UITP ADVANCING PUBLIC TRANSPORT

KNOWLEDGE BRIEF

PERFORMANCE OF INDIAN METRO SYSTEMS: LESSONS FOR UPCOMING URBAN RAIL PROJECTS

NOVEMBER | 2021

INTRODUCTION

India's development and operations of existing metro rail systems provide valuable insights towards improving upcoming systems' planning and investments. The Government of India (GoI) continued financial support over the past two decades, and the Metro Rail Policy formulated in 2017[1], led to the development of a wide range of rail-based mass transport systems across the country.

Today, India has metro rail, suburban rail and monorail. Amongst these, metro rail systems witnessed the fastest growth, from network length of 222km in three cities in 2011 to 697km in 13 cities by 2021. Approved additional metro rail network of 1,032km will expand the reach of metro systems up to 27 cities[2]. In addition, lighter urban rail systems such as Metrolite and Metro Neo are being conceptualised and developed by many small- and medium-sized cities. The approved metro rail projects have a projected expenditure of INR 3 trillion ($40.4bn, €31.2bn)[3] over the next five years, including equity investments by central and state governments and financing from other developmental and commercial financing entities[4].

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This Knowledge Brief presents the operational and financial performance of existing metro rail systems in four metropolitan cities with the longest approved metro network in India-Delhi, Mumbai, Bengaluru and Chennai. These cities provide a representative case study of metro systems in India, both existing and upcoming.

For more details on the case cities and the methodology used in the paper, please refer to the annexe, 'Methodology: Performance of Indian Metro Rail Systems'.

1 Background and context further explained here
2 Ministry of Housing and Urban Affairs, 2021. *Annual Report 2020-21*. Government of India
3 Conversion Rate: 1 USD= 74.2 INR; 1 EUR = 87.8 INR
4 Rawat, 2019. *Rs 3-trillion metro rail projects proposed for the next five years*. Business Standard News.

A BACKGROUND ON METROS

Metros are amongst the most critical, complex and valuable infrastructures for cities to perform successfully in the global competition to attract people, talent and business. With their large trains and short headways, metros offer more than 60,000 passengers per hour per direction (pphpd) and are ideally suited for the most heavily used transport corridors[5]. Metros are the pulsing arteries of bustling cities.

They deliver high economic, social and environmental value through a set of unrivalled positive externalities. The benefits are incommensurable and recurrent not over years or decades, but over generations.

METROS ARE:

A stress-saver: Legible and easy to understand routes, high frequency, high reliability and travel time predictability offer passengers quality time to themselves.

A life-style marker: Metros provide a real alternative to unsustainable modes. For a similar level of service, urban rail attracts up to 20% additional passengers in comparison to other modes. Metros contribute to high quality placemaking and stations are seen as an integral part of urban life[6].

A strong enabler of economic development: Good and reliable metro services support efficient economies. The 50 largest metropolitan areas by GDP in the world are all supported by urban rail systems – 76% have metros. Metros support the concentration of people and ideas that spark innovation and urban economies and reduce traffic congestion. In addition to the accessibility and connectivity benefits, socio-economic research in the past decade has identified a series of so-called wider economic benefits such as the agglomeration effect that provides additional justification for high investment requirements[7].

A space (re)creator: Space is a precious commodity in dense metropolitan areas. With very limited space requirements, metros are the most space-efficient transport system. In addition, dense and high-rise development (retail, office, housing) above and around metro stations allows for additional space, value and convenience in dense areas, thereby contributing significantly to high quality of urban environment and life.

A confidence-building location factor and a land value booster: Metros are a permanent infrastructure that signals a strong commitment of decision makers to sustainable mobility and spatial accessibility for customers, visitors and employees. They offer strong investment opportunities. Numerous studies also demonstrate that businesses and real-estate within the vicinity of metros are universally seen as a premium location[8].

A competitive edge to attract talents: Of the various measures available to employers to attract talents, convenient accessibility and fast commutes are key.

