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The Power of Pedals:

Mainstreaming cycling in India through public bicycle sharing (PBS)

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Abstract

India - a major global economy with a large population but extremely low vehicle penetration - is well poised to ride the wave of shared mobility. As of 2011, nearly half of the daily commute in urban India comprised cycling and walking. However, over the years, the patronage for cycling has declined. In an era where digitalisation of mobility is rampant, new-age public bicycle sharing (PBS) is common, and there is heightened environmental consciousness among the masses, what explains this decreasing preference for cycling, especially among non-livelihood cyclists? This white paper investigates this pertinent question in the larger socio-economic context of India, studies the benefits and impact of PBS, and delineates the barriers to mainstreaming cycling in general and scaling up PBS in particular. PBS - a 100 percent clean and affordable mobility option - can potentially alter the entire urban mobility paradigm of a country. It democratises access to cycling, making cycles available to all when and where they want. With the help of government and businesses as enablers, and civil society to create awareness, commuters can be driven away from private motorised transport and towards cycling, helping India become a net-zero nation. Thus, the paper presents policy interventions and choice architecture that may allow India to build its own cycling future.

Introduction

Cycling - a 100 percent clean mobility mode - has been an integral part of the mobility system in India from time immemorial. Cycling and walking - a part of non-motorised transport (NMT) - form the backbone of Indian mobility systems with about 42% of urban households owning a bicycle and 48.7% of urban work trips powered by NMT (Census, 2011). Yet, the patronage for cycles is on the decline, decreasing by 4.1% in Indian cities between 2001-2011 (TERI, 2018). Cities have tried to prevent this decline by introducing bicycle sharing as part of the public transport paradigm. In simple terms, Public Bicycle Sharing (PBS) involves cycles accessed over a smartphone, and shared by multiple users in a specific geography - a quintessential facet of the digital sharing era the world lives in today!

As per the Ministry of Housing and Urban Affairs (MoHUA) of the Government of India, PBS is defined as "a high-quality bicycle-based public transport system in which bicycles, stored in a closely spaced network of stations, are made available for short-term use" (GIZ, 2021). Thus, PBS allows anyone to pick up a cycle from one point and return it to another, making point-to-point, human powered mobility possible (ITDP, 2018). There are three basic features that every PBS system focuses on: shared-use, availability of bicycles on-demand at specified locations, and human or battery-powered fleet. By allowing the asset of cycles to be shared by multiple users, PBS eliminates the need to own. Thereby, PBS democratises cycling by making cycles available to all when and where they want. PBS can therefore be leveraged to ensure that more commuters choose cycling while retaining and increasing the current share of bicycle ridership.

But why are cycling in general and PBS in particular significant? India is committed to achieving net zero carbon emissions by 2070 (PIB, 2021). However, this requires significant reduction in emissions from road transport, which is the highest contributor of transport-based emissions (MoEFCC, 2018). Although the international community at the recent COP26 deliberations missed out on the promotion of active and green mobility to achieve net-zero goals, India is well poised to benefit from the accelerated adoption of cycling especially by leveraging PBS.



Image 1: A collage of cyclists and cycles. Top left: a young woman riding a cycle accompanied by an elder male walking beside her. Top right: A public bicycle sharing stand with cycles parked next to each other. Bottom right: A middle-aged man riding a bicycle. Bottom left: Several cyclists riding on a flyover¹.

An improvement in the average living standards and low physical activity due to the digital invasion of everyday life is a growing concern. Consequently, India's youth is choosing bicycles as a means to maintain their health and fitness, although cycling is still limited to leisurely activities. What can be done to change this? This paper looks at the promise of anchoring India's transition to a "cycling nation" through PBS. As will be seen later in the paper, PBS has the potential to meet

end-to-end mobility needs for short-trips while also acting as a feeder-mode for first-and-last mile connectivity for mass transit systems. After its introduction in India in 2017, PBS is still in its nascency, warranting an in-depth investigation on the barriers of adoption and scale, financial viability of existing business models, and opportunities and potential policy interventions that may allow Indian cities to popularise PBS, thereby improving the uptake of cycling. In this context, this paper presents major findings from the PBS-in-India investigation, combined with learnings from PBS projects around the world.

Genesis and evolution of PBS

Cities implement PBS for reasons ranging from the need to increase the overall mode share of cycling to complementing other modes of public transport.

Global success stories of PBS

Globally, the initial traction towards large-scale bicycle systems took place in the 1960s as a result of growing concerns around road fatalities associated with increasing car ownership and use in Amsterdam. The concerns were further aggravated by the Middle East oil crisis in 1973 when oil-producing nations halted exports to the USA and Western Europe. These twin pressures along with a democratic demand through nation-wide activism persuaded the Dutch government to diverge from their car-centric transport policies (BBC, 2013) and prioritise cycling.

