a driver's licence and 87.5% confirming they owned a private motorcycle or scooter, a clear preference for motorised private transport is apparent here, too, especially when it comes to using motorised two-wheelers. The survey also showed that most primary travel is between home and work or school, implying that mobility needs are oriented towards these routes as well as the traffic links between residential and working areas.

Box 2: Country profile Indonesia

Morocco

Morocco has about 37 million inhabitants^[14] (as of 2021). Urbanisation is accelerating, and the rising population of the cities is reflected in higher demand for mobility products and solutions in urban areas as well as in the periphery of urban centres. Urban mobility in Morocco relies predominantly on road transport, with cars, taxis and (interregional) buses and trams being the main methods of transport. Links between regions and cities play an important role in the country's future mobility plans, so that the government is seeking to invest in further expanding the road infrastructure (e.g. highways, bridges, tunnels). Designing the mobility of the future is also influenced by global trends, such as support for electromobility.^[15] At 84.5%, the vast majority of survey respondents own a driver's licence and 59.6% own a private car. As in the other two focus countries, around 80% of the routes primarily travelled daily link home with the place of work or study.

Box 3: Country profile Morocco

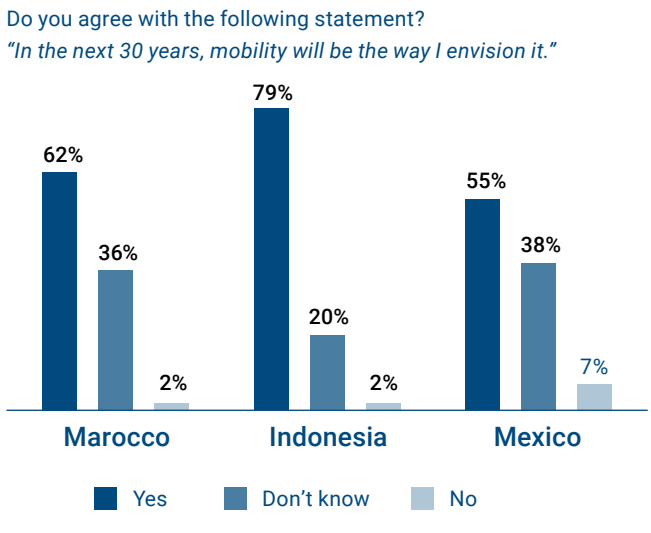
3.1. Future modes of transport and satisfaction with mobility

Current trends and changes show that focussing only on what is technically doable will no longer be enough in future. Instead, users should be asked about their personal mobility preferences. In this context, user satisfaction is a critical factor for

increased adoption and acceptance of urban mobility services and can help increase the overall use and adoption of urban mobility services, which can have a positive impact on rising traffic congestion and overall quality of life in urban areas.

The survey conducted as part of this study asked respondents how they rate their satisfaction with the general mobility situation at their respective locations and the potential for using different modes of transport (Figure 2). Respondents in all three focus countries showed a high degree of optimism about the future in their response to the statement “In the next 30 years, mobility will be the way I envision it”. Optimism was most pronounced in Indonesia, where 79% of respondents agreed with the statement, while over half of participants in Mexico (55%) believed that mobility would correspond to the way they imagined it in future. In Morocco, the result was slightly higher than in Mexico, at 62%.

Figure 2 | Assessment of future satisfaction with mobility in the international comparison (N=550)



This assessment was shared equally by the genders. The various cultural factors in the participating focus countries, as well as the organically grown patterns of traffic functions and interactions between traffic participants, played an important role in this. In the South-East Asian countries, there was a pronounced pattern of respect and consideration for others in traffic, which is not strictly dependent on clearly enforced traffic regulations, but instead works based on its own internal logic and without external interventions.

“All of this happens in a spirit of great harmony [in Thailand], which offers considerable advantages. It would not work in other countries, or if you tried to transfer it to Europe-an countries, because the mentality of people is not suited for it.”

(Tomasz Mazur, Siemens Mobility Thailand)

Survey participants who were sceptical of the statement about positive future prospects had the opportunity to give reasons. In Indonesia, cultural and regulatory reasons were most often cited. Respondents pointed out that infrastructure developments and urban mobility projects were not aligned with urban population growth and that there wasn't a regulatory framework that would allow traffic management goals to be implemented. Survey participants in Morocco highlighted financial trends (e.g. high fuel prices and the trend towards further increases) as being the main obstacle to future mobility changes that would align with their expectations. In Mexico, reasons included rapid urbanisation (disproportionate population growth versus sluggish traffic planning), regulations (lack of a clear development strategy, lacking consideration of future trends, lacking standards for designing more efficient mobility) as well as cultural factors (lacking awareness or interest in alternative mobility solutions on the part of the urban population).

Participants were also asked to name the modes of transport for which they saw the greatest potential in their area (Figure 3). Respondents in Mexico said that private cars had the greatest potential compared to the ten options (bicycle, motorcycle/scooter, public transport, pedestrian, car sharing, bike sharing, electric scooter, cableway/funicular, cargo bike, air taxi). It was noticeable that transport by bicycle and on foot – the second- and third-placed entries – were also considered to hold great potential, and were considered more significant than public transport, which was placed fourth. Rental options like bike sharing or car sharing, as well as electric scooters, motorbikes and scooters, were considered less relevant.

The results for the focus country of Morocco were very similar. Here, too, cars were considered to hold the greatest potential of the eleven means of transport listed, with pedestrian and bicycle modes of transport listed second and third. The main difference compared to Mexico was that foot traffic was given a slightly higher priority than bicycle transport. Public transport was placed fourth, with little to differentiate it from the Mexican scores.

In contrast to Mexico and Morocco, where private cars were ascribed the greatest potential, respondents in Indonesia rated public transport the highest on average, with cars placed second and bicycles, third.

Figure 3 | Evaluation of modes of transport considered to hold great potential for the future



The three most highly prioritised modes of transport, average value, out of eleven options (maximum placement value 11)

This could be because of the higher population density in Indonesia compared to Morocco and Mexico. ^[16, 17] Over and above this, building infrastructure and expanding public transport – along with the related investments – was ranked higher than motorised private transport in Indonesian town and traffic planning preferences. This assessment is reinforced by the cultural weighting of various mobility solutions: whereas private cars represent a social status symbol in Mexico in particular, using public transport in South-East Asia is often linked with the notion of being socially responsible and environmentally considerate.

3.2. Need for action in traffic planning

Based on the urban mobility challenges in emerging markets and the related demands on urban traffic systems, respondents were asked to rate the areas with the most pressing need for action in the traffic planning areas listed in *Box 4*.

Road construction/refurbishment

Road construction and refurbishment relates to expanding the capacity of the existing road infrastructure, for example by widening or adding lanes, as well maintenance, repairs and rehabilitation of existing roads.

Parking space

Creating space for parking is a traffic-related measure that mainly addresses motorised private transport and is used in places where there are high traffic volumes from cars, resulting in a great need for parking spaces in the urban environment. Providing sufficient parking spaces can improve access to certain areas.

Bus lines

This area relates to routes, itineraries and services offered by bus transport systems to connect different places in a region or city. The goal is to offer users a safe, efficient, affordable and accessible mode of transport. The design and implementation of bus lines can have a significant impact on mobility, accessibility and the quality of life of people living in an area.

Rail connections

Efficient rail connections can help reduce traffic jams, improve air quality and provide better access to urban nodes such as airports, but terminals or other modes of transport. Shifting traffic to rail tracks can help ease the pressure on the roads.

Expansion and rehabilitation of pedestrian walkways

The purpose of expanding and rehabilitating pedestrian walkways is to offer pedestrians safe and accessible paths providing them with an alternative means of transport between the locations of everyday life. It can be achieved by widening existing pavements, expanding the network of pavements or building new pedestrian crossings and signals.

Expansion and rehabilitation of bicycle paths and infrastructure

The aim of expanding and rehabilitating bicycle paths and infrastructure is to make using a bicycle in urban spaces more attractive as well as safer. Separate cycle lanes or dedicated cycle paths can be created to separate bicycle traffic from car traffic. In addition to the network of cycle paths, the bicycle infrastructure also includes places to park or repair a bike as well as connections to other modes of transport or bike sharing products.

Access to mobility

Access to mobility refers to the opportunity individuals or groups have of accessing various modes of transport, enabling them to participate in areas of social life including work, education, healthcare or recreation. Access to mobility can be improved by providing sufficient transport options and mobility solutions, but this should be aligned with the needs of various groups, particularly those who are marginalised and vulnerable.

Creating new mobility solutions

Creating new mobility solutions means expanding the current assortment of mobility services and modes of transport. This may include new technologies, services and infrastructure, such as sharing products, demand-based apps or – in future – autonomous vehicles. A comprehensive and diverse mobility offering aims to reflect the needs of all traffic participants in the urban environment and makes it easier to get around in congested urban areas.

Box 4: Definition of needs for action in traffic planning

Participants in Mexico saw the greatest need for action in creating new mobility products (*Figure 4*): over half of those surveyed (69%) said they would welcome an expanded assortment of solutions as well as more attractive existing solutions, for example by making available better public transport information (e.g. timetables) or improving connections between different transport providers in a city (e.g. through integrative apps). Around 48% of respondents considered the expansion of pedestrian walkways in urban spaces important, particularly in the context of improving road safety for all traffic participants. 46% of respondents in Mexico saw a need for action in the area of bus lines. Here, expanding public transport plays a critical role in the country's urban development as well as its ability to achieve the Sustainable Development Goals because transport in Mexican conurbations is currently dominated by motorised private transport. Greater use of public transport would also help address traffic jams, a problem which is prevalent throughout Mexico's cities. In addition, respondents also mentioned creating more parking spaces and improving rail connections as areas needing attention.

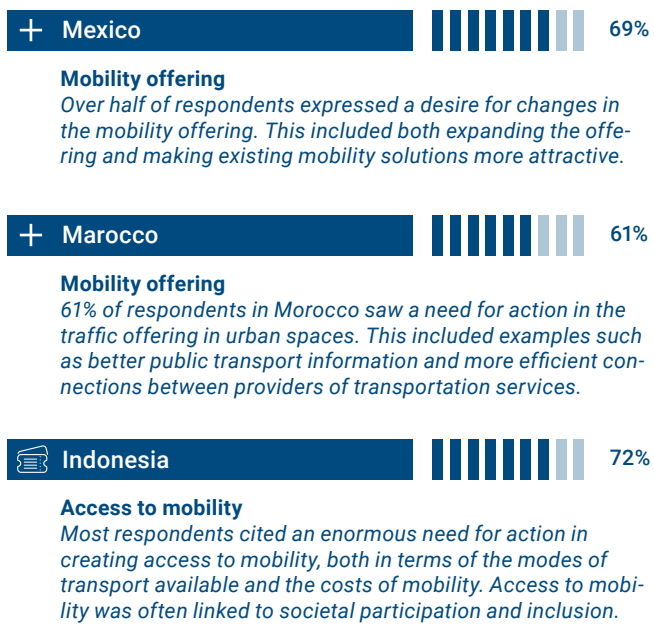
61% of respondents from Morocco placed mobility solutions at the top of the list of things requiring action (*Figure 4*). The attribute "mobility solutions" means more than just introducing new bus lines or expanding rail connections. It also means openness towards new mobility services entering the market. This includes solutions yet to be developed. The second-

placed area of traffic planning needing action was creating parking spaces in urban areas, as well as access to parking spaces (56%). The high perceived relevance of the topic matches the perception of the car as the most important future mode of transport with the greatest potential for the future. 42% of respondents in Morocco would also like to see better bus connections. In addition to the number of bus lines and the timing of the trips, other important issues included the availability of data involved in using the service (e.g. making timetables available) as well as the reliability of the existing offerings.