CHALLENGES

In addition to the many benefits, it must be recognised that implementing metro systems is complex and presents challenges:

High capital intensity: Besides initial construction investment in greenfield projects, maintaining their value and functionality along the full lifecycle, by proactive asset management. A sound and robust economic and business model needs proper consideration to deploy its full benefits.

A long-term planning process: In built-up mature cities, it is not rare to see 10-20 years elapse between the emergence of the first idea to the opening of a line. This long time to market requires political stability and continued efforts to generate a high level of convergence and consensus among stakeholders.

Economic benefits including economic growth, increasing land value, reducing travel stress, lifestyle aspects, competitive edge and efficient usage of land resources and many other intangible benefits are not covered in this Knowledge Brief however are exceptionally important for a city.

5 UITP, 2019. *Metros: The Backbone of Mobile Communities and Sustainable Cities*. Knowledge Brief. 6 UITP, 2009. *Assessing the benefits of public transport*. Position Paper.
7 UITP, 2009 8 UITP, 2019. *The value of public transport: How to implement land value capture*. Policy Brief.

PERFORMANCE ANALYSIS OF INDIAN METRO SYSTEMS

The performance of selected Indian metro systems is benchmarked against the performance of global leaders such as London, Singapore and Hong Kong on specific indicators to identify potential areas of improvement.

The operational performance indicators used are:

- Daily ridership
- Daily ridership per km network
- The comparison between the actual ridership achieved and initial projected ridership

The financial performance indicators used are:

- Total project cost
- Cost per km of network
- Revenue realised, split by source of revenue and revenue recovery ratio

Furthermore, two alternative scenarios were analysed to evaluate the financial performance in case the originally-projected ridership was achieved, and the revenue needed to achieve financial breakeven.

The performance analysis has been carried out for three years preceding the COVID-19 pandemic, in full scale economic activities, services and travel demands scenario. Table 1 compares the network lengths and average daily ridership for the case cities for the financial years (FY) 2017-18, 2018-19 and 2019-20. The per-capita network connectivity of the Indian metro systems is much lower compared to the international counterparts, partly due to the higher population base of Indian cities and nascent stage of networks outside Delhi.

Table 1: Overview of Metro network length and population coverage for case cities

CITY	POPULATION (MILLION)			NETWORK LENGTH (KM)			NETWORK PER MILLION PEOPLE (KM)
	2018	2019	2020	FY'18	FY'19	FY'20	FY'20
Delhi	28.5	29.4	30.3	252	344	389	12.8
Mumbai	20	20.2	20.4	11	11	11	0.5
Bangalore	11.4	11.9	12.3	42	42	42	3.4
Chennai	10.5	10.7	10.97	34	45	45	4.1
London	9.1	9.2	9.3	436			46.9
Hong Kong	7.4	7.5	7.6	187	187	194	25.5
Singapore	5.8	5.9	5.9	232 (137*)			39.7

* Network Length for Singapore Mass Rapid Transit (SMRT)

RIDERSHIP ANALYSIS

Table 2 provides the average daily ridership for the Indian case cities and the global benchmarks. Delhi has the highest daily ridership among Indian and international peers by FY'20 and has reported doubling of its ridership over the past three years. The remaining Indian metro systems have significantly lower ridership due to their limited network coverage.

Part of the increase in Delhi Metro's ridership is attributed to addition of new lines. Delhi Metro moved from counting ridership through the entire trip from origin to destination, to counting passenger journeys wherein journey on separate metro lines are counted separate journeys e.g. a passenger travelling over three lines in one trip is counted as three passenger journeys. Therefore, Delhi reports a 55% higher ridership than London that has similar network length but counts the entire journey as a trip.