¹ Photos by a) <u>Nita Jatar Kulkarni</u>, and b) <u>suraj kardile</u> c) <u>Firdaus Roslan</u>, and <u>Vardhan Halwai</u> on <u>Unsplash</u>

Similarly, influenced by varied reasons, several cities globally have adopted unique methods for the implementation of citywide PBS systems; a select few are listed in Table 1.

Table 1: Learnings from the cycling culture of cities				
City, Country	Year	Major driver	Outcomes	Highlights
Amsterdam, The Netherlands	1965	- Road fatalities due to motorisation - Middle East oil crisis in 1973	32% modal share	 "Car-free & zero-emissions" city; reduced automobile dependency Cultural association Road regulations that prioritise & protect cyclists
Copenhagen, Denmark	1995	- Middle East oil crisis in 1973 - Environmental movement & citizen demand	50% of daily trips on bicycles	 Cycling as part of Municipal development plans Cycling culture of city - Copenhagenization² Danish urbanist, Jan Gehl's placemaking strategies³ inspired global cities to adopt NMT
Paris, France	2007	- Citizen support & growing bicycle enthusiasts - Environmental movement	108,117 daily ridership (2014), 15% modal share targeted by 2020-21	- Reduced car use by 5 percent - Highest market penetration in world (one bicycle per 97 residents)
Hangzhou, China	2008	- Rapid decline in use of public transit	30% of commuters use PBS for daily commute	 Increased the use of buses Resulted in the development of the Hangzhou model⁴ wherein relevant stakeholders come together to create an enabling environment for PBS

Source : BBC, 2013; Chandler, 2020; Coville, 2015; Nordstorm, 2018

Overall, PBS is implemented as one of the many strategies to mitigate growing urbanisation challenges faced by cities including the need to strengthen public transit, as seen in Antwerp or Hangzhou. Therefore, PBS is not a silver bullet and requires implementation with long-term transport strategies in mind.

² 'Copenhagenization' is a concept in urban planning and design relating to the implementation of better pedestrian facilities and segregated bicycle facilities for utility cycling in cities; modern usage of the term is said to have originated with Danish urban design consultant Jan Gehl (Beacom, 2012).

³ Jan Gehl studied public spaces to see how they really work, using Strøget and Copenhagen as a laboratory for his research; advised cities around the world, including Melbourne, London and New York, on how to improve the quality of urban life (Beacom, 2012).

⁴ "Four-in-one" principle; four stakeholders namely the city management committee, the traffic police, the municipal administration, and the bus group jointly choose a site location for PBS implementation. They then publish a notice for recommendations and no objection from citizens on the suitability of said location for PBS (Urban Sustainability Exchange, 2006).

PBS in India

From children cycling to school, and men and women alike pedaling to work everyday, to renting a bicycle at tourist destinations, cycling has always been an integral part of India's mobility journey. The first bicycle sharing programme was launched in 2010 in Thane, called *FreMo*, with the objective of moving citizens away from private motorised transport. Subsequently PBS started gaining more attention, and therefore, a pilot project called *Cycle Chalao* was launched in Mumbai and Pune, followed by a separate PBS programme in Bengaluru called ATCAG (Automated Tracking and Control of Green Assets). In 2012, a campus-wide PBS system was launched in the Indian Institute of Science (IISc), Bengaluru, called *Namma Cycle*.

In 2017, Mysuru became the first Indian city to have a city-wide PBS system, implemented by the municipal corporation, and received enormous attention especially from tourists. Building on these pilots, several policies like the National Urban Transport Policy (NUTP), Jawaharlal Nehru National Urban Renewal Mission (JnNURM), and Smart City Mission (SCM) began prioritising the adoption and implementation of NMT and associated infrastructure. While cities like Ranchi and Bhopal adopted PBS under the SCM, cities like Bengaluru and Mysuru have PBS systems operated by a private entity, regulated by the Directorate of Urban Land Transport (DULT), Government of Karnataka.

The interest of global bicycle operators like Ofo and Mobike created an opportune moment for widespread implementation of PBS in India. Although Ofo exited the Indian market within six months of its launch due to financial constraints and operational instability (Yadav, 2020), the local governments realised that commuter needs in Indian cities present a conducive environment for uptake of cycling. Therefore, cities like Ahmedabad, Bengaluru, Bhopal, Delhi, Kolkata, and Mumbai continued to invest in PBS pilots. Along with an Ahmedabad-based company called MyByK which implemented the famous river-front PBS project in the city, several companies like Pink Pedals, Yulu, SmartBike and Ola Pedal started PBS operations across the country. While start-ups like Chartered Bike partnered with the smart cities of Bhopal and Kolkata to introduce PBS, MyByK initially focussed on campus-wide and smaller pilot projects in Ahmedabad and Mumbai. Even when ridership plummeted after initial boost, system operators and local governments tried to reanalyse system viability through the lens of finance, ridership statistics and commuter reviews, to keep the initiatives going (GIZ GmbH, 2021).