In contrast to Morocco and Mexico, most survey respondents in Indonesia (72%) said the most important area needing action was access to mobility (Figure 4). In addition to the available modes of transport, this also related to the cost of mobility. Access to mobility was often linked to providing all population groups with the opportunity to participate in society, as doing so would allow individuals to participate in daily life and in social, cultural and economic activities. Limited access to mobility was linked to social exclusion. Access to urban mobility can play an important role in promoting social inclusion, especially for vulnerable or marginalised groups such as older people or low-income households^[18]. As in Morocco and Mexico, respondents in Indonesia highlighted mobility solutions (65%) and improved bus connections (62%) as areas needing attention and action.

Figure 4 | Greatest need for action, by country

Greatest need for action in traffic planning, by focus country. The figure shows the area mentioned the most often.



The general focus on creating mobility solutions and providing access to mobility is apparent in all three of the emerging markets surveyed. This can be read as an indication of similar structural challenges in urban mobility in the focus countries.

3.3. Mobility attributes and needs

Social preferences provide important guard rails for future technological developments in the mobility system. To help identify transport requirements and needs in the various focus countries, participants were asked to prioritise certain attributes commonly considered to be particularly relevant for urban mobility in the literature.^{[19] [20]} The following box provides an overview of the attributes.

Affordable

Future mobility concepts should generate relative price benefits for users. Well-priced solutions are more likely to be considered. Attractive prices can also boost social participation in urban life.

Safe

Mobility should not only fulfil today's safety standards, but also the demanding requirements of the future. This includes both the system and traffic safety of diverse modes of transport, but also safety in the sense of preventing crime in various mobility scenarios. Not least, this aspect should be considered against the backdrop of gender-sensitive mobility planning.

Emission-free

Zero-emission vehicles, in contrast to internal combustion engines, do not emit any substances harmful to the environment on site and thereby help reduce local CO₂ emissions.

Flexible

Flexible mobility means ensuring spontaneous availability wherever it is needed. It aims to give users more choice and control regarding their modes of transport while making it easier and more comfortable to get around.

Joint use

Joint-use mobility means that routes are traversed in the company of others rather than by oneself. This can mean travelling with acquaintances or with people one does not know.

Fast

Fast mobility means shorter waiting times and an optimised transport network allowing users to get to their destination as directly as possible and with a minimal time investment.

Comfortable

Comfortable mobility means the opposite of overcrowded trains or buses and represents the evolution of products towards individual spaces where passengers can lean back in comfort while travelling.

Restful

This attribute of mobility solutions refers to improving the quality of the travelling experience and the reduction of traffic-related stress.

User-friendly

This attribute means that future mobility solutions should be easy to use, inclusive and easy to understand across all sections of society.

Appropriate

In connection with urban mobility in emerging markets, “appropriate” refers principally to functional usage. Mobility products must be appropriate to their respective use cases and match the requirements as closely as possible. This has to be considered against the background of location-specific challenges.

Box 5: Defining the attributes of future mobility solutions

In general, respondents from all the participating focus countries preferred the same attributes: “Safe”, “affordable”, “comfortable”, “fast” and “flexible” are five of the ten attributes required of future mobility solutions in the cities (Figure 4).

While the ranking of the attributes is as listed and identical in Indonesia and Morocco, with very minor variations, Mexico displays a minor deviation in that attributes 4 and 5 are swapped. In other words, the flexibility of mobility solutions is considered slightly more important in Mexico than rapidity is. This could again be related to Mexico’s strong focus on private transport in contrast to public transport. The use of private cars as a general trend in the country could be interpreted to mean that many respondents value flexibility in mobility by preference and by custom. ^[21]

Figure 5 | Preferred attributes of mobility in the focus countries

	Attribut 1	Attribut 2	Attribut 3	Attribut 4	Attribut 5
Marocco	Safe	Affordable	Comfortable	Fast	Flexible
Indonesia	Safe	Affordable	Comfortable	Fast	Flexible
Mexico	Safe	Affordable	Comfortable	Flexible	Fast

The five most commonly named mobility attributes, out of ten options

The gender-related differences in responses are particularly noteworthy. In all three countries, but above all in Indonesia, female respondents considered the attribute “safe” to be particularly important. In Morocco, male respondents placed greater value on the affordability of mobility solutions than their safety.

“The topic of gender in transport is something that really needs to be addressed and we really need best practices because [...] it’s not a topic that everyone talks about, but it’s a topic that everyone knows about.”

(Kawtar Benabdelaziz, GIZ Project Manager, Morocco).

In other words, safety is clearly prioritised in the emerging markets included in the survey. Safety can involve multiple dimensions, including system and traffic safety, but also being safe from criminals.

The attributes “zero-emission”, “user-friendly”, “restful”, “joint use” and “appropriate” are not insignificant according to the survey, but occupy the lower ranks 6-10 of preferred mobility attributes. The restfulness of travel and sharing transport with familiar or unfamiliar people were considered significantly less important by the respondents.

3.4. Mobility requirements and needs compared

Addressing mobility needs and requirements in the urban context requires considering a combination of infrastructure, technological, political and planning aspects. Identifying various location-specific mobility requirements makes it possible to implement mobility solutions that take into account both the needs of rapidly urbanising populations as well as the goals of (super-)national sustainability initiatives, such as the Sustainable Development Goals. Moreover, it enables creating a just and accessible transport situation for all sections of the population. Which needs and demands mobility has to satisfy is a result of multiple factors that may be highly location dependent.

Emerging markets typically display rapid rates of urbanisation and high rates of population growth, especially in major cities and megacities ^[11]. The needs of a rapidly growing urban population are often confronted with severely limited space. This means that there is high pressure on open spaces, particularly in Indonesia and South-East Asia, while there is simultaneously a great need for mass transit systems. As a result, public transport occupies a prominent place in urban planning and traffic management. ^[22] However, due to a lack of public transport and its declining quality, which is reflected in aspects such as the punctuality and reliability of mobility services and required information (e.g. timetables, routes), but also in the safety of use or more difficult access for certain population groups (e.g. children, the elderly, women), the use of public transport tends to become less attractive even while its relevance is increasing.

Furthermore, there is often a lack of an institutional framework and integrated administration of the various public transport products. A final significant problem is the lacking coverage of the first and last mile. Motorised means of transport are preferred in South-East Asia, not least because of the climatic conditions and the hot and humid climate, a factor that has to be taken into consideration when designing mobility solutions for the first and last mile.

“You know the biggest problem in Indonesia is of the first and last mile of transporting.”

(Achmad Zacky Ambadar, GIZ Project Manager, Indonesia)

There are multidimensional challenges resulting from the nature and current design of the public transport system on the one hand and from geographical and cultural attitudes in the population on the other hand.

In the case of Morocco, too, clear challenges exist in urban transport, especially when it comes to availability and safety. Because Morocco forms an important link for road traffic and freight transport between Europe and Africa, transport and traffic are responsible for the second-highest share of CO₂ emissions after energy production. Furthermore, the country is dependent on imported fuels, meaning that decarbonising transport is a relevant issue for Morocco. This is one more reason why more energy-efficient, lower-emission alternatives should receive more attention in passenger transport.

A core challenge in achieving this goal is posed by the country's administrative structure: responsibilities reside at various administrative levels, making it more difficult to coordinate traffic planning and mobility design.

"[...] the Ministry of Transport is [...] only responsible for road transport, especially freight. But in the urban area it's the Ministry of the Interior that is responsible for all the mobility inside the urban area [...] and it works together with the municipality or the cities to develop the transport. [...] Every region has its own responsibilities."

(Kawtar Benabdelaziz, GIZ Project Manager, Morocco)

Mexico's mobility situation is best understood by looking at the country's urban planning model. The approach is described as the "American Model" and has its origins in the 20th century. It provides for a spatial and functional differentiation of the city according to various activities of everyday life. But this model results in a high degree of urban sprawl and suburbanisation in Mexican conurbations, which is reflected in the high concentration of private cars and the prioritisation of cars in traffic management and urban planning. This prioritisation relates to cultural references that assign a high social value to the ownership of private cars as a status symbol. Alternative modes of transport are given less prominence from a planning and regulatory perspective. This type of urban planning and the resulting high traffic volumes – in addition to delays in mobility – have a negative effect on environmental factors, including worse air quality. Because of these problems, proposals have been made to develop an alternative urban planning model for Mexico, in terms of which the cities would be obliged to provide alternative mobility solutions.

"And so what's happening in Latin America is that only certain social classes or economic classes are able to live that theoretical model out, which is the model of driving everywhere."

(Marco Martínez O'Daly, expert on Mexico and Central America)

"The [...] challenge I would address is also linked with what we call the American Dream, [...] a concept that was born in the 20th century [...], which was the idea of finally being to live in the city with the rural benefits. And so the suburban model, the sprawl model where everyone would be able to have their own single family housing complex in a 15-20 minute drive from work, what allows families to feel like they were getting the benefit of traditional royal families living outside the city in a more peaceful environment and have the benefits of the work and economic opportunities of living close to the urban areas."

(Marco Martínez O'Daly, expert on Mexico and Central America)

The international user survey and the interviews with experts in the various focus countries allowed us to identify urban mobility challenges, needs and requirements, which are highly location-specific and should always be viewed against the backdrop of the local context. Nonetheless, there are similarities and overlapping topics that all the countries have in common. Based on these findings, four topic areas were identified that are relevant for the choice of best practice examples to do justice to the demands of urban traffic and mobility design:

- The availability of efficient mobility solutions with low space requirements
- Solutions aimed at improving the availability of data and the digitalisation of existing mobility solutions
- Securing access to mobility
- Effective governance tools in urban mobility

The selected best practices illustrate urban mobility solutions that can help address the challenges commonly encountered in emerging markets.

One goal of the study is to identify urban mobility solutions that take into account both user needs and existing, overarching urban mobility challenges. Against this backdrop, the selected best-practice examples represent the amalgamation of the three methodological components, as the findings generated from the user survey are combined with the expert knowledge gained in the interviews and the existing knowledge base available in the current research context.

4. Innovation showcase

In this chapter, we present best-practice examples illustrating the effective implementation of innovative mobility solutions in various emerging markets around the world.