Table 2: Average daily ridership of the metro systems (millions)[9]

NAME OF THE CITY	FY'18	FY'19	FY'20
Delhi*	2.54	4.03	5.70
Mumbai	0.38	0.34	0.45
Bangalore	0.31	0.34	0.40
Chennai	0.02	0.08	0.12
London	4.05	4.13	3.98
Hong Kong	4.50	4.60	3.89
Singapore (SMRT)	2.10	2.06	2.07

*Includes total number of boardings on all lines

9 Indian financial year: April to March; (FY'20 is April 2019 to March 2020)

Figure 1: Ridership per day per km (2019-20)

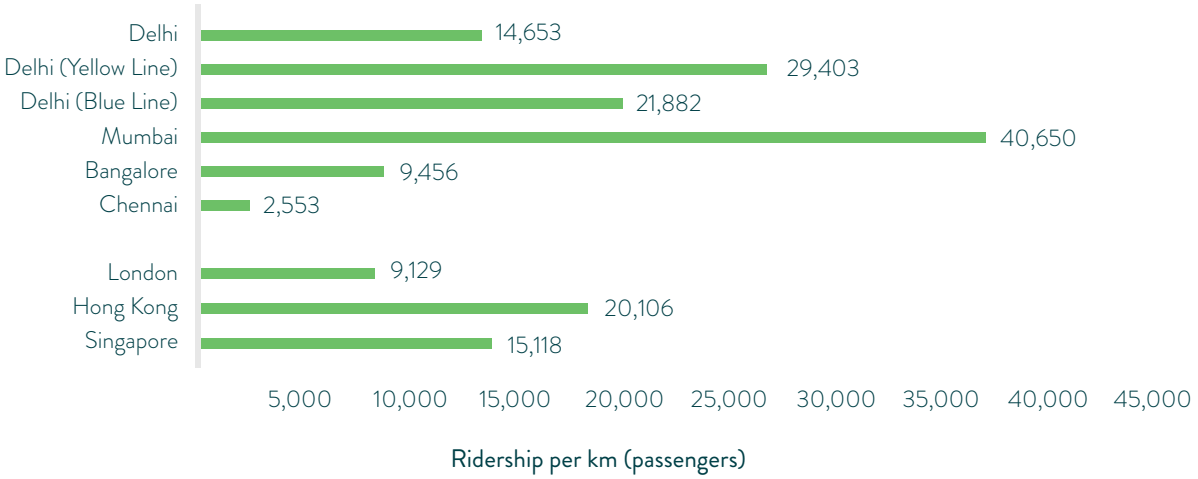


Figure 1 shows the average daily ridership per km of the networks, comparing their ridership intensity. Amongst international peers, Hong Kong has the highest ridership per km. Mumbai Metro carries approximately 40,000 people per km, which is the highest among the four cities[10]. Delhi Metro carries approximately 14,000 people per km with demand concentrated on two out of its nine lines, i.e., the blue and yellow lines constitute around 30% network length and 60% ridership of the system[11].

Ridership: Projection versus Actuals

Despite having ridership per km similar to international peers, the absolute ridership achieved by Indian metro systems is much lower than their originally projected ridership at planning phase. Table 3 presents a summary of the comparison between projected and actual ridership realised for the four Indian metro systems. Delhi metro achieved only 38% of its projected ridership until FY'18 but increased to 79% by FY'20 due to changes in the counting methodology. Mumbai Metro One achieved 74% of its projected numbers by 2019, while Bangalore and Chennai achieved just 27% and 13% of their ridership targets respectively.

Other metro rail projects in India, which are not analysed in the current paper, have also reported similar trends of not meeting their projected ridership. For example, Lucknow (22.9km) achieved just 8.6% of its projected ridership, Kochi (25km) achieved 14.5%, Hyderabad (67km) 15.2% and Jaipur (12km) achieved 7.6% of the forecasted ridership numbers.