Even as commercial PBS operations took off in India, an Amsterdam-based NGO, BYCS, started the Bicycle Mayor programme in the country in 2016 with the aim of strengthening infrastructure by supporting community initiatives, promoting a culture of active mobility, and inspiring citizens to ride bicycles for daily-trips. The Bicycle Mayor programme has rapidly scaled in India, with forty mayors in diverse locations as of 2020. Since 2017, the mayors have hosted a plethora of cycling events, ranging from operational support for social awareness to local crowdfunding campaigns. Through their "silent revolution", the bicycle mayors of India have attracted a lot of attention and are leading by example (Tripathi, 2019).



Image 2: Development of PBS in Indian cities

Image 2 shows the genesis and development of PBS in India. The first map shows cities and suburbs such as Ahmedabad, Bengaluru, Mumbai, Pune, and Thane introducing PBS pilots in 2017. The second map shows how between 2017 and 2018, PBS gained traction and popularity in several cities such as Bengaluru, Bhopal, Chandigarh, Delhi, Hyderabad, Mumbai, Mysuru, Ranchi, Surat, and Thane. The last map shows the PBS projects launched or renewed as part of the 'Cycle4Change' Challenge launched by the MoHUA.

Sustainability and Affordability: Factors influencing the youth to choose bicycles

It is well known that macro- and micro-economic issues affect behaviours (Akerlof, 2002; Mukhopadhyay, 2016). As the factors influencing the cycling choice of the youth in India are studied in depth, the aspects of sustainability and affordability come to the fore. Governmental programmes including promotion schemes and incentives, civil society support, and citizen awareness and demand for sustainable mobility are enabling India to become a global EV hub. Simultaneously, market forces are catalysing the evolution of PBS in India (and around the world) from providing pedal-based mechanical cycles to pedal-assisted and electric bicycles. The FAME⁵ schemes by the Government of India are instrumental in driving the adoption of EVs and hybrid vehicles. The second phase of FAME launched in 2019 is now extended up to 2024. While FAME offers subsidies on electric motorbikes, electric scooters or e-scooters, e-cars, and e-rickshaws and e-auto-rickshaws, a committee has been constituted at the Government of India level to design subsidies for e-bicycles as well. It is expected that with the implementation of such a subsidy, e-bicycles would become cheaper by INR 3,000 to 5,000 if not more (Bhatnagar, 2021).

Another catalyst is the lowering of regulatory hurdles to drive the adoption of sustainable mobility modes. In India, all vehicles with power less than 0.25kW and with a maximum speed of less than 25 kmph, including e-bicycles and e-scooters under existing PBS systems, do not fall under the regulatory ambit of motor vehicles (MORTH, 1989). This exempts cycles from specific registration processes and also allows cyclists to ride without the need of any license or government-issued passes. These factors, including sustainability and affordability of cycles, have generated and are expected to generate a growing interest among youth for cycling in general and electric bicycles in particular.

Impact of Covid-19 on cycling

The dual health-cum-economic crisis of Covid-19 has necessitated physical distancing in mobility. Coupled with the heightened health concerns of the global population, bicycle sales and utilisation of PBS surged, with many western countries regarding it as the "bicycle boom of 2020" (Bernhard, 2020). Closer home in India, cycle sales grew by hundred percent to 4.2 million units between May and September 2020 alone (PTI, 2020). While the demand in retail sales was high, the institutional sales were registered to be very low. Such was the demand in May-September 2020, doubling every month, that people in many cities had to be on waiting lists to buy a bicycle of their choice (Sharma, 2020). With dwindling production of bicycles due to limited human resource during lockdown, the price of bicycles went up significantly and is expected to further rise by 30-40 percent in 2021 (Prasad and Deb, 2021). In absolute numbers, the low-end models at approximately INR 3,600 are expected to cost INR 4860, lowering their affordability for the masses (PTI, 2020). Yet, the global pandemic continued to see increasing interest among youth towards cycling, owing to restrictions and limited availability of motorised modes of transport. Furthermore, Yulu anchored the business opportunities presented in megacities due to lockdown restrictions and extended their services to hyperlocal delivery platforms in Bengaluru and Mumbai. However, these high cycle sales may be incongruent with actual ridership of bicycles, as is evident from the modal split and bicycle ridership⁶ of PBS in India (GIZ, 2021).

⁵ Faster Adoption and Manufacturing of Hybrid and Electric Vehicles

⁶ PBS in Mysuru completed 1,200 trips per day on average before the pandemic, dropping to 800 trips per day post-lockdown.