Best practices describe optimised and tested methods of execution and implementation ^[23]. They represent a tool for accumulating and applying specific information and knowledge that can act in a supporting capacity in other situations and contexts. In this sense, best practices are an efficient solution to a problem based on a combination of innovation, effectiveness, and practical feasibility. They also encourage audiences to reflect on how they work, while their role-model nature serves as an incentive to transfer them to other contexts ^[24, 25]

The role-model nature of best practices can help initiate systemic changes ^[26] that lead to innovation and sustainability transitions. This also applies to urban mobility ^[27]. In the urban mobility discourse, best practices serve as a source of inspiration and ideas as well as a communication tool in urban development and mobility planning.

The best-practice examples used in the innovation showcase are not limited to technological examples. Social and regulatory innovation is also taken into consideration, as are new urban mobility business models or alternative urbanistic concepts. On the one hand, the best-practice examples refer to the focus countries, but they can also be extrapolated to other countries that find themselves in a similar situation. The aim is to give a comprehensive overview of innovative approaches and solutions in emerging markets worldwide.

4.1. Mobility approaches for urban transformation

The mobility solutions we discuss can be grouped in four overlapping areas of action, which turned out to be particularly relevant in the user surveys and interviews. They relate to the challenges in emerging markets highlighted in *Chapter 3*. The areas of action represent social, technological and spatial developments in the focus countries that will have to be

Figure 6 | Areas of action relating to mobility solutions



addressed by many other international cities in the coming years. The examples serve to illustrate approaches to overcome these challenges.

The best practices presented in this context provide insights into successful initiatives. They serve as orientation guides for stakeholders and document framework conditions that were relevant for the implementation and execution of the projects ^[28]. In the context of transferability, variables such as local cultural conventions, societal norms, demands and structural conditions have to be taken into consideration ^[28].

4.1.1. (Spatially) efficient mobility

While the rate of urbanisation has slowed dramatically in industrialised countries since the 1950s, even reversing in some cases, urban populations are expected to continue growing rapidly in Asia, Africa and Latin America ^[29]. The patterns of urban development in emerging markets are distinctly different from those in the industrialised nations. Existing cities are registering rapid population growth ^[29]. In urban areas with high population densities, the space requirements of the transport infrastructure and its operations represent a

significant challenge ^[30]. Aside from taking up a lot of space, transport systems in these cities are often characterised by above-average accident statistics and negative environmental impacts (e.g. pollution, traffic noise) because of the high traffic volumes ^[30]. This creates a need for mobility solutions that use space efficiently, as well as for strategic traffic planning that takes into consideration scale effects associated with the high population growth rates when providing mass transportation modes. In developing new strategies and projects, factors such as topographical conditions, vested interests, power relations and local needs are critically because they significantly impact the forms of mobility offered, as well as their usage and acceptance ^[30].

When it comes to making available the types of mass transportation that count among the most spatially efficient forms of mobility, factors such as affordability, speed and comfort have to be considered ^[31]. The spatial distribution of the infrastructure is also a critical factor in providing equal access to diverse sections of the urban population. Expanding railbound transport also requires upgrading pedestrian walkways and bus lines to boost their attractiveness. Initiatives like the one pursued in La Magdalena in Quito, Ecuador, for example, aim to reduce car usage by beautifying public spaces and thereby



incentivising pedestrians and cyclists to use them. The objective is to prioritise transportation methods that make more efficient use of space ^[32]. Providing bicycle infrastructure as part of sustainable traffic management is also becoming increasingly important in emerging markets ^[33]. This new approach to traffic management offers considerable benefits, particularly in the area of health and the environment (e.g. air quality).

The overall intention is to develop town-planning strategies that satisfy the needs of the population as a whole. In this context, using urban spaces more efficiently plays an essential role in enabling fast, flexible and attractive modes of transport for diverse sections of the population.

Metro, Bangkok, Thailand

Mass transport and spatially efficient infrastructure

*[31, 34 35]



Source: Pixabay (islandworks - Q.K.)

To counteract extreme traffic congestion in Thailand, transit-oriented approaches were developed in Bangkok to provide mobility services through public transport. Currently there are five rapid transit railway lines with an overall length of about 110 kilometres. Thailand's government is planning to extend the network, offering 12 lines covering about 500 kilometres by 2030. The ongoing expansion of the metro system makes it easy to get around quickly in the city, represents an attractive alternative compared to sitting in endless traffic jams in private transport, and connects diverse parts of the city. Despite construction challenges, metro lines were built along the arterials with the heaviest traffic to combat traffic challenges.

Active / in operation: **Since 2004**

Innovation radar: **Transferred**

TransJakarta, Jakarta, Indonesia

Mass transit and spatially efficient infrastructure

*[36, 37]



Source: Pexels (Ngrh Mei)

The bus rapid transit (BRT) system in Jakarta is the world's largest, extending over 200 kilometres in total. The goal was to establish an integrated system that improved the travel experiences of a million passengers per day. By separating the buses from general private transport, distances can be bridged faster and more efficiently. TransJakarta stands out because it is the most accessible as well as the safest mode of transport in Jakarta. By connecting smaller vehicles (local buses), paratransit operators etc., coverage was extended to even more parts of the city. The next step is multimodal integration with LRT (light rail transit) and the new Metro Rail in Jakarta.

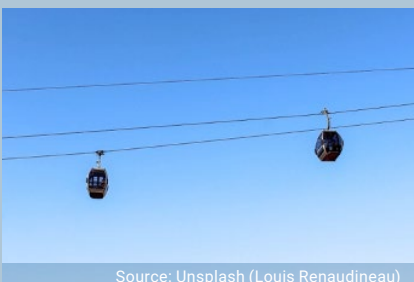
Active / in operation: **Since 2004**

Innovation radar: **Transferred**

Metrocable, Caracas, Venezuela

Mass transit and spatially efficient infrastructure

*[38]



Source: Unsplash (Louis Renaudineau)

The cableway system of Caracas has been in operation since 2010 and covers a length of about 1800 metres (speed: 18 km/h). The cableway helped address an urgent mobility need in a way that accounted for topographical requirements and helped link mountain slopes that were previously not well connected. The line has five stations. The success of Caracas Metrocable has encouraged local authorities to extend the existing cableway system to other parts of the city. A distinctive feature of the system is its efficient use of space, as some stations were integrated in office buildings and the towers along the route occupy little space. This mobility system is highly suited to being integrated into areas that are already densely populated.

Active / in operation: **Since 2010**

Innovation radar: **Transferred**

La Magdalena, Quito, Ecuador

Traffic management

*^[32]

Source: Pixabay (RoamingPro - Jerry Nettik)

The La Magdalena district features distinctive, pastel-coloured dots on the road surface that were created by local artists. They also help make the road – which is a highly frequented pedestrian route – safer by creating a sense of a space shared by car users, cyclists and pedestrians. The “Crash Spots” programme aimed to drastically reduce traffic accidents. It was also designed to reconceptualise public spaces by redistributing traffic areas and making them more attractive for pedestrians. The city of Quito is using innovative approaches related to tactical urbanism and aims to create an awareness among residents of the various usage and appropriation possibilities of public spaces.

Active / in operation: **Since 2020**Innovation radar: **Introduced**

Quinto Centenario (5C), Bogota, Colombia

Traffic management

*^[33]

Source: Pixabay (tpeluffo)

With an overall length of 25 kilometres, the 5C route is the first “cycle avenue” traversing the city from north to south and linking residents from districts with low, medium and high income to places of work, education and recreation. The aim of the project is to reduce greenhouse gas emissions in the city and support the long-term shift to more sustainable forms of mobility. The project is also intended to serve as a best-practice example for the sustainable, replicable funding of cycle infrastructure. This first rapid cycle corridor in Latin America passes through seven districts and creates a new standard for mobility-based sustainability and safety in Bogotá. Early estimates project 34,000 users per day.

Active / in operation: **Since 2017**Innovation radar: **Transferred**

4.1.2. Digitalisation and availability of data

Digitalising mobility in emerging markets can boost the effectiveness of traffic system controls, improve traffic safety, avoid traffic jams, and reduce energy and resource consumption. The availability of data is an important aspect of digitalisation in mobility. The availability and usage of such data can help make mobility in emerging markets more efficient and sustainable, for example by improving traffic management and control. Safety can be improved, travel times shortened, and the attractiveness of public transport be boosted on the basis of sound data ^[39]. Collecting and using mobility data can also enable effective evaluation and progress assessments in many areas of traffic management. Identifying social mobility needs can be improved by ensuring that more high-quality data are available. Across various cities, data on key factors and the spatial distribution of activities are critical for developing effective mobility concepts. Settlement and infrastructure patterns, as well as the distribution of workplaces and public services, can lead to complex and inefficient movement patterns of people and goods ^[40]. Digital applications are also playing an increasingly important role in the context of intermodality ^[41].

While transport-related technologies are seen as positive in highly industrialised countries with high levels of economic wealth, studies indicate that people in emerging markets are more reluctant to embrace them ^[39]. Among other reasons, this is because supporting technologies in transit are often unequally distributed in emerging markets. Studies suggest that the lower willingness to use them is linked to the fact that users are suspicious about how their personal data will be used. A further usage barrier is that users expect frequent system outages and that they feel that they are under surveillance ^[39]. Accordingly, the challenge in the context of the social usage and acceptance of digital applications in emerging markets involves counteracting these factors and developing needs-based solutions that help improve traffic dynamics in urban spaces. Digital applications offer many ways to approach solving current challenges in the mobility sector. For example, coordination apps like What3Words and SnooCode (Ghana), which are based on algorithmic addressing systems, can help logistics, private and emergency services get to their destinations faster and more efficiently ^[42]. Such applications represent a solution approach for many African cities where urbanisation is happening so fast that street maps are outdated as soon as they are published ^[43].

Apart from information platforms providing access to traffic news – and which thereby contribute to traffic safety and easier route planning (e.g. by identifying peak congestion times and locations) – app-based products providing access to diverse mobility services (e.g. Go-Jek, Gokada) are spreading fast ^[44,45]. Offering reliable and attractive mobility alternatives can reduce the importance of having to own a car as a key factor in individual mobility. Whereas in the past, the essential benefit of having a car was the flexibility it provided in terms of time and place, such factors can be transferred to other modes of transport with the support of digital apps, while restrictive traffic rules and congested roads make it less attractive to use a car ^[41]. This means that smartphones are evolving to become the digital key to the intermodal world, providing

ubiquitous access to modes of transport ^[41]. The actual traffic experience remains an important factor and will continue to be a key distinguishing feature between different modes of transport in future.

In total, implementing digital mobility applications can provide travellers with easier access to travel information, more personalisation and greater flexibility. Operators can benefit from significant efficiency gains while political decision makers can use improved data availability to address environmental, social and economic challenges ^[46]. However, it must be noted that digitalisation initiatives also mean new rules and requirements for users and should be designed in a way that provides equal access for all sections of the population ^[46].

Ma3route, Kenya

Data availability (data crowdsourcing)

^[47]



Source: Pexels (Anete Lusina)

Ma3Route is a mobile, web and SMS platform that gathers traffic data in Kenya. In 2020, Ma3Route had 1.1 million followers on Twitter and about 400,000 subscribed users on the app. Whenever a user publishes a traffic news update on the app, Ma3Route shows the report on the app and posts it on Twitter. Capturing road traffic accidents via social media makes it possible to analyse local conditions, helping to improve road safety. The accident statistics gathered by this method can provide new opportunities to improve the physical infrastructure in the context of political measures, as new insights regarding high-risk times and locations can be gained and leveraged. Overall, Ma3Route is intended to ease travel in developing countries by democratising traffic information.