Table 3: Projected versus Actual metro ridership

	PROJECTED DAILY RIDERSHIP (MILLION)			AVERAGE DAILY RIDERSHIP (MILLION)			RIDERSHIP ACHIEVED		
	FY'18	FY'19	FY'20	FY'18	FY'19	FY'20	FY'18	FY'19	FY'20
Delhi	6.8	7.0	7.2	2.5	4.0	5.7	38%	58%	79%
Mumbai	0.6	0.6	0.6	0.4	0.3	0.5	68%	57%	74%
Bangalore	1.3	1.4	1.5	0.3	0.3	0.4	24%	24%	27%
Chennai	0.8	0.9	0.9	0.02	0.1	0.1	3%	9%	13%

Source: Detailed Project Reports and Annual Reports for Metro Corporations

Future metro projects under various stages can learn from existing metro rail projects and develop more realistic demand and financial projections.

Delhi Metro had achieved 32% of planning phase projected ridership and 79% of projections of 2011, and it conducted revisions again based on actual ridership. Table 4 summarises the successive revisions in ridership projections.

10 Sanjai, 2014. *Mumbai Metro services to start on Sunday amid tariff dispute*. Mint.
11 Prasad, 2019. *Delhi Metro Blue, yellow lines form 60% of total ridership! Know which lines record highest, lowest ridership*. Financial Express.

Table 4: Delhi Metro's revisions to projected ridership based on actual ridership (millions)

HORIZON YEAR FOR PROJECTIONS	INITIAL PROJECTIONS (1995 & 2004)	REVISED PROJECTION (2006)	REVISED PROJECTION (2006 & 2011)	REVISED PROJECTION (2011)	REVISED PROJECTION (2018)
YEAR	PHASE I+II	PHASE I+II	PHASE I+II+II	PHASE I+II+II	PHASE I+II+II
Projections for 2021	15.7	5.4	7.2	9.5	4.1
Ridership achieved FY'20 (Phase I+II+III)[12]	5.7				
Ridership achieved	36%	105%	79%	60%	139%

FINANCIAL ANALYSIS

The financial analysis of the metros is carried out from the perspective of their costs and revenues separately and overall financial performance benchmarked against the international peers.

Cost analysis of Indian metro systems

A key reason for lower metro network development in Indian cities is the high capital cost. Costs are dependent on land acquisition, share of underground network and many other aspects. Table 5 presents the total cost and cost per km for the development of the four metro systems. When comparing Bangalore and Chennai, we see that costs can be lower despite having a higher underground share of the network.

Mumbai Metro One has the highest cost per km, at INR 390 crore[13] per km ($53m, €44m), possibly due to the higher land acquisition costs in Mumbai. The Mumbai cost per km is closely followed by the Bangalore's at INR 327 crore per km ($44m, €37m), while Chennai has reported a cost of INR 259 crore per km ($35m, €29m). Delhi Metro has the least cost per km at INR 181 crore per km ($24m, €21m) across all its phases. The costs of successive phases of Delhi Metro given in Table 4 show a significant escalation in costs per km for phase 3, possibly due to higher land acquisition costs and overall cost inflation of materials and labour. Overall project costs of the metro systems have increased by 77% over the past decade. These trends provide a good benchmark for cities planning to increase their network lengths and new cities initiating rail projects.

Table 5: Cost of building metro rail systems in India

CITY	UNDERGROUND NETWORK LENGTH (KM)	UNDERGROUND NETWORK SHARE	ELEVATED NETWORK LENGTH (KM)	ELEVATED NETWORK SHARE	PROJECT COST (INR CRORE)	COST PER KM (INR CRORE)
Delhi (Total)	89.1	25%	263.4	75%	70,433	181
Delhi Phase 1	13.2	20%	51.9	80%	10,571	162
Delhi Phase 2	34.9	28%	90.0	72%	18,783	150
Delhi Phase 3	41.0	25%	121.5	75%	41,079	253
Mumbai	-	-	11.1	100%	4,321	389
Bangalore	8.8	21%	33.5	79%	13,845	327
Chennai	24.8	55%	20.3	45%	11,667	259

Revenue analysis of Indian metro systems

Table 6 presents the share of operational and other revenue of the Indian metro systems compared with the international benchmark cities for FY 2019-20 (except for SMRT for which data is only available for 2015-16). Further, the farebox and non-farebox revenue such as rental and advertisement split within operational revenue is also included. Other revenue includes deferred income such as monetary grants towards capital expenditure, revenue from sale of scraps, interest income from deposits and advances, sale of tender documents among others.