The Wave of Change

With the easing of lockdown restrictions nationwide and reopening of motorised public-transport options, bicycle ridership may start taking a back seat again, as already seen in Kolkata. Kolkata has a citywide ban on cycling on major arterial roads, preventing both livelihood cyclists⁷ and cycle enthusiasts from choosing cycling for daily commute (Kolkata Traffic Police, 2021). Although this ban was lifted in early 2020, the ban has been reintroduced owing to the increased congestion once the lockdown restrictions were eased. At the same time, West Bengal is leading in bicycle distribution and has thereby floated an expression of interest (EOI) for setting up a bicycle manufacturing unit in the state. Recognising the role of bicycles in reducing pollution and improving health, the state is committed to nurture and support MSMEs (micro, small, and medium enterprises) including startups for local production and promotion of cycling (WBIDC, 2021). These developments point to the necessity of enhanced coordination among different stakeholders in the government machinery, and the urgency with which states must adopt uniform and collective zero-emission goals and strategies.

Undoubtedly, the mere rise in cycle sales and its limited use during the pandemic does not indicate rising preference of citizens for sustainable mobility (Bernhard, 2020). Sustainable choice may only be validated if actual ridership numbers are retained, and recreational riders also commit to cycling as a primary mode of commute. Notably, businesses and investors have sensed a wind of change towards cycling and are thereby coming up with innovative models to invest in cycling. Particularly in mega-cities, a major driver for private vehicle ridership is the lack of first and last mile connectivity of public transit. PBS could be the saviour, given that approximately 70 percent of citizens in urban areas travel less than 5km for work (Census of India, 2011; Tiwari & Nishant, 2018). Since Indian cities report an average trip length of 2-4 km for cycling (GIZ, 2021), PBS has immense potential to flourish, if implemented in a commuter-centric manner.

Assessing Potential Barriers for PBS adoption

This section looks at barriers for adoption in three phases, demarcated by the introduction of city-wide PBS in 2017, and the outbreak of the pandemic in 2020.

Before 2017: Historical barriers for uptake of PBS

Till 2017, cycling formed only 13.3 percent of the work trips in urban areas, compared to private motorised transport constituting 21 percent of everyday commute (Census of India, 2011). In the first decade of the 21st century, cycling usage dropped by 4.1% (TERI, 2018) while private transport has been adopted in an unfettered fashion over the years. There are several barriers that contribute to this trend of low uptake of cycling.

- Socio-cultural barriers:
 - 1. Bicycles have a different standing with respect to the economic background of the user in cities. Its appeal to the masses is mostly seen to be a derivative of their social status (Aggarwal, 2019).
 - 2. Furthermore, gender-based societal norms also limit the use of cycling among half of the population, i.e. girls and women. In addition to gender-specific concern for safer riding environments, women's

⁷ Individuals who are dependent on cycles for their livelihoods; for instance, street vendors running businesses off a bicycle or informal or unorganised workers using cycles for daily commute. (B-PAC & DULT, 2021)

choice of cycling is also limited by socio-cultural perceptions and access constraints. In Chennai, as of 2017, cycling rates among low-income men were 8 percent compared to 1 percent for women (Shah et al., 2017). In the 2018 Ease of Moving Index Survey involving 43,500 citizens across 20 cities in India, while 95 percent of the female respondents stated that sustainable modes such as cycling was important to them, they indicated preference for motorised transport for everyday commute due to enhanced convenience, access, and reliability (Tiwari & Raman, 2018; Shah & Raman, 2019). Combined with the fact that women car owners nearly doubled from 12% to 25% in the past decade, women are increasingly moving away from cycling (Gupta, 2017).

• Behavioural barriers:

- 1. People in India are aspirational about upgrading to a two-wheeler and a four-wheeler, since motorised transport is often associated with a comfortable, convenient, and safe commuter experience, while signalling upward socio-economic mobility (Nielsen, 2015).
- 2. The deeper symbolic relationship between citizens and cars is further strengthened by incentives and subsidies that support the ownership and use of personal vehicles. Free parking at work, tax exemption on fuel and maintenance as perks on a job, and even driveway commercial centres all promote cars. While city infrastructure continues to prioritise cars and passively wires human brains for a car-dependent lifestyle, public transport and non-motorised transport are struggling to be attractive enough.
- Infrastructural barriers:
 - Rapid urbanisation and unfettered motorisation have resulted in transport planners focussing on infrastructure for motorised transport, pushing NMT further to the curb. An analysis of municipal corporation budget allocation for Ahmedabad, Bengaluru, Chennai, Pune and Nagpur between 2012-16 shows that only 2% was spent towards NMT infrastructure development (TERI, 2018).

• Regulatory barriers:

 The Bureau of Indian Standards (BIS) has laid out about 29 cycling standards⁸, all voluntary in nature. This lack of quality controls results in unorganised bicycle-suppliers distributing substandard bicycles, jeopardising the safety of cyclists (BIS, 2008).