Active / in operation: **Since 2012**

Innovation radar: **Established**

One Delhi, Delhi, India

Localisation and navigation

^[48]



Source: Pixabay (cskkkk - esk)

In November 2022, the overhauled version of the One Delhi app was launched. The app supports navigation in Delhi's public transport system. One of the main reasons for developing the app was that people didn't use buses to get around the city because they weren't familiar with the routes and because of unreliable timetables (because of traffic jams). By making it easier to access such information, the goal was to make it more attractive to use the bus. Among other things, the app provides functions such as live tracking for over 7,300 buses and forecasts of exact waiting times.

Active / in operation: **Since 2022**

Innovation radar: **Introduced**

Go-Jek, Indonesia*Mobility networking by means of an app*

*[49]



Source: Unsplash (Afif Ramdhasuma)

Go-Jek is an app-based development in support of integrated traffic services. It integrates transport, delivery, lifestyle and pay services. The motorbike taxi service with its over 200,000 drivers has become one of the most popular means of transport in Indonesian cities. All Go-Jek services are accessible via smartphone apps that track the user's location and bring together riders and users in close proximity. The platform also enables seamless transitions between motorbike taxis and public transport by localising nearby stops and stations and providing real-time timetable information. The start-up's services are also supplemented through the addition of Go-car, a car rental service.

Active / in operation: **Since 2010**Innovation radar: **Transferred****Gokada, Nigeria***Mobility networking by means of an app*

*[45, 50]



Source: Pexels (Daniel Sikpi)

The transport company Gokada was founded in February 2018 and developed an on-demand motorbike taxi app that allows customers to easily order a trip. Motorbike taxis traditionally grew organically by offering a flexible, accessible door-to-door service in the absence of organised, reliable public transport. Gokada differentiates itself from the competition by offering more direct and faster mobility. Female users in particular favour this mode of transport to avoid the hassle and harassment of using public or informal transport.

Active / in operation: **Since 2018**Innovation radar: **Established****What3Words, Côte d'Ivoire***Localisation and navigation*

*[51, 52]



Source: Pixabay (ninastock)

What3Words is an award-winning addressing system that was adopted as the address standard for Côte d'Ivoire's postal system. The three-word-addresses were introduced to improve the national infrastructure. This digital system offers many opportunities to identify locations accurately, an important benefit in the context of rapidly growing cities and many informal settlements. Based on an algorithm, the system generates three-word codes that serve as a unique identifier for 3m x 3m blocks. As the system combines a code with a specific grid, it is helpful in locating places or activities and offers new opportunities for logistics or mobility service providers serving informal settlements.

Active / in operation: **Since 2016**Innovation radar: **Transferred**

4.1.3. Accessible mobility

In addition to structural and environmental challenges, many emerging markets are also battling to provide equal access to mobility because of structural racism in mobility that means that safe mobility is not available to many people by default^[53]. Accessible mobility means reducing barriers and providing diverse transport options to allow all people to participate in social life. This includes ensuring access to the first and last mile and linking rural areas to urban spaces.

Mobility is a basic prerequisite for economic growth and development. Quality of life is directly linked to the performance and competitiveness of transport systems as well as their safety and attractiveness^[30]. In many emerging markets, access and safety strategies play a critical role in the mobility context^[53]. Women using public transport in countries with pronounced differences in the treatment of genders are regularly exposed to sexual harassment and violence^[54]. To combat this problem, many cities have created transit services reserved exclusively for women. These measures are intended not only to provide safer and more equitable mobility for women, but also to raise awareness for the underlying societal problems^[54]. Such initiatives and projects have been launched in dozens of cities all over the world, including Rio de Janeiro, Brazil; Lahore,

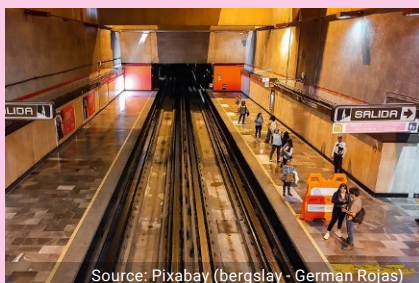
Pakistan; Jakarta, Indonesia; Dubai, United Arab Emirates; and Tokyo, Japan^[54]. In addition to gender-restricted forms of transport, there are also online platforms (e.g. SafetiPin) that provide safety information about public spaces in support of fear-free mobility for residents^[55]. Providing mobility infrastructure can also help to bridge spatial segregation (see Medellín, Colombia)^[56]. Developing financial services such as M-Pesa is a further means of supporting the mobility of diverse sections of the population. Enabling cashless payments benefits not only the mobility service providers, it also helps passengers because it gives them greater flexibility and safety when using public transport^[55].

When it comes to first- and last-mile transport, sharing concepts are becoming increasingly important. This is because share mobility solutions offer numerous benefits in the areas of flexibility, accessibility and competitiveness. In addition to environmental advantages, the shift of traffic to shared solutions results in fewer trips, shorter distances and a reduced need for parking space^[53]. Establishing shared mobility services offers opportunities in the context of gender-equitable planning initiatives in emerging markets and can also be connected to existing public transport. This offers scope for diverse integrated modes of transport that can substitute for the private ownership of vehicles^[53].

Women-Only Transportation, Mexico City, Mexico

Gender-sensitive mobility planning

[54, 57]



Source: Pixabay (bergslay - German Rojas)

In 2002, modes of transport reserved exclusively for women were introduced for the first time in Mexico City^[45]. The aim is to create safe spaces for female commuters. The “pink” modes of transport (taxis, buses, subway cars) were mostly introduced by feminist organisations to reduce gender discrimination in urban mobility. In addition to the “pink” fleet, monitoring stations were introduced to allow women to report harassment. The campaign focuses on strengthening female mobility by drawing attention to safety issues while also implementing concrete solutions. This form of best practice responds to the need for safe mobility solutions for women, which female participants in the survey highlighted as being particularly important.

Active / in operation: **Since 2002**

Innovation radar: **Transferred**

SafetiPin App, India

Gender-sensitive mobility planning

* [49, 58]



Source: Unsplash (elCarito)

SafetiPin is a mobile app and online platform that provides safety information about public spaces. The app was developed to increase the freedom of movement of people – primarily women – where movement is limited by fear of violence. Since 2013, the app has been supporting secure route planning by providing safety assessments of public spaces as well as GPS tracking functionality. The safety assessments are based on nine parameters (lighting, visibility, openness, crowds, diversity of people, nearby public transport, availability of pedestrian walkways, presence of security personnel and the feeling associated with it). Data are crowdsourced.

Active / in operation: **Since 2013**

Innovation radar: **Established**

Women on Wheels, Pakistan

Gender-sensitive mobility planning

* [59]



The Lahore traffic police developed a motorcycle training programme that is meant to increase the mobility of women while combating the harassment of women and girls on the street as well as countering other forms of violence in public spaces. The initiative is being supported by the Department for Women's Development of the Punjab province as well as UN Women Pakistan. Women are rarely seen on motorcycles in Pakistan, where this form of transport is traditionally used by men. The goal of the initiative is to support women in reclaiming public spaces and giving them more freedom in individual mobility.

Active / in operation: **Since 2016 (Lahore), 2018 (Punjab), 2019 (Karachi)**

Innovation radar: **Established**

Safe City Programme, Marrakesh, Morocco

Gender-sensitive mobility planning

* [60, 61]



The aim of the project is to provide all women and girls living in Morocco's cities with safe access to public spaces, enabling them to use the spaces without fear and without the threat of sexual harassment. Gender-sensitive guidelines were developed to create safe and inclusive public spaces, ensure safe mobility and promote access to services for women and girls. The programme is supported by UN Women and the Ministry for Housing, which are jointly developing national gender-sensitive planning guidelines. Overall, the initiative takes the form of an awareness campaign designed to improve gender equity.

Active / in operation: **Since 2016**

Innovation radar: **Transferred**

SafeBoda, Kenya

Safety

* [62, 63]



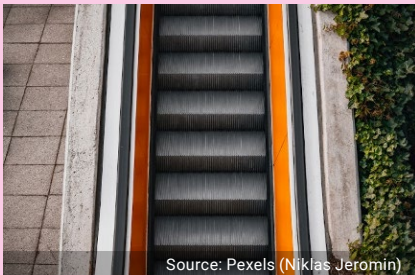
As motorcycles offer the greatest advantages compared to other forms of transport in dense traffic and on untarred roads, they are often used in low- and medium-income countries. But despite their advantages, motorcycles are also involved in many traffic accidents, often resulting in serious injury. SafeBoda offers its motorcycle riders multi-step safety training, basic first responder training, and bike helmets. Studies have shown that SafeBoda riders display safer driving behaviours than regular riders. The programme highlights that traffic safety can be improved by training drivers or riders.

Active / in operation: **Since 2014**

Innovation radar: **Transferred**

Escalator transport systems in Medellín, Colombia*First and last mile*

* [56]



Source: Pexels (Niklas Jeromin)

The Medellín escalator is considered the world's longest. It covers an elevation difference of about 130 metres on the district's steep mountain slopes, the equivalent of having to climb 357 steps. The escalator consists of six sections and aims to let residents cover a route in six minutes that would take half an hour on foot. There is no charge for using the escalator. It was built at a cost equivalent to about five million Euro. The electrical escalator is mainly conceived of as a traffic intervention to reduce socio-spatial segregation.

Active / in operation: **Since 2011**Innovation radar: **Established****EcoBici – BikeSharing Mexico City, Mexico***First and last mile*

* [64, 65]

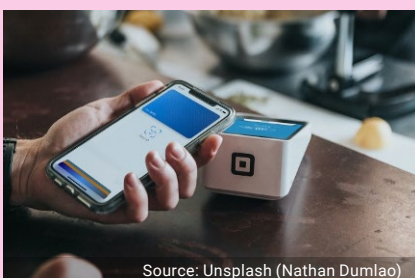


Source: Unsplash (NII)

Ecobici is a bicycle system in Mexico City, where this form of transport has been integrated as a key component of mobility. The bicycles are accessible to the city's residents, visitors from surrounding areas, and tourists. Registered users can take a bicycle from any station and return it within 45 minutes at the closest station. There is no distance limit. There are already 84 stations spread throughout the city and more than 840,000 trips have been made.

Active / in operation: **Since 2010**Innovation radar: **Transferred****M-Pesa – payment service – Kenya***Financing*

* [38, 54]



Source: Unsplash (Nathan Dumlaio)

M-Pesa is a mobile payment service that allows users to invest, transfer and withdraw money using their smartphones – and without needing a traditional bank account (all that's needed is a SIM card and a valid form of identification). The system was introduced in 2007 by mobile company Safaricom and has since undergone rapid growth. In 2016, M-Pesa had about 25 million clients, making it one of the developing world's most successful mobile-based financial services. The services are used by people of all ages, independent of their income and place of residence.