12 Hindustan Times, 2021. *Average daily ridership of Delhi Metro at 10 lakh, down from 57 lakh pre-lockdown.*
13 1 Crore = 10 million

Table 6: Revenue distribution in Financial Year 2020

CITY	OPERATIONAL REVENUE			OTHER REVENUE	TOTAL
	TOTAL OPERATIONAL REVENUE	FAREBOX REVENUE	NON-FAREBOX REVENUE	OTHER REVENUE	
Delhi	85%	48%	37%	15%	100%
Mumbai	103%	89%	14%	-3%	100%
Bangalore	88%	79%	9%	12%	100%
Chennai	58%	42%	16%	42%	100%
Transport for London	63%	52%	11%	37%	100%
MTR Hong Kong (FY'19)*	88%	32%	56%	12%	100%
SMRT Singapore (FY'16)	99.7%	71%	28%	0.3%	100%

*Calendar year 2019

Except for Chennai, the revenue of Indian metro systems is dominated by operational revenue. Within operational revenue, farebox revenue constitutes high share in all the cities. The citywide analysis of revenue patterns is as follows:

Delhi's passenger fare revenue amounts to only 48% whereas 37% comes from other non-farebox sources such as feeder bus, rental, revenue from real estate, consultancy, and other projects. The remaining 15% was recovered through non-operational revenue. including the interests, deferred income, training and recruitment, sale of scraps etc.

Unlike Delhi, **Mumbai Metro One** has 89% of passenger fare revenue making the system prone to high losses due to service closure during the COVID-19 pandemic. Rental income, advertisement revenue, and others non-operating income account for remaining 11%[14].

Bangalore has 79% passenger fare revenue share. Non-farebox revenue such as rental and advertisement form only 9%, making it lowest amongst the four cities.

The **Chennai metro** rail has the lowest farebox revenue share of the four cities, at 42% while the 16% of its operational revenue comes from feeder services and property development income. Low operational revenue proportion can be attributed to high share of grants received from GoI and Government of Tamil Nadu, worth 26% of the total revenue. These grants are provided with an interest rate below the current applicable market rate and are classified under deferred income.

As compared to Bangalore, Mumbai and Chennai having non-farebox revenue percentage as 6%, 14% and 16% respectively, international cases have much higher non-farebox revenue contributions at 58% and 28% for MTR and SMRT respectively, indicating significant scope for improvement in Indian cities. With the high dependency on farebox revenue, Indian metro systems faced significant losses due to service closure during the COVID-19 pandemic.

Table 7: Financial performance summary of the Indian metro rail systems (FY'20)

INCOME AND EXPENDITURE SUMMARY	INCOME AND EXPENDITURE DISTRIBUTION	DELHI (INR CR)	MUMBAI (INR CR)	BANGALORE (INR CR)	CHENNAI (INR CR)
Revenue	Operational Revenue	5,951	346	419	165
	Other Revenue	1,064	-10	57	122
	Total Revenue	7,015	337	476	287
Expenditure	Operational expenditure	4,215	155	360	197
	Non-Operating expenditure	3,426	423	711	616
	Total Expenditure	7,641	578	1,072	812
Operational Profit/(Loss)		1,736	191	58	-32
Total Profit/(Loss) before tax		-626	-242	-596	-525
Total Annual Profit/(Loss) after tax		-541	-242	-599	-527
Total Annual Profit/(Loss) (Million USD)		-74	-33	-82	-72

*1 Crore = 10 Million

14 Venkatraman, 2020. *Mumbai Metro to explore non-fare sources such as advertising, land monetisation for revenue*. Hindustan Times.