2017-2019: Pre-COVID-19 barriers to PBS

With the launch of citywide PBS in India in 2017 and its adoption in other cities, the socio-cultural inhibitions around cycling started to diminish. However, PBS did not gain the much-anticipated momentum. While several cities were planning for PBS systems, Kolkata, Pune, Mumbai, and Bengaluru withdrew or significantly reduced PBS operations. In addition to the historical reasons for the low uptake of PBS in India, the following potential barriers too had a role to play.

- Financial barriers:
 - 1. Although PBS requires significantly and substantially lower investments as compared to other transport systems, the business models currently in use require upfront investments, with funding and financing required for bulk purchase of cycles, and installation, implementation, and operation of PBS (Diwan and

⁸ BIS has set quality standards which ensure the manufacturing quality of cycles for the safety of cyclists; however, all the standards are voluntary in nature for cycle manufacturers and distributors, and thus, compliance is limited (GIZ, 2021).

George, 2021). The low rental-charges do not cover the operating costs and thus PBS becomes unviable⁹.

• Behavioural barriers:

1. Riders use PBS only for recreational purposes, which in the long-run do not convert to daily trips. Therefore, operators struggle to achieve ridership targets, necessary to make the system viable¹⁰.

• Infrastructural barriers:

- Globally, larger and dense PBS systems have generated higher daily-trips per cycle. Copenhagen and Antwerp have 6.5 and 8.1 bicycles per 1,000 population, and achieve 7 and 5.6 trips per cycle per day respectively. However, Indian systems are smaller in size and coverage, and attract less than three trips per cycle per day. Mysuru has 4 bicycles per square kilometer, followed by Bengaluru with 3, and Bhopal with merely 0.7 bicycles per square-kilometer (GIZ GmbH, 2021).
- 2. A 2021 study found that about 60 percent of non-users do not prefer PBS due to the lack of infrastructure (GIZ, 2021), also validated by studies on NMT earlier (Tiwari & Raman, 2018; Shah & Raman, 2019). Most Indian cities either lack segregated bicycle lanes or have incomplete bicycle lane networks, with no priority at signals or intersections.

• Regulatory barriers:

 Pedal-based and pedal-assisted bicycles are covered under the 12% GST slab while electric bicycles are charged under a lower GST slab of 5% (GIZ, 2021). This makes the use of mechanical bicycles under a PBS system more expensive than an electric one even though both are sustainable modes of transportation, with the former leading to a more active lifestyle for city-dwellers.

Since 2020: Barriers to PBS since COVID-19

The surge in bicycle sales and ridership during COVID-19 is indicative of a perception change towards cycling in Indian cities. However, with the easing of restrictions and motorised modes restarting to ply on their regular routes, cyclists are again beginning to encounter pre-Covid barriers. The potential barriers to PBS that emerged additionally, in a post-pandemic India, are outlined below.

• Behavioural barriers:

- Trends in the US and UK show that when the youth are given a choice, they prefer to not drive for daily commute owing to economic complexities, legal issues around licenses, and social factors. However, this may not be true for youth in India, especially in budding megacities and Tier-II cities. The youth is still inclined towards upgrading to two-wheelers and four-wheelers as it signifies upward socio-economic mobility.
- 2. Due to the lack of multi-modal integration in cities, commuters lack access to mobility information such as public transit schedules, PBS availability, etc. These create a poor user experience in addition to limiting mobility choice of commuters.
- Infrastructural barriers:
 - City design has not integrated NMT as a crucial part of urban mobility, and pushed cycling to the curb.
 From indirectly encouraging private vehicle ridership with higher parking-minimum standards to not

⁹ Based on interviews with PBS operators

¹⁰ Based on interviews with PBS operators

defining clear measures for improving the cycling environment, city master plans fail to support PBS, in turn not promoting cycling.

- Financial barriers:
 - 1. Business models for PBS continue to lack innovative methods to recover both capex and opex, with the majority of financing methods focussing only on fare and advertisement revenue. This makes PBS unviable in the long run.

Opportunities for reimagining PBS in India

Policy experts often refer to the success of PBS systems in advanced economies as a result of their "culture", but about fifty years back, Dutch roads were choked with cars. With the high fuel prices and roads beginning to congest again post-Covid in mega cities, India needs to urgently reimagine personal mobility options. As the younger generations turn to cycles as a way out of congestion and pollution, there seems to be hope for the country to mainstream cycles. This requires a holistic strategy, anchored in concerted efforts including community engagement.

Policy Interventions outside India

Table 2 illustrates policy interventions that have allowed cities to build their own cycling culture. These measures range from fiscal incentives to accelerate adoption to infrastructural or design interventions that modify commuter behaviour.