Active / in operation: **Since 2017**Innovation radar: **Transferred**

In the mobility context, M-Pesa allows users to pay for Uber or taxi trips by means of a mobile transaction. As Kenya's transport system is notorious for its corruption and robberies – with transport companies losing around a third of their revenue to theft and extortion – cashless payments in public transport give passengers and staff a safer mobility option. Cashless payments also create new opportunities and more flexibility in public transport.

4.1.4. Governance in urban mobility

Controlling and regulating the transport sector – with the involvement of various stakeholders at multiple levels – plays an important role in emerging markets. The goal of mobility governance is to ensure a coordinated and sustainable approach to traffic management and development that takes into account the needs of all transit participants as well as ecological, economic and social requirements. Mobility governance refers to the decision-making processes, regulations and (financial) instruments that impact the transportation sector.

Both in industrialised countries and in emerging economies, cars are seen as a primary means of transport as well as a cultural indicator of prosperity and development [41]. Because of the many challenges confronting cities in emerging markets, however, the role of the car also needs to be redefined. This means aligning transportation systems of the future with human needs and establishing new mobility concepts. Cities in Latin America in particular are confronted with the challenge of enhancing urban centres, making public spaces more attractive and safer, and reducing the enormous levels of traffic congestion [66]. While urban spaces were dominated by other forms of usage just a few decades ago and formed important centres of community life, nowadays it is common to find empty sidewalks and overloaded thoroughfares [66]. In Lima, 51% of people spend over two hours per day in traffic jams, while in Mexico City, people spend an average of 18 days in traffic jams.

South American cities in particular are therefore striving to ease the existing traffic conditions. Measures used to counteract negative traffic developments often include access restrictions (e.g. odd-even regulation in Delhi, India, driving bans (e.g. car-free days in Jakarta, Bandung, Garut, Malang in Indonesia), usage fees, innovative traffic regulations or special traffic lanes [41]. In countries like Malaysia, GPS data are used to analyse traffic flows and ease congestion. In South Africa, real-time data are captured to identify traffic patterns to enable more efficient traffic control.

In the context of urban traffic and transportation policy, this leads to a heterogeneous mobility environment that is becoming increasingly complex, making it harder to understand and navigate [41]. Skills and experience are needed to identify suitable transit options. It also requires agile adaptation strategies on the part of users [41].

A further approach that is being more widely adopted is “tactical urbanism”, in terms of which temporary, easy to change local interventions are made which are first developed through participative processes [67]. Overall, the goal is to trigger long-term changes through short-term interventions while involving the local population in redesigning the road environment and revitalising public spaces, as in the Panamá Camina project in Panama [66]. This approach is becoming increasingly important in Latin America and highlights the relevance of successfully implemented, tactically located experiments which are complemented by data-capture tools to supply evidence-based approaches to planning processes [66].

Over and above, digital applications are increasingly being used to enforce traffic rules – as well as to protect at-risk traffic participants [39]. It is notable that across all countries, heightened environmental and health risks, as well as financial deficits, are playing a critical role in influencing political measures in the context of urban mobility [41].

Cities in emerging markets battled with the weaknesses of their mobility concepts during the Covid-19 pandemic especially [68]. At the same time, the need to change objectives and measures towards more just, environmentally friendly and more efficient traffic management was recognised and corresponding measures were rapidly implemented during the pandemic [66]. For instance, over 35 kilometres of new cycle paths were built in Bogotá, Colombia up to 2020. Rancagua and Arica in Chile converted their car-centric roads to roads suitable for pedestrian use at short notice. Such changes would have taken a great deal longer before the pandemic [66]. Rapidly implementing such measures – as well as the widespread societal acceptance of new, active forms of mobility – represent important indicators for future town-planning measures. Especially because the attractiveness of active mobility forms an important component of sustainable urban development: towns that are pedestrian-friendly are more equitable and contribute to the health and safety of residents. Walking is a democratic and healthy mode of transport [68].

At the same time, cars will continue to play the same important role in the future that they play today, as the participant responses in the international survey showed. That sets the context for a core challenge that traffic and urban planning will have to address.

Parking space management – Peking, China

Regulation and policy

* [69]



Source: Unsplash (Tao Yuan)

Owing to high traffic volumes in the city of Peking, the urban city commission of Peking is developing new parking strategies. One of the objectives is to limit unregulated parking to reclaim road space for pedestrians and cyclists by introducing new forms of parking management. This involves technology-based monitoring of parking occupancy to minimise traffic jams and wastage as well as sensor-based tracking of traffic violations. India provides a comparable example. The government in Delhi has developed a guideline that provides for progressive steps towards solving the problem of rising congestion and indiscriminate parking. Transferring such strategies to other countries or cities should always be done in a way that complies with privacy laws and local guidelines.

Active / in operation: **Since 2013**Innovation radar: **Transferred**

Odd-even regulations, Dehli, India

Regulation and policy

* [70]



Source: Unsplash (Marvin Castellino)

Over 660 million people in India breathe air that does not comply with national air quality standards. In response, the government in Delhi tested the so-called “odd-even” traffic rule in 2016. This approach to traffic management involves allowing only cars with odd-numbered licence plates to drive on odd-numbered calendar days and vice versa. The pilot projects lasted for fourteen days in each instance and were used to analyse air quality to assess the project’s impact. Fine-particle testing found reductions of 14-16% while the project was running.

Active / in operation: **Since 2016**Innovation radar: **Transferred**

Panamá camina – tactical urbansim; Panama City, Panama

Regulation and policy

* [66, 71]



Source: Unsplash (Richie Gomez)

In the course of this project, a large road intersection was converted into a pedestrian zone to encourage people to walk the city centre as well as to promote art and culture in the city. This experiment in Panama City had a limited duration and was intended to highlight the importance of people as the core dimension of urban development. The data collected during the four-week intervention showed that access to safe and orderly streets raises quality of life for residents and brings them into harmony with their environment. Tactical urbanism provides an innovative and inclusive method of involving local communities in redesigning road spaces and reclaiming public spaces.

Active / in operation: **Since 2018**Innovation radar: **Transferred**

Car Free Day, Jakarta, Indonesia*Regulation and policy*

* [61]

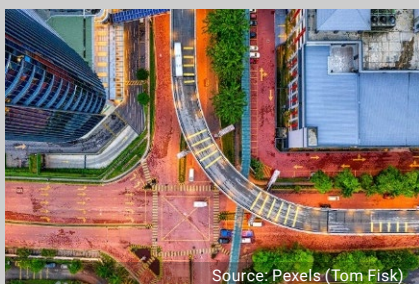


Source: Unsplash (adhia huza)

The original aim of car-free days in Jakarta was to reduce air pollution in high-density areas, to reduce noise pollution, reduce psychological and physical health, promote social interaction and raise awareness for the environment among residents. At an overarching level, the days represented an awareness campaign to rethink the role of cars while challenging the paradigm of car-centric cities. In the long term, the goal was to achieve a re-evaluation of urban spaces and travel patterns.

Active / in operation: **Since 2011**Innovation radar: **Transferred****Open Traffic, Malaysia***Regulation and policy*

* [44, 72]



Source: Pexels (Tom Fisk)

Open Traffic provides Malaysia's traffic management authorities and urban planners with access to an open dataset to better control traffic flows. In the long term, the aim is to use the data to reduce traffic flows and direct them more effectively.

The Open Traffic initiative is based on a data-sharing platform that aims to make available traffic information provided by Grab (a leading ride-hailing company) to eliminate traffic jams and improve traffic safety in the country's major cities. Anonymised traffic data are mapped to analyse congestion peaks and travel times.

Active / in operation: **Since 2016**Innovation radar: **Established****Traffic Monitoring, Johannesburg, South Africa***Regulation and policy*

* [73]



Source: Unsplash (Clodagh Da Paixao)

South Africa's population has grown by seven million people in the last ten years. This means that measures have to be taken to counteract traffic congestion which is also responsible for environmental pollution. This can be enabled on the basis of innovative traffic technology using artificial intelligence. In the context of a pilot project that analysed several vehicles between Johannesburg and Pretoria, it could be shown that traffic patterns could be generated by tracking data in real-time. These insights make it possible to direct traffic flows more effectively, for instance through smart traffic lights. Traffic can thereby be better directed and distributed. The data gathered are also valuable for measuring pollution levels to undertake preventative measures to improve air quality in cities and thereby contribute to a coordinated approach to traffic development in growing cities.

Active / in operation: **Since 2019**Innovation radar: **Introduced**

4.2. Best practices: an overview

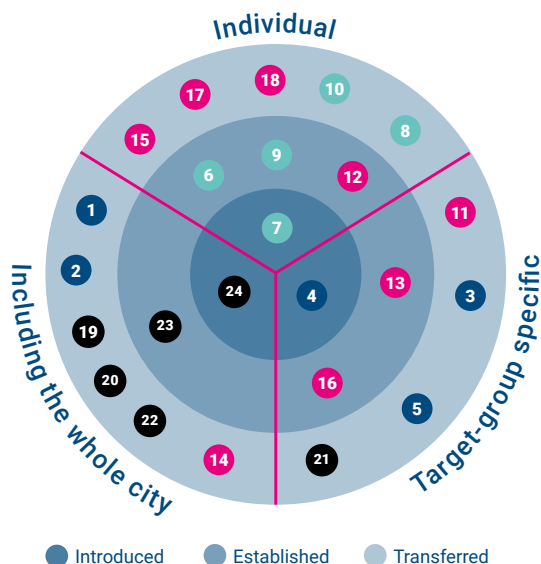
The innovation radar (Figure 7) gives an overview of all the best practices illustrated in Chapter 4.1. These are mapped according to the degree of innovation. The radar contains three groups with similar features as a typology:

- **Introduced:** projects at this level were implemented in 2019 or later and are highly novel.
- **Established:** Projects at this level were implemented before 2019 and have since been supplemented through further features or have been made available to more users by increasing their area of coverage.
- **Transferred:** This level maps projects implemented before 2019. These projects have also been transferred to other cities or other countries.

In this way, the radar reveals the paradox connotation of the best-practice approach, which both makes a claim of tried-and-tested functionality as well as displaying a high level of innovativeness. The innovation showcase thus depicts a diverse and broad range of solutions.

A further grouping is applied using the categories *whole city*, *target group specific* and *individual*. This makes use of an existing framework from the smart-city literature [74]. *Whole-city* best practices refers to large-scale infrastructure projects and shows how resources used by all citizens (e.g. public transport) are provided, used and managed. *Target-group-specific best practices* address selected urban residents, defined by area (e.g. district/suburb), demographic features or shared interests. *Individual best practices* offer user-specific solutions (e.g. apps), among other things by processing and using personal information. The colours used in the radar are used to assign the respective best practice to one of the four areas of action.