Overall financial performance of Indian Metro systems and international peers

Table 7 provides an overview of the financial performance of the four case cities for FY 2019-20, including revenues and expenditure along with profit/loss before tax. The operational expenditure includes the operating costs such staff costs, power, fuel, insurance, repairs and maintenance, housekeeping, security etc. The non-operating expenses include cost of finance, amortised cost of capital expenditure and other expenses.

Except Chennai, the three Indian metros reported operational profits (Operational Revenue – Operational Expenditure). However, they post losses when non-operational expenditure is included in the analysis due to the high capital cost of civil infrastructure, rolling stock and maintenance facilities. Notably, Bangalore and Chennai metros have posted losses like Delhi metro, despite having just a fraction of its network length.

Since all metros are in moratorium period of loan where they only pay the interest and not principal, they will face further losses in post-moratorium phase. Furthermore, the financial situation of all metro systems deteriorated further due to the lockdowns and ridership drops over various phases of COVID-19 in 2020 and 2021.

GoI's move to encourage lighter and cheaper modes such as Metrolite and Metro Neo systems would mitigate such losses in the future. However, public transport authorities and operators worldwide have a service obligation to provide affordable transport services and therefore may incur losses that require government subsidy.

Table 8 provides an overview of the financial performance of the three international benchmark cities. The metro services are overseen by the transport authority as part of an integrated system that also includes bus, taxi and even property development to generate revenue for public transport. Hence, the numbers cover performance across other public modes of transport in these cities, and not just the metro. All the three cities posted both operational and overall profits, which enable them to use the revenues for future investments.

Table 8: Financial summary of international case cities

INCOME AND EXPENDITURE SUMMARY	INCOME AND EXPENDITURE DISTRIBUTION	SMRT SINGAPORE ($M)	MTR HONG KONG (HK$ MILLION)	TRANSPORT FOR LONDON (£M)
		FY 2015-16	FY 2019*	FY 2019-20
Revenue	Operational Revenue	1,297	54,504	5,762
	Other Revenue	3	7,367	3,377
	Total Revenue	**1,300**	**61,871**	**9,139**
Expenditure	Operational expenditure	954	39,178	7,739
	Non-Operating expenditure	216	8,679	622
	Total Expenditure	**1,171**	**47,857**	**8,361**
Operational Profit/(Loss)		342	15,326	1,977
Total Profit/(Loss) before tax		129	14,014	778
Total Annual Profit/(Loss)		109	11,932	2,457