Table 2: Policies promoting PBS around the world			
Country	Policy/ Design Intervention	Intervention Type	
The Netherlands	Tax-free cycle purchase	Incentivisation	
	Per-kilometre reimbursement plans for cyclists	Incentivisation	
	"Bicycle-credits" and "carbon-credits" programme for cycling	Incentivisation	
	A single platform for bicycle-sharing across city/country	Behavioural design	
	Cycling freeways and dedicated parking spaces for cycles	Infrastructural support	
Italy	Credits for cycling to work	Incentivisation	
Denmark	Bicycle bridge, cycle superhighways, elevated bicycle ramps, and new infrastructure for cycling	Infrastructural support	
	Regular cycling events, for all ages - building the cycling culture among kids since childhood	Nudge planning	
	Stringent rules for both cyclists and motorists for improving safety and reducing road fatalities	Regulatory support	
France	Tax exemptions for cycle purchase	Incentivisation	

	Cycle-to-work schemes	Incentivisation
Belgium	Tax-free bicycle schemes	Incentivisation
	Cycling pathways through forest and lake to protect natural habitats	Environmental and infrastructural support

Source : Adapted from BBC, 2013; Chandler, 2020; Coville, 2015; Nordstorm, 2018

Recommendations to increase adoption of PBS in India

In India, the Ministry of Housing and Urban Affairs has launched several programmes and challenges to promote walking, cycling and public transport in urban areas. The Government's 'Cycle4Change Challenge' encourages Indian cities to re-imagine their PBS implementation plans and strategies, as can be seen in Table 3.

Table 3: Interventions in Indian Cities as part of the Cycle4Change Challenge				
	New Town, Kolkata	Rajkot	Bhubaneshwar	Bengaluru
Awareness	Women-centric training programmes; Awareness campaigns; Cycling events;	Webinars; Events; Cycle2Work each friday; Rallies and Cyclothons	Sensitisation programmes; Bicycle movement and campaigns; Pledge-taking; Cyclothon events; Promotional products ¹¹ (physical and virtual)	Community-driven programmes for placemaking and attracting users to cycle
Infrastructure	20 km cycle track, 70 km proposed further; Signages; Mobile Cycle Repair Clinic; Relaunch of app-based PBS	Encroachment removal, Monitoring of cycling tracks with CCTVs, Repair of cycle tracks and curbs; Healthy Streets design	Innovative designs for mixed land use; Signages and Bollards; Cycle tracks and parking	Junction designs; Parking hubs and parklets; Signages; Placemaking ¹² for slow-street
Incentives	Reward cyclists and vouchers for outlets in New Town	Incentives for buying cycle	-	-
Technology & Engagement	-	-	-	Mark your cycle route, Citizen-centric design; Sustainable Mobility

¹¹ Social media products, Stickers and print media, Dynamic Message Signages, and Art installations

¹² Strategies to make streets people-friendly; organisation painting on roads and community-driven initiatives to build pop-up bicycle lanes; strategies that create slow-street and increase social interactions

				Accords (SuMA) ¹³ ; Test Bed for Clean Air Streets ¹⁴ ; Pedal Port ¹⁵ ; Bicycle Separator Challenge ¹⁶
Ridership	65 percent monthly growth	-	Pilot showed a potential increase by 70%	-
Agencies involved	Smart City Fund/HIDCO ¹⁷ Fund, NKDA ¹⁸ Fund, Bidhannagar Police Commissionerate, Government offices in New Town, CSR Funds	Rajkot Municipal Corporation	Municipal Budget, State Transport Fund Reallocation, Green Financing, Smart City Fund, Funding from International Agencies, Advertisements revenue	DULT, Smart City, Greenlinks Scheme ¹⁹

Source: Adapted from NIUA, 2021

Similarly, the Top 11 Awardees out of the 25 in the challenge came up with innovative proposals centred on improving infrastructure, incentivising the right behaviour, and driving community engagement. However, these are insufficient to bring about the widespread adoption of PBS.

As the youth of India is growing conscious about climate change and the future of the planet, there has been a growing shift towards sustainable lifestyles, further enhancing the "social image" of an environmentally-conscious citizen. Through social media promotions and social figures getting photographed riding a bicycle, bicycling is transitioning into a trend among the younger generations.

In this backdrop, India could adopt the following measures to accelerate the adoption of PBS.

- Behavioural Solutions:
 - a. Promotion of cycling with the help of social media and influencers: As seen for social awareness campaigns like vaccination, girl education or waste management, celebrities or influencers like artists or sports persons can be roped in for promoting cycling as a sustainable mode of transport.