Figure 7 | Innovation radar for categorising best-practice examples



No.	Best practice	Place of implementation (year of introduction)
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(Area-)efficient mobility

1	Metro Bangkok subway network	Bangkok, Thailand (2004)
2	TransJakarta Bus Rapid Transit	Jakarta, Indonesia (2004)
3	Caracas Metrocable cableway system	Caracas, Venezuela (2010)
4	Traffic calming in La Magdalena	Quito, Ecuador (2020)
5	Quinto Centenario as bicycle infrastructure	Bogota, Colombia (2017)

Digitisation and data availability

6	Ma3route traffic monitoring app	Kenia (2012)
7	One Delhi All-in-One navigation app	Delhi, India (2022)
8	GoJek integrated traffic services	Indonesia (2010)
9	Gokada On-Demand motorbike taxi app	Nigeria (2018)
10	Whats3Words as an address system	Côte d'Ivoire (2016)

Accessible mobility

11	Women-Only transportation	Mexico City, Mexico (2002)
12	SafetiPin safety app	India (2013)
13	Women on Wheels safety campaign	Pakistan (2016)
14	Marrakech Safe City safety campaign	Marrakech, Morocco (2016)
15	SafeBoda mobility, delivery and payment app	Kenya (2014)
16	Escalator transport systems	Medellín, Colombia (2011)
17	EcoBici bike sharing	Mexico City, Mexico (2010)
18	M-Pesa-Service payment service	Kenya (2007)

Governance in urban mobility

19	Parking space management	Peking, China (2013)
20	Odd-even regulations for traffic management	Delhi, India (2016)
21	Panamá camina ass tactical urbanism	Panama City, Panama (2018)
22	Car Free Day awareness campaign	Indonesia (2001)
23	OpenTraffic, data sharing platform	Malaysia (2016)
24	Traffic Monitoring	Johannesburg, South Africa (2019)

4.3. Excursus: Best practices in industrialised countries, using Germany as an example

Industrialised countries also face several urban mobility challenges. In some areas, such as digitalisation or spatially efficient traffic infrastructure, urban stakeholders in industrialised countries are dealing with similar concepts and approaches as their emerging market peers. In the following, we describe some of the mobility-related challenges in industrialised countries, using Germany as an example.

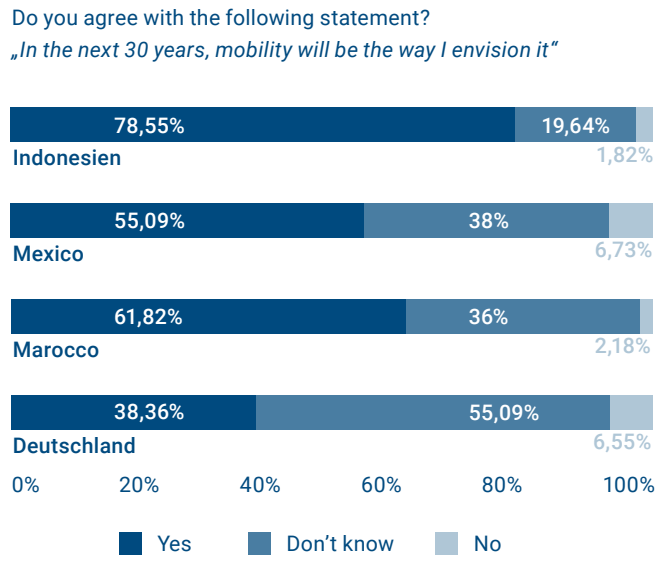
4.3.1. Urban mobility challenges in industrialised countries, using Germany as an example

In Germany, a paradigm change is underway at the city level that will have a significant impact. On the one hand, customised mobility is becoming increasingly important. But at the same time, the context within which mobility takes place is becoming increasingly complex [75]. It is being impacted by trends at the national level, including urbanisation, digitalisation, automation, electrification, and the demographic transition. Some parts of Germany's traffic infrastructure are no longer aligned with the needs of a growing urban population and mobility in a state of transition. Public transport in particular needs higher investment levels, as the user survey carried out in Germany shows. It clearly supports the statement about public transport. 52% of those surveyed in Germany see a need for action when it comes to bus connections, and 42% for train connections. In rural areas in particular, there is a clear demand for expanding public transport options. The user survey showed that respondents in Germany had a less optimistic view of the future. Almost 62% of those surveyed disagreed with the following statement: "In the next 30 years, mobility will be the way I envision it" or were unsure. This is significantly different from the focus countries, which showed high levels of optimism about the future (Figure 8). Reasons include poor connections in the countryside and being dependent on cars in rural areas.

Germany is also pursuing the policy objective of significantly reducing greenhouse gas emissions. But the German transportation sector has not managed to make any significant advances in recent decades because technological progress was negated by increasing traffic volumes. Sustainable mobility development concepts are becoming increasingly important in the context of high levels of traffic and air pollution in German cities. This includes concepts like the 15-minute city, by means of which traffic and commute volumes are reduced through urbanistic and structural changes.

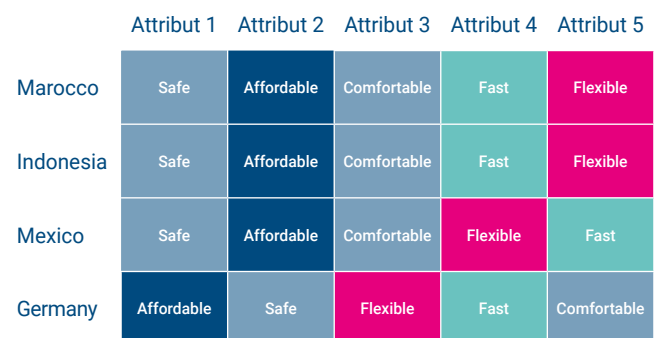
It is not disputed that innovation and larger technology advances play an important role in a broader transportation transition. The increasing degree of technologisation and digitalisation in mobility is, however, also causing reservations that may slow down or delay more significant progress. This is confirmed by the survey, which found the attribute "safe" to be one of the three top preferences in Germany (Figure 9). The

Figure 8 | Assessment of satisfaction with existing mobility solutions compared to Germany



attributes "affordable" and "flexible" are also among the preferred features of mobility. The former could have been driven by current events and increased price sensitivity in the population. The desired flexibility corresponds to increased individualisation and the wish to be able to use various mobility products in accordance with one's own particular needs and requirements. As the attribute "safe" could have a different connotation than in an emerging market is shown by current debates about IT systems in vehicles and in the area of traffic control, as well concerns about the supposedly greater risk of fire in the case of electric vehicles and worries about privacy.

Figure 9 | Preferred mobility attributes compared to Germany.



The five most commonly named mobility attributes, out of ten options.

Ultimately, Germany is facing the challenge of developing and establishing electro-mobility. Currently there are insufficient charging stations to satisfy the demand of growing numbers of electric cars. In rural areas especially, there are not enough charging stations [76].

4.3.2. Exchange of best practice examples as an opportunity for industrialised and emerging economies

The transfer of innovative solutions from emerging markets to industrialised economies is also referred to as reverse innovation or trickle-up innovation. Trickle-up innovation describes a process where innovations developed for the needs of emerging markets are subsequently adjusted and transferred to industrialised countries [77]. In this way, emerging markets can supply new solution approaches for other parts of the world and provide industrialised countries with opportunities for global learning. Related approaches, like “frugal innovation” and “good-enough innovation”, also deal with the transfer of knowledge and technology between industrialised and emerging economies. All these concepts construct value judgements and hierarchical systems of logic that are intentionally questioned in this study.

The identified areas of action supply some evidence of this. They also apply to industrialised countries like Germany and illustrate transparent development perspectives. Over-arching topics and challenges such as spatial availability, traffic-related environmental pollution or issues of access to mobility remain important factors in urban mobility – and this is true of cities throughout the world.

One example is the issue of land usage and land pressure in Germany. Increasing numbers of people are occupying more and more living space [78]. At the same time, land is in short supply in urban centres and there are very limited opportunities for new construction [79]. This leads to high demands on the future planning of necessary infrastructure. The best-practice examples presented offer approaches and solutions that may be applicable even when taking into consideration local conditions in Germany. They include urban cableways, like the system in Caracas, which have become an important element of public transport over the course of many years in various Latin American cities. Cableways are currently becoming increasingly politically relevant in Germany because of their efficient land use, their environmentally friendly nature and their low infrastructure requirements, and can usefully complement existing public transport systems [80]. At the same time, the comprehensive experience gained from previous international implementations makes technical execution easier.

In the area of the digitalisation of urban mobility, too, best-practice examples offer effective solution approaches which could also be applied in Germany. Apart from technological innovation themes, such as, for example, artificial intelligence or future-oriented transportation concepts like flying taxis, Germany is also facing far more basic challenges. These include vendor-neutral data availability and usage across modes of transport or the application of intelligent traffic systems. Digital applications enable solutions for addressing current urban mobility challenges. This becomes apparent, for example, in the form of the Open Traffic initiative in Malaysia, which is focused on making available data that can be used to improve traffic flows and analyse times of peak congestion. In this way, the best practices offer complementary approaches and represent experience values from which existing activities in Germany could also benefit.

Viewing urban mobility as a tool of transformation in Germany and Europe for achieving climate and sustainability objectives is linked to changes in transportation, infrastructure and social mobility structures. Temporary interventions and field tests are needed to encourage changes in mobility patterns, test their acceptance and analyse the effectiveness of new approaches. Tactical urbanism approaches from the best-practices catalogue can be used to raise awareness and shape narratives. In accordance with Germany’s future research and development strategy, these match efforts to implement the configuration of urban innovation and research spaces as well as field tests by means of transformation research [81].

In summary, the users’ view of Germany reveals a backlog in infrastructure investment and gaps in comprehensive public transport offerings, which stand in stark contrast to the country’s aspiration to play a leading role in technology and international innovation in mobility and transportation. Germany also has to deal with the issue that access and availability of mobility offerings are spatially unequally distributed. This observation, when paired with the desire for safe, affordable and flexible mobility, shows that mobility needs cannot be addressed through technological progress alone. Instead, the findings can also be interpreted as a policy mandate that includes suitable framework conditions for the use of, access to, and configuration of urban mobility systems. In this context, looking at international projects with an open – and sometimes humble – attitude can be helpful. Such projects should not be viewed as easily transferable blueprints, but their underlying solution principles and strategies can serve as orientation guides and a source of inspiration (see Chapter 5).

5. International transferability of innovative mobility approaches

“Every country has problems, and each thinks that its problems are unique to its place and time. [...] However, problems that are unique to one country [...] are abnormal. [...] Confronted with a common problem, policy makers in cities, regional governments and nations can learn from how their counterparts elsewhere respond. More than that, it raises the possibility that policy makers can draw lessons that will help them deal better with their own problems.” ^[82]

Learning from successful examples and understanding how urban mobility can be designed in a way that is future-proof and efficient represents an enormous advantage for cities. The social implications highlighted in preceding articles in particular highlight the special role mobility plays in the context of urban and regional development. Mobility and urban planning often occur in lockstep and are closely linked. The rapid growth in the number of cars over the past century, for instance, meant that urban infrastructure adapted to accommodate this new technology. Because of the tightly interwoven interactions, there is a high degree of interest in transferring urban mobility solutions, and many of the parties involved in policy design, planning and implementation are on the lookout for innovative mobility concepts. This means that urban mobility policy has become a core element of policy transfer ^[83].