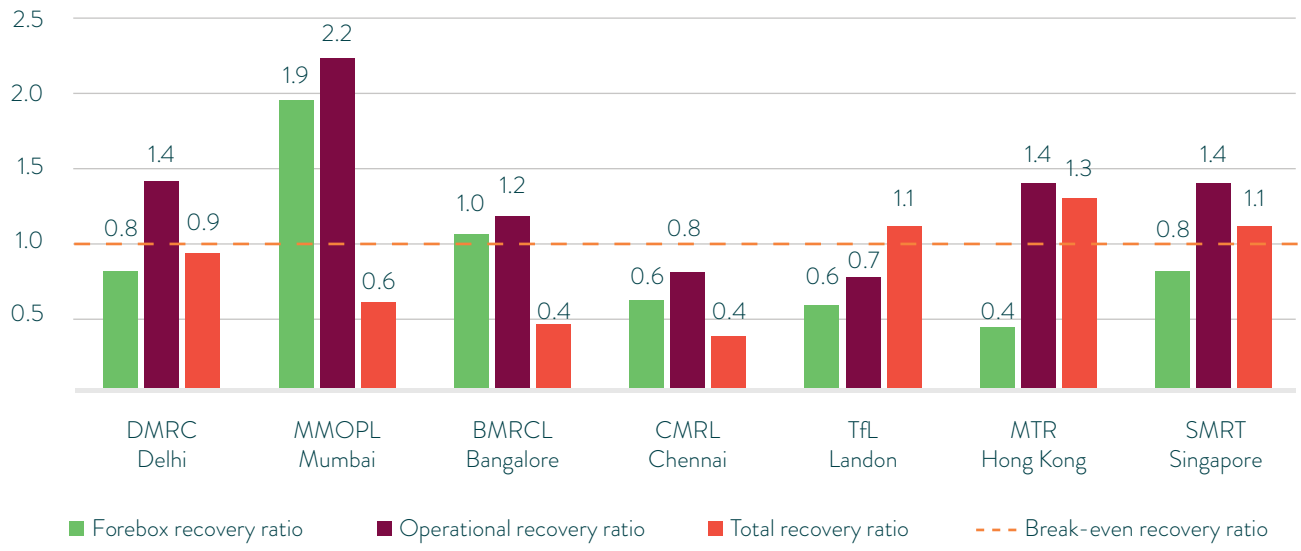
*Calendar year 2019

The financial performance of Indian metros and the international peers are compared using revenue recovery ratio as an indicator to measure the system's ability to recover costs from its various sources of revenue. The three revenue recovery ratios analysed are:

- Farebox revenue recovery ratio measured as the ratio of fare revenue and operational expenditure.
- Operational revenue recovery ratio measured as the ratio of total operational revenue and operational expenditure.
- Total revenue recovery ratio measured as the ratio of total revenue and total expenditure.

Figure 3 presents these revenue recovery ratios for the Indian metro systems and the international peers, wherein all ratios with values above 1 indicate the system can recover its costs while the ones less than 1 indicate the requirement for subsidies to recover operating or overall costs. While all the metros have total recovery ratios less than one, Mumbai and Bangalore break even on operating expenditure just through farebox revenues, with farebox revenue recovery ratios of 1.9 and 1.0 respectively. With the addition of non-farebox operating revenue, the operational recovery ratio becomes favourable for Delhi as well. Delhi metro has generated the highest profit on operational revenue and best total recovery ratio at 0.9 amongst the four case cities.

Figure 3: Revenue Recovery Ratios of Indian metros and international peers[15]



The above examples demonstrate how London, Hong Kong and Singapore succeed through an integrated transport authority which cross-subsidises public transport through revenue from congestion and parking charges, property development and other non-transport operations. Indian cities have plans for Unified Metropolitan Transport Authorities (UMTAs) for last 2 decades, which can allow for integration of services and finances across modes however is yet to witness success.

ALTERNATIVE ANALYSIS

In this section, we present a scenario analysis of the likely profit/loss before taxes of the case metros, expecting that they achieve their originally projected ridership and the ridership needed for financial breakeven. Table 9 provides a summary of the current and projected ridership for two scenarios including the percentage ridership increase needed. The likely Profit/Loss is calculated by extrapolating the per-capita farebox revenues from current ridership to the projected ridership. For Delhi, the analysis used the revised ridership from 2006 (Phase I & II) and 2011 (Phase III) while for the others we used the projected ridership from their detailed project reports.

Delhi and Mumbai would need to increase their ridership by 27% and 35% respectively, to meet their originally projected ridership. If these targets are met, Delhi Metro can post profits while Mumbai Metro would need to increase ridership by 44% to break even. Bangalore and Chennai would require a much higher increase in ridership to meet targets: 266% and 685% respectively. Their ridership is likely to increase with ongoing network expansion.

Theoretically, Indian metro systems can reach breakeven in case their projected ridership are met.

Table 9: Ridership increase required to achieve the projected ridership

CITY	ACTUAL RIDERSHIP (2019-20) (M PER DAY)	PROFIT/ LOSS (2019-20) (INR CRORE)	RIDERSHIP NEEDED TO MEET PROJECTIONS (M PER DAY)	INCREASE REQUIRED TO MEET PROJECTIONS	PROFIT/LOSS IF RIDERSHIP TARGETS MET (2019-20; INR CRORE)	RIDERSHIP REQUIRED TO BREAK EVEN (M PER DAY)	INCREASE REQUIRED TO BREAK EVEN
Delhi	5.7	-626	7.2	27%	+66	7.1	25%
Mumbai	0.5	-241	0.6	35%	-33	0.6	44%
Bangalore	0.4	-596	1.5	266%	+182	1.2	208%
Chennai	0.1	-525	0.9	685%	+521	0.5	334%