¹³ with 9 communities to support a locality to formulate specific goals and action plans for transforming itself into a sustainable neighbourhood

¹⁴ 8 startups from India, testing and showcasing their technologies and products

¹⁵ An innovative product with required tools to facilitate on-road basic maintenance of cycles

¹⁶ A design solution for cycle lanes which has low footprints, is attractive and easy to install to ensure safety of cyclists

¹⁷ Housing Infrastructure Development Corporation, West Bengal

¹⁸ New Town Kolkata Development Authority, West Bengal

¹⁹ Funding support for NMT projects in tier-2 and tier-3 cities

- b. Easy information architecture and user experience: A platform that provides access to all information about PBS and public transport allows users to make the most optimal mobility decisions that are sustainable for both the commuter and the city.
- c. Nudging and using game theory for PBS: PBS can appeal to citizens, especially the younger generation through interactive content and activities for its users beside cycling, such as comparing cycling kilometers with friends, earning virtual trophies for cycling, etc. Awareness campaigns, cycling events, workshops, etc. further promote cycling.

• Infrastructural Solutions:

- a. Providing adequate cycling infrastructure for ensuring the safety and comfort of cyclists: Segregated lanes, cycling pathways and highways, bicycle bridges, bicycle parking spaces, etc. are the need of the hour.
- b. Prioritising cyclists at signals, intersections and roundabouts
- c. Adequate street lighting and signages, with proper shading and street furniture to ensure the comfort of cyclists.

• Regulatory Solutions:

- a. Having an equitable GST slab and tax exemption slab for all bicycle types making cycles affordable for all.
- b. Enforcing mandatory adherence to BIS quality standards thereby improving safety and overall performance of cycles in India
- c. Cycling rules, empowered by an Act that makes it compulsory for cyclists and motorists to adhere to certain traffic regulations for added road safety in case of non-segregated lanes and cycling amidst high-speed vehicles

• Financial Solutions:

- a. Incentives for purchase of cycles and tax exemptions
- b. Earning "cycle credits" and "carbon credits"²⁰ for the kilometers travelled using a bicycle
- c. Earning vouchers and rewards for cycling to work, thereby, subsidising use of sustainable modes of transport rather than private vehicle use
- d. Reinventing the business model of PBS enabling stakeholders to create a win-win-win situation *(discussed in detail in the forthcoming section).*

For PBS to thrive in Indian cities, the government has a critical role to play right from the planning to the implementation stages along with providing viability gap funding in the initial years. Public private partnerships and other collaborations may be explored.

Business model innovations for viable PBS systems

In Indian cities, mobility systems operate as publicly-owned and privately-operated, or non-profit owned and operated. The first model is called the Gross Cost Contract (GCC) while the second is called the Net Cost Contract (NCC). While the GCC appoints the operator through competitive bidding, the NCC appoints one using a permit or an MoU. Thus, the PBS operators in Mysuru, Bhopal and Ranchi are appointed through a tendering process, while Pune and Bengaluru use

²⁰ Cycling will allow commuters to earn cash vouchers and other credits that may be redeemed for commercial or other transportation services (CarbonFund, 2010).

a permit-based system. Subsequently, the NCC model loads the entire business risks on the operator alone, making PBS unviable.

PBS requires the constant support of different stakeholders, adhering to business models that introduce value-added factors additional to bicycles such as incentives, schemes, pedal-assisted and electric options, etc. Therefore, each stakeholder must have clearly defined roles and investment and revenue streams, as outlined in Table 4.

Table 4: Strengthening stakeholder roles and relationships to promote PBS			
Stakeholder	Roles and responsibilities	Revenue Streams	
Local government	 i. Support planning and design of PBS during planning stages ii. Hold minimal stakes during capital expenditure iii. Facilitate data sharing and enable the creation of multimodal, integrated solutions iv. Conduct awareness programmes, workshops, skill development, etc. for PBS v. Provide incentives and subsidies for cycles 	i. Parking and congestion charges ²¹ levied on unsustainable modes ii. Fare revenue iii. Sponsorship fees iv. Advertisement on stations and cycles v. Municipal funding vi. Smart City fund	
Private Businesses (For-profit)	 i. Own privately or publicly, but operate privately only ii. Minimal government involvement for operations iii. Build relations with other transport agencies for improving uptake iv. Introduce value-added factors through tie-ups with the government 	i. Fare revenue ii. Advertisement revenue iii. Sponsorship fees iv. Public-private partnership funding	
Public Transport Agencies	 i. Help PBS operators and the local government plan the system so as to complement and augment public transit ii. Allow integration of PBS software with that of public transit iii. Seamless transfers between PBS and public transit and integrated ticketing system iv. Schemes to incentivise or subsidise the use of public transit for using PBS 	i. Government subsidies ii. Advertisement revenue iii. Public transit fare revenue as a result of seamless transfers iv. Municipal funding	
Not-For-Profit Organisations	 i. Can either operate with support of public agencies or support private operators in scaling up ii. Most important role in awareness, promotion, accelerating adoption of PBS iii. Support incentive schemes, nudge-based policies, and innovative pilots 	i. Public-private partnership funding ii. Fare revenue iii. Low-interest loans iv. Local funding, crowd-funding and donations	

²¹ Congestion pricing requires a motorist to pay for using a busy road; however, it must be done equitably to ensure the desired behavioural change (Raman, 2021). Equity also ensures sustainable mode choices are not penalised.