In recent years in particular, strong pressure is being felt to achieve sustainability and innovation transitions in the mobility sector in urban environments the world over. Similarly, the demand for effective, innovative and sustainable solutions which can serve as examples for address urban traffic problems has increased ^[59]. Disseminating such best practices is considered essential as their role model character can help trigger systemic changes ^[26]. The principle is that urban spaces are unique, but that the challenges they are facing are similar. This also applies to possible solutions ^[1].

“The basic problem of transportation is always the same.”

(Achmad Zacky Ambadar, GIZ Project Manager, Indonesia)

The best practice idea assumes that the subject matter is or should be transferable. Solutions developed in the context of one project are replicated in a different context, e.g. in a different organisation, another suburb or a different city

entirely ^[84]. The aim is not to reinvent the wheel, but to save costs and effort by leveraging existing experience and insights ^[24]. Replication is the result of successful scaling.

“Let's say cities or in some government, they are really willing to have an exchange with everyone here, globally, not only with the neighbouring country or neighbouring cities”

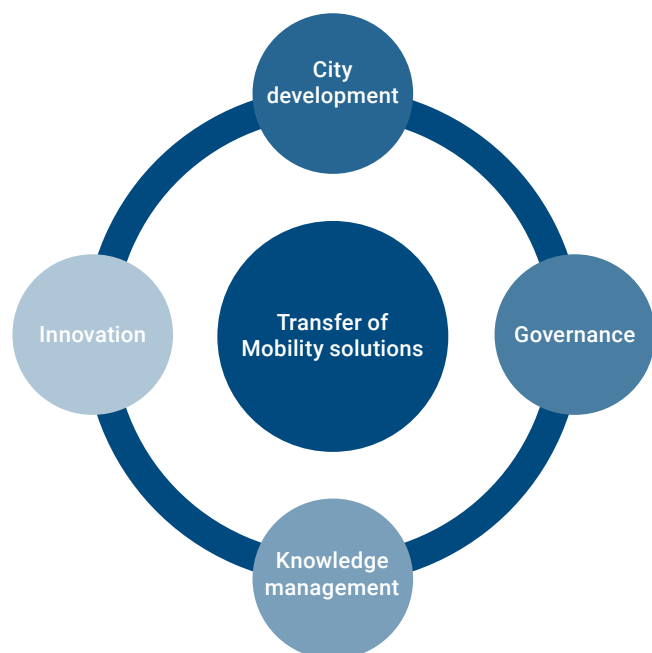
(Marco Martínez O'Daly, expert on Mexico and Central America)

5.1. From good examples to successful transfers

In urban and innovation research, replication is seen as part of the overall scaling process that describes the diffusion and implementation of urban offerings, services and technologies. Replication is the third step following on from piloting and expansion ^[84]. In general, scalability refers to the fundamental applicability of a functional logic, despite changes in the spatial area of application or the overarching framework conditions. Replication thus describes transferring a functional logic to a different place by exchanging information, ideas, experience and technical solutions ^[85]. In the following, the term “transfer” will be used instead of “replication” because it is more intuitive and requires less explanation.

Transferring urban innovations is subject to a range of influences that highlight the complexity of the topic and the need to analyse it in detail. Both in theory and operational practice, scaling and transfer refer to disciplines such as knowledge management, governance, innovation and urban development ^[86].

Knowledge management represents one of the key strategies for improving urban systems because the effectiveness of urban planning initiatives depends significantly on individual and collective knowledge ^[87]. In its interaction with the governance perspective, knowledge management supports addressing socio-urban needs, for instance by clarifying the environmental impact of cities and applying suitable policy, town planning and urban development measures ^[88]. The innovation perspective refers to creating conducive framework conditions which favour the establishment of new approaches while emphasising the needs of residents and other stakeholders. The influence of urban development and of the smart city domain are reflected in a problem solution approaches based on alternative spatial and technological approaches ^[86]. Figure 9 shows the areas impacting the transfer process.

Figure 10 | Impact on scaling and transfer by ... ^[86]

Transfer activities between cities are not limited to certain countries, regions or larger geographic spaces. Nonetheless, networks and structures have emerged at all levels for this very purpose. In Europe in particular, the exchange between cities was institutionally anchored in recent years by means of support programmes and innovation policy initiatives.

The European Commission funded sustainable urban mobility projects that proved successful in selected flagship cities and which were intended to be copied by so-called follower cities subsequently ^[89]. But innovative mobility solutions are also gaining in importance beyond Europe's borders. Global associations like the C40 network, which brings together city leaders from about 100 large cities and addresses questions including inner-city goods transport and people transit, serve as global think tanks and platforms for collective learning. There are also networks with a stronger geographical focus, such as the ASEAN Smart City Network ^[90].

“Because sometimes if we are only in Southeast Asia, the improvement is so limited.”

(Faela Sufa, expert on Indonesia)

Independent of their size and area of coverage, such international networks help create new relationships and interactions that produce increasing mutual benefits. Urban problems are addressed through plans, programmes and strategies that have been shown to work elsewhere ^[91]. All these initiatives involve global stakeholders ranging from consultants and subject-matter experts to think tanks and representatives from public bodies, municipal administrations and town councils. Representatives from emerging and industrialised countries

are able to contribute inspiring examples and best practices on an equal footing. Newly emerging mobility solutions and knowledge from different jurisdictions represent hold considerable potential not just within the country of origin, but also beyond its borders ^[91].

“[...] so I think the transferability [...] throughout the world is not only possible, but it's necessary”

(Marco Martínez O'Daly, expert on Mexico and Central America)

5.2. Challenges in transferring innovative solutions

Mobility best practices are not universally applicable, but depend on geographic, socio-economic, historical and cultural factors ^[92]. While exchanging ideas and knowledge about applicable solutions between cities is indisputably useful, the way in which transfers happen is still vague and contested ^[93, 94]. The complexity of urban systems creates various barriers that limit the comparability and transferability of established practices ^[95].

Transferring technologies, products, practices and concepts represents a normative and policy objective. At the same time, transfers can also be commercially motivated, for example to expand the area of coverage of an existing business model. In both cases, the desire to make efficient use of financial resources is apparent. But independent of the underlying motivation, the sole aspiration should not be to replicate the solution because the actual aim is to transfer the desired impact. This means that the solution has to be customised.

A core challenge is adapting it to local resources, circumstances and framework conditions ^[84, 93]. Contrasts in local requirements, regulations and cultural values as well as partner and stakeholder networks are par for the course ^[84, 93, 96, 97]. In mobility in particular, spatial and infrastructural differences are highly noticeable ^[75]. Municipal agencies often lack the resources and skills needed for a successful transfer of solutions. This leads to the involvement of private-sector partners, which may result in long-term relationships of dependency ^[96].

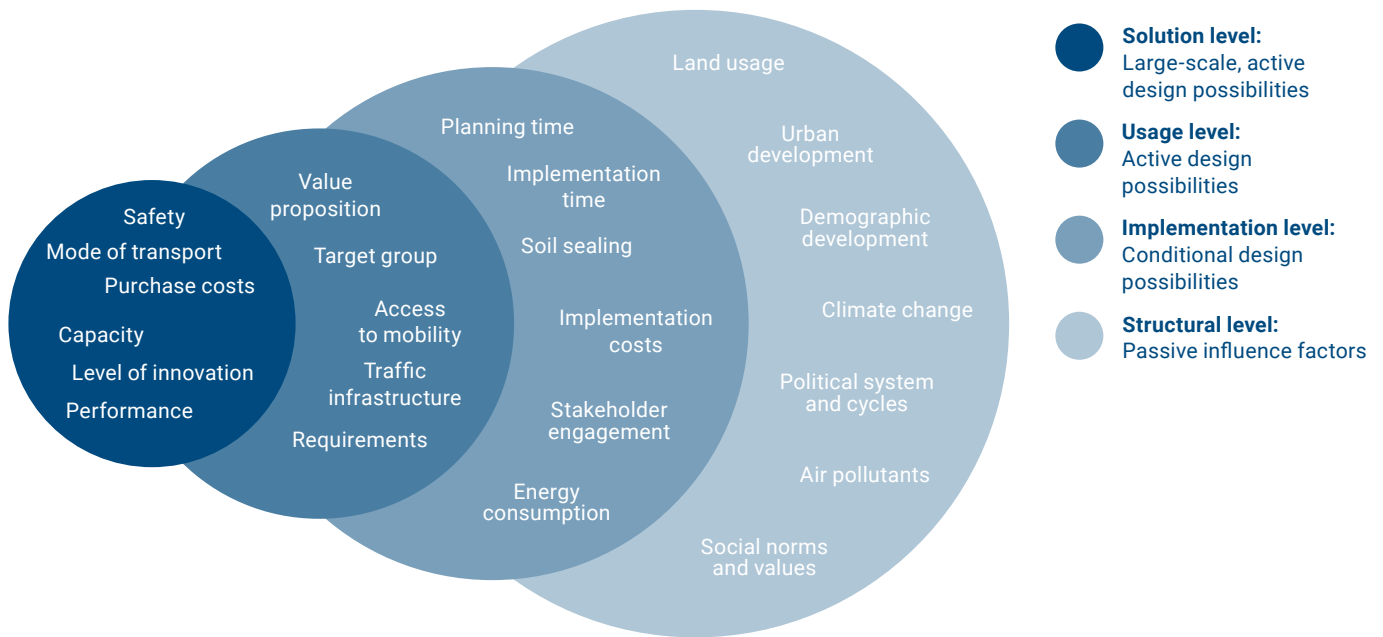
The original reason for transferring best practices is to make available knowledge and information enabling the transfer of tested, successful solutions. In practice, the learning process is often more important than the result. It is often overlooked that the problems encountered in implementing the project – for instance, obstacles and setbacks – provide valuable information. Sometimes this information is even more valuable than knowing the actual success factors. But such information is often implicit, making it difficult to capture and transfer systematically ^[84, 87].

Political values, preferences and interests also play a critical role in decisions about transferring proven practice. These can also turn into challenges because they can vary with political cycles, making binding planning more difficult ^[93]. This makes it even more important to embed projects in

longer-term and larger strategic visions [98, 99]. Such visions can help bridge the gap between first-time implementation and longer-term anchoring [84, 100]. Alignment with existing requirements and taking into account the reservations of citizens is equally important. Involving different interest groups and enabling their participation promotes acceptance and enables replication [95].

However, the scope for individual action in the transfer process remains limited. Figure 10 shows influence factors and scopes for action that decrease as projects become more embedded in social and political structures. This also confirms the need for interdisciplinary cooperation to connect technological competence, the understanding of problems and solutions, political will and the ability to coordinate.

Figure 11 | Design and impact criteria regarding the transferability of mobility solutions



5.3. Transfer principles and tools

The preceding partial chapters illustrate the various aspects of transferring projects and solutions in international urban and mobility development. The interviews with experts in the focus countries confirm the validity of the scientific discourse for Morocco, Indonesia and Mexico. The analysis of the qualitative data also reveals individual impulses that can be used to support transfer and mutual learning. In the following, they are summarised as transfer principles and tools. They describe approaches relating to collaborative cooperation, networking, and the configuration of operational processes:

I. Cooperative planning and execution of transformation projects

Cooperation between cities at the project level provides access to technologies and know-how. Municipalities in particular benefit from partnerships with peers who have already implemented similar projects successfully. Training, exchange and mentoring programmes assist in effective implementation. Similarly, involving trusted technology partners and vendors from the partner city boosts the chances that transfers will be successful.