15 Figures may differ based on difference in methodology adopted by different cities. For detailed methodology, refer to the annex *'Methodology: Performance of Indian Metro Rail Systems'*

RECOMMENDATIONS FOR UPCOMING RAIL PROJECTS

RIDERSHIP PERFORMANCE OF METROS

Complementary actions for ridership improvement: Metros can only be implemented successfully if they are integrated with other public transport modes to provide adequate first- and last-mile connectivity. This is both the responsibility of operators and authorities, and partnerships are crucial between all stakeholders.

Comprehensive ridership estimates: Accurate ridership estimates are crucial to have a realistic assessment of the projects role in solving city's mobility needs and financial planning of systems. Comparison with international peers reveals that the ridership per km of the current metro systems is comparable to some of the busiest metro systems globally. The actual ridership achieved by current metros provide a good benchmark for planning the upcoming metro and other urban rail networks. Even existing systems can calibrate their ridership targets, like the periodic revisions in ridership projections made by Delhi metro over the years.

FINANCIAL PERFORMANCE OF METROS

Cost of metro systems have grown substantially over the years with the recent metro systems costing upwards of INR 300 crore per km ($40m, €34m). The mix of elevated and underground network and land acquisitions can have a substantial impact on the cost of metros and should be considered.

Revenue of metro systems: Indian metro systems are heavily reliant on operational revenue and within that on farebox revenue. Delhi Metro provides a best-case example of increasing non-farebox revenue through land value capture. Other systems need to build on this example for long-term financial sustainability.

Overall financial performance:

- All the cities have significant network expansion plans, it is expected that their existing losses are likely to be exacerbated in the future in case of a business-as-usual approach towards their development.
- Financial planning for future systems should use the current performance as a benchmark than the projections being used in planning and approval phases.
- Future urban rail systems should focus on minimising the capital cost and financial requirement by evaluating the urban rail network needs rationally based on urban development and mobility needs and exploring lower cost systems like Metrolite and Metro Neo.

Improving revenues with a focus on existing sources and identification of new sources to meet future funding needs. This can include exploring the following options and other strategies:

- **Improving farebox revenues** through smart pricing strategies like dynamic pricing with targeted discounts based on the time of day, distance of travel etc.
- **Improving non-farebox revenues** through land value capture, advertising revenue, co-branding of metro stations and smart cards, providing consulting services etc.
- **Other market-based instruments** to direct mobility choices towards mass transport options can also provide sustainable revenue.

Integrated governance of metro systems: International peers such as London, Singapore and Hong Kong govern and fund their metro systems as a part of their integrated transport authorities for all modes enabling them to cross-subsidise public transport through non-fare revenues. A well-functioning UMTA is crucial for the sustainability of an urban rail system.

Impact of COVID-19 and recovery: The COVID-19 pandemic has exacerbated the financial losses of metro systems which had poor finances even prior to the pandemic. Thus, measures towards ensuring adequate financial support to public transport agencies has become vital to ensure continuity of their services in case of such situations in the future. A Public Transport Service Contract (PTSC) framework between the metro agency and the Government assuring such financial support in-lieu of the services offered can go a long-way in ensuring the financial sustainability of metro systems.

CONCLUSION

This Knowledge Brief identifies avenues for improving the planning and performance of both the existing as well as upcoming mass transport systems in India. The Indian metro rail projects fare well operationally when compared with international best practices, but significant scope for improvement persists on their financial performance. Governments need to acknowledge that existing metro rail systems will continue to face financial losses and need to make adequate arrangements for their capital and operational funding gaps to ensure their sustainability. Upcoming metro and other urban rail projects need to learn from the costs and benefits of operational systems and evaluate projects accordingly.

Metros deliver high economic, social and environmental value. The benefits are incommensurable and recurrent not over years or decades, but over generations.

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