Multilateral Organisations	i. Provide institutional support for PBS operators	i. International or developmental funding
Organisacions	policies, schemes, and subsidies	ii. Public-private partnership funding
	iii. Large-scale awareness programmes, accelerate uptake through promotions	iii. International loans
	iv. Support for planning systems and acquiring international insights for PBS	

Source : Adapted from Diwan & George, 2021

Conclusion

By embracing the power of pedals, India is well poised to become a net-zero nation by 2070, if not earlier. Cycling is the most sustainable mobility choice, making cities more accessible to all, making cities more liveable. Cycling is an active mobility choice keeping India free from pollution-related health concerns, and keeping Indians healthy. Even as rapid urbanisation and social aspirations lead to heightened motorisation, leveraging new-age technology-integrated business models such as public bicycle sharing will enable India to create people-centric cities.

The romanticisation of cycling has already begun at a personal level for citizens, with many residential associations forming their own cycling groups, although limited to small pockets within megacities. On their part, the platform economy is riding the wave of sustainable mobility. Delivery platforms like Swiggy and Zomato are promoting "green deliveries" by cyclists (Gupta, 2019; Dash, 2018). Likewise the growing segment of wearable smart-technologies for active mobility is incentivising citizens to adapt to a long-term cycling culture. Supported by government initiatives in the form of challenges and funding, cities are trying to articulate their own, contextual cycling strategy. Combined with business models like PBS, mainstreaming cycling in India is not far away.

The Government on its part is playing an active role in catalysing this change. Initiatives such as the 'Cycle4Change Challenge' by the Ministry of Housing and Urban Affairs and the citywide pilots under public-private partnership modes are helping India embrace and leverage PBS to mainstream cycling. These measures including governmental support and viability gap funding only need to be strengthened going forward. Even as cities across India help citizens and businesses overcome the numerous barriers to accessing cycling through PBS, global best practices too could be considered, as seen in the previous sections. An interesting proposition is to use carbon credits to finance and incentivise cycling projects. The UN Clean Development Mechanism allows bicycle projects to earn saleable credits which can further allow the promotion of nation-wide cycling projects (UNFCCC, 2018). Enabling users to earn carbon credits simply by cycling a certain number of kilometers acts as an added impetus. However, this requires that the government, businesses, credit companies, and civil society organisations collaborate towards realising the net-zero vision through cycling. After all, an estimated reduction in emissions by 37 percent is possible through walking and cycling alone in Indian cities (Maheshwari et al., 2020).

Without doubt, mapping the road towards India's cycling future is most dependent on dialogues at policy-making level towards initiatives that put cycling in the forefront. Low-cost trials and strategic planning of short-term initiatives, medium-term goals, and long-term vision laid out around behavioural interventions and human-focussed infrastructure design is crucial. Schemes like Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and The Urban Learning Internship Program (TULIP) must be leveraged for building capacity in urban local bodies. Bicycle

infrastructure is the cheapest and increases road development project costs by only 10 percent (Kaur & Ghosh, 2021). Therefore, reallocation of funds from the transport budget may help with immediate action plans for cycling-safe environments in cities. Given the global pandemic, this is the ideal time to re-introduce dialogues around state-level NMT Policies which stress on innovative business models, participatory initiatives, and community-driven solutions.

Ultimately, cycling is dependent on its users and we as citizens must commit to sustainable travel. Citizen demand through massive, nation-wide activism in France and the Netherlands are examples of how citizens led a change in their urban mobility paradigm. Urban mobility is ever-evolving, given the transient nature of cities, and evolving needs and aspirations of people. Policies must always be resilient and have enough scope for accommodating long-term changes. Overall, the time is here for India to believe in the power of pedals.

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This White Paper presents an overview of the genesis and impact of PBS in India, details the barriers to mass adoption of PBS, highlights the measures taken around the world to promote PBS, and recommends the fiscal and non-fiscal initiatives India should urgently undertake to mainstream cycling by leveraging PBS. The paper has greatly benefitted from interactions with experts in the field of non-motorised transport. Ola Mobility Institute (OMI) would like to express sincere gratitude to Arjit Soni, Founder and CEO, MYBYK. Their invaluable insights have enriched OMI's research, and we look forward to a sustained collaboration with more stakeholders to develop, inform and disseminate actionable insights in this area of work.

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