“This is why the exchange programs are so beneficial because this helps them both identify things that are working pragmatically and financially for other cities. But also identify the ones that are not working.”

(Faela Sufa, expert on Indonesia)

II. Making use of exchange programmes and formats

Cities are very interested in learning from each other. Opportunities for formal and informal exchange and personal networking (e.g. networks, conferences) assist in the transfer of innovative solutions. Often, what makes transfers work – apart from systematic and formalised processes – is the relevant involvement and coordination of individuals.

III. Strengthening bottom-up transfers by raising awareness

Transfer processes should be initiated not only at the level of administrations and governments. Civil society involvement or entrepreneurial thinking can also trigger urban

mobility change processes at the individual or collective level. For this to work, civic engagement has to be incentivised, opportunities to participate have to be promoted, and an awareness should be created of urban mobility problems and spaces for engagement.

“This was a great learning lesson for us [...] the learning lesson for us is that these things cannot be changed from the top down. These things will only be changed through the exchange of success stories, and that’s what we’re finding with all these cities.”

(Marco Martínez O’Daly, expert on Mexico and Central America)

IV. Understanding transfers as a process of innovation

Applying established solutions in a new context can also be a form of innovation. The uniqueness of cities always means that requirements differ, so existing concepts inevitably have to be recombined and combined in new ways. Understanding transfer projects as a form of innovation means choosing openness, an iterative approach and a strong orientation on local citizen needs. The transfer should be seen as a learning process rather than a formalised moving across of knowledge and technologies. In emerging markets in particular, this provides leap-frogging opportunities. In other words, it may be possible to skip certain stages of development and process steps.

V. Looking for similar partners and role models

Transfer projects are easier to complete in the context of similar administrative and governance structures. Such contexts are typically found in nearby countries, countries with comparable cultural influences, or countries with similar political systems. Furthermore, many emerging markets are economically closely linked to industrialised economies that share some of these features (e.g. Mexico and the USA, Morocco and France). But even outside of these dominant market dynamics, there are transfer pathways and learning opportunities for emerging markets.

“Also the transfer is like to try to find a system that is close as it is to your own system. For example, if the city says [...] I financed my public transport with 90% from the taxes that comes from the region and this is [...] a fiscal tool that is not put in place [...] in your own country, it’s going to be difficult to have any knowledge transfer because everything is based on some-thing that cannot be replicated.”

(Kawtar Benabdelaziz, GIZ Project Manager Morocco)

VI. Choosing international mobility sponsors as trendsetters

Many rapidly growing economies display a high level of heterogeneity in their urbanistic and social structures (demographically, infrastructurally, topographically, economically). Consequently, suitable projects and ideas can often be found beyond a country’s borders. International cooperation, city partnerships and overarching projects help build trust and understanding.

“Town twinning. [...] Partnership between towns and cities that show that it works. They had the exchange of expertise from the city to city.”

(Kawtar Benabdelaziz, GIZ Project Manager Morocco)

VII. Strengthening networks between emerging markets

There are many networks and associations of cities and municipalities at the international level, which provide partners from industrialised and emerging economies with opportunities to engage and collaborate. To date, representatives from municipalities and institutions in emerging markets have rarely initiated or led such offerings. This could become more common in future as emerging markets aim to promote their own perspectives and interests more effectively in the international discourse.

The principles and tools of transfer describe overarching opportunities to improve international collaboration and cooperation at the policy, institutional and economic level. It requires concrete operationalisation in the form of projects and initiatives. One thing all the options described above share in common is their time horizon. Long-term relationships built on trust are a critical ingredient enabling effective exchange and learning.

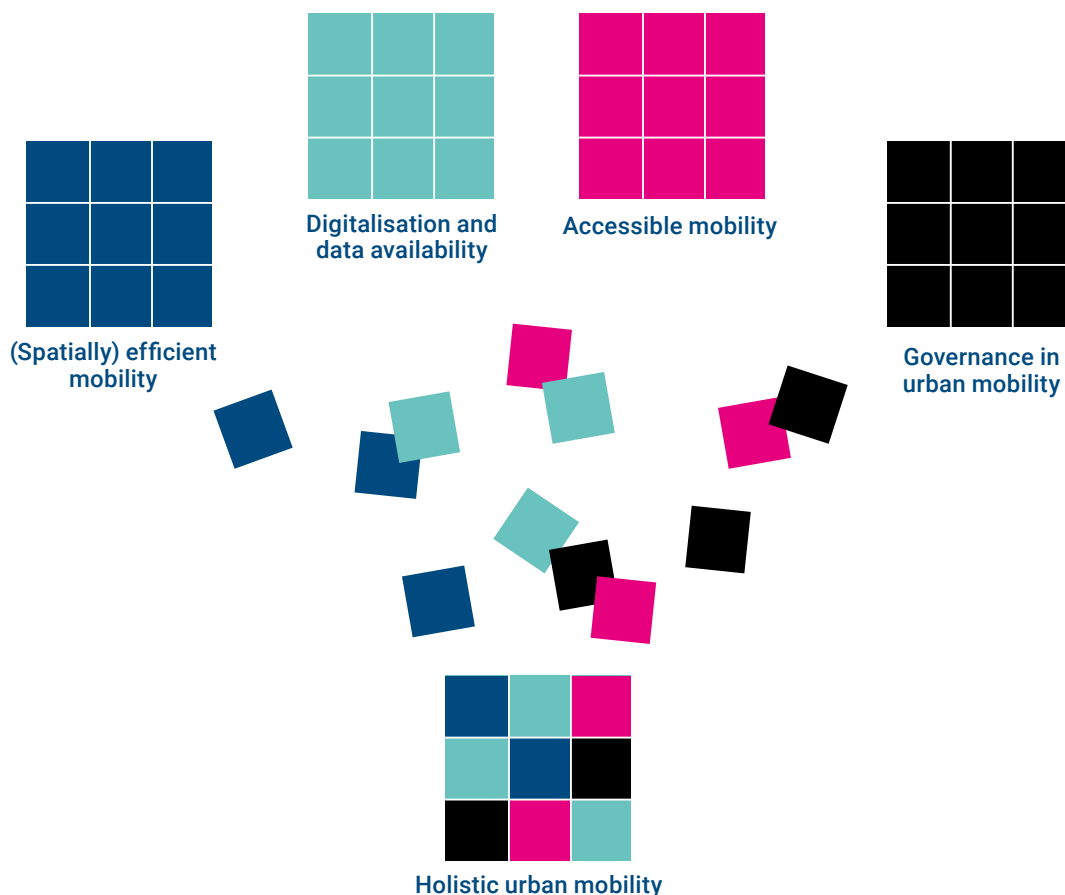
6. Conclusion and outlook

Current debates in industrialised countries – on issues like the drive system transition or the introduction of autonomous vehicles – illustrate how the public discourse on mobility is dominated by developments in technology. The non-technological aspects that often determine acceptance and application are in many cases ignored. The technology-focused view of progress makes it easy to overlook that the large-scale introduction of existing solutions can trigger even greater societal changes than introducing a radical innovation for the first time. Successfully implementing known and sensible approaches – instead of introducing high-tech products – can have a direct and positive impact on the daily reality of large sections of an urban population. Urban mobility in emerging markets illustrates this phenomenon particularly clearly. Large cities in emerging markets have to catch up with industrialised countries in a globally competitive environment both in terms of their infrastructure and their technologies. At the same time, they face considerable and fundamental challenges in providing reliable mobility options. This is plainly visible in daily urban traffic patterns, where in extreme cases autonomous electric vehicles share the road with lightly motorised tuk-tuks.

These conditions highlight the need for action and illustrate the impact of the initial research question regarding the evolution of urban mobility in emerging economies. In the context of this study, we began by creating an understanding of the issue (*Chapter 2*). We then identified existing needs (*Chapter 3*) and possible solutions (*Chapter 4*). We concluded with an overview of the principles and tools that should be considered when transferring solutions and promoting exchange, especially between emerging markets (*Chapter 5*).

Urban mobility systems, faced with complex challenges and pressing needs, have to meet a broad range of requirements. We therefore chose a methodological mix that considered the user perspective, the current scientific discourse, and the views of mobility planners and vendors, as assessed by means of expert interviews. The user survey made an important contribution in helping to understand the issues and describes pre-vailing affinities and expectations that must be considered in mobility management and urban development. In the focus countries, users emphasised that mobility must be safe, affordable, and comfortable. In Mexico, Morocco and Indonesia, survey respondents displayed a high

Figure 12 | Components of holistic urban mobility in emerging markets



degree of confidence that current deficits would be addressed in accordance with their expectations. Apart from satisfying individual requirements, mobility planning will have to be compatible with overarching policy goals such as improving environmental compatibility.

The innovation showcases served to illustrate approaches that address these various aspects in concrete terms. Four areas of action were identified in the context of the study: *digitalisation and data availability*; *governance in urban mobility*; *accessible mobility*; and *(spatially) efficient mobility*. In practice, implementation requires individual combinations and weightings of these best-practice approaches, which together provide the components of urban traffic management and mobility planning (see *Figure 12*).

The examples highlighted in the innovation showcases serve to trigger thought processes and provide inspiration for new action spaces and perspectives. They provide a way to communicate, illustrate and legitimate change projects. Using best practices productively means distilling, combining and contextualising projects.

This can only be done by enabling far-reaching formal, informal and institutional exchanges between relevant stakeholders and knowledge bearers. Obvious short-cuts or simple blueprints are never sufficient. It always takes individual transfer pathways and strategies that can contribute to a knowledge-intensive, flexible and robust process. Overarching orientation guidelines are summarised in *Chapter 5*.

Despite the existing dynamism and often pressing need for action in the countries included in the review, foresight, patience and persistence are required. This is also confirmed by looking at the innovation radar (*Figure 6*), which shows that innovation diffusion processes across multiple emerging markets can take several years.

This study of the three focus countries does not allow generalised conclusions to be drawn about the very heterogeneous and large group of rising nations. Instead, it should be seen as a starting point and an invitation to take a closer look at further cities and regions. Analysing the respective mobility situations reveals many structural challenges (e.g. safety, reliable infrastructure, high costs) that are apparent in personal mobility, but require the causes to be effectively addressed elsewhere.

New technologies and research-intensive development concepts will be needed to make cities and urban spaces liveable and future-proof. The findings presented here do not contradict this premise in any way. Instead, it focuses on the broad nature of the innovation concept. Ultimately, innovation is measured by societal progress rather than the use of new tools. The study can therefore be seen as a plea for intense engagement with a broad-based and international diffusion of solutions and technologies. The focus countries covered in this study show that there is no lack of understanding or solutions, but rather a deficit in implementation. Future implementation paths will therefore have to break away from existing narratives and logics that are one-dimensional in limiting themselves to trickle-down hierarchies.

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