

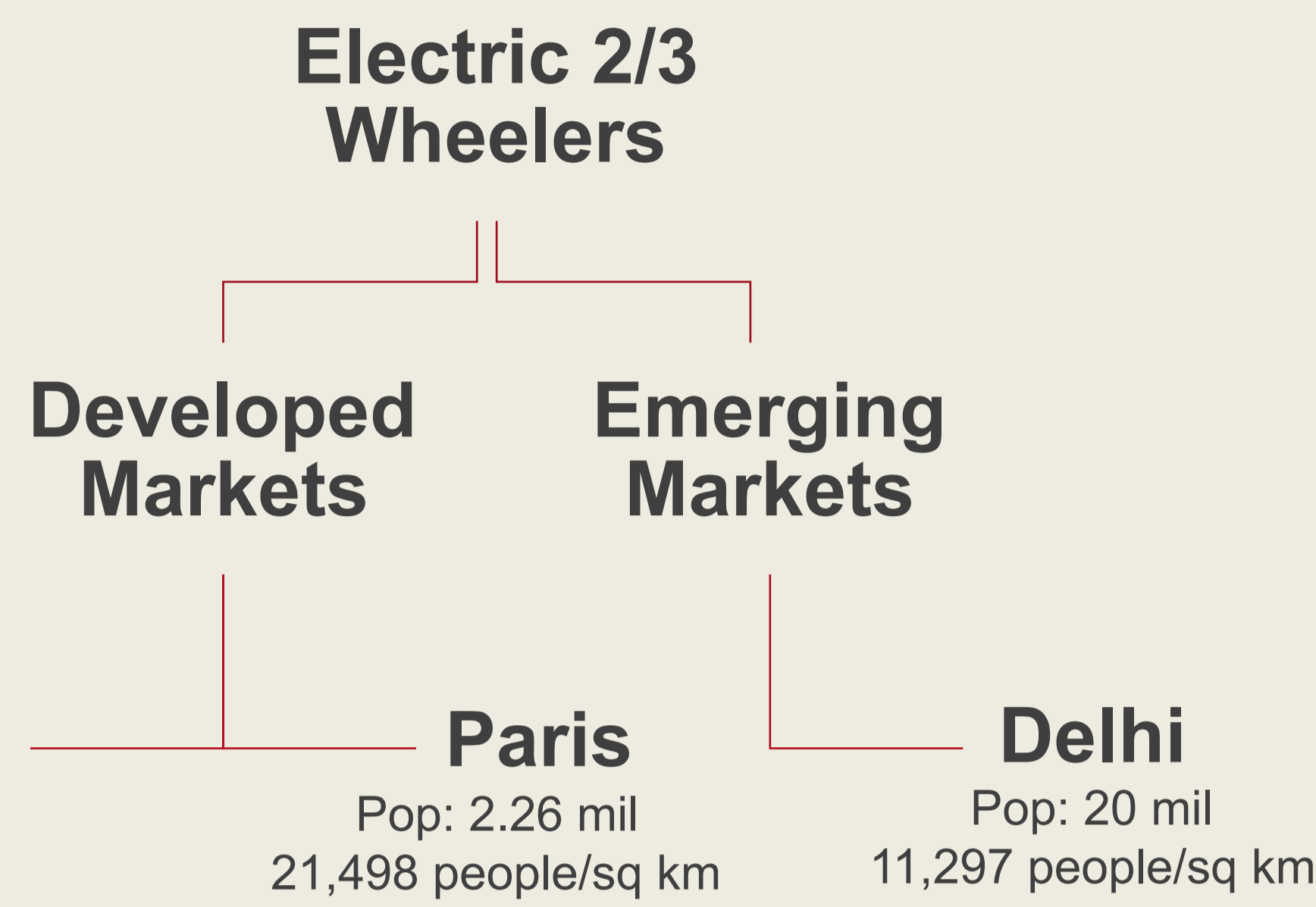
E-mobility of 2 and 3 wheelers: Copenhagen, Paris & Delhi

Agrawal, Amit; Czeh, Alexander; Singh Chouhan, Mahendra

Conference | 12 April 2018 | Berlin

Introduction Approach Systems

- How do 2/3 E-Mobility deployments compare across cities in developed and emerging markets?
- What are the lessons learned for each city?
- How can we scale such project globally?



 Bycyklen Pedelec Sharing System










 Velib Pedelec Sharing System

 Private Taxi E-Rickshaw System

Scale, Economics & Regulation Capacities & Technology

	Copenhagen	Paris	Delhi		Copenhagen	Paris	Delhi
Number of e-vehicles / Stations	1860 / 105	5460 / 1229	100.000 / free floating	Road space consumption (w.r.t. car)	9 %	9%	80 %
Usage	~ 1 mil rents in 2016	~ 20 mil rents in 2017	500 mil rents in 2017	Transport capacity - people	1	1	4-5
Passengers/users per day per vehicle	1.4	10-15	18	Transport capacity - goods - Kg	15	15	25
Vehicle capital cost (Euro)	~2,300	~2800	~1000-1500	Integration with public transport	Free Transport & Travel planner App	no	Serves as feeder for metro (S-bahn)
Price per km or per hour per passenger (E)	4	1	0.20	Electric Motor type - in Watts	250	250	650-1400 DC
Hourly price over hourly GDP per capita	17 %	6 %	25 %	Battery type	37V 10 Ah Li-ON	36V 8.8 Ah Li-ON	12V 100Ah VRLA
Regulation / licensing	License until 2021 by City administration	city government awarded the concession	Mildly regulated from 2014 - low compliances	Range km	25	50	90-100
				Speed boost (km/hr)	+22	+25	25
				Vehicle weight kg	30	25	300

Lessons Learned per E-Mobility System

Copenhagen	Paris	Delhi
<p>  </p> <ul style="list-style-type: none"> Price <ul style="list-style-type: none"> > Promote the low costs in comparison to MIT Integration in PT <ul style="list-style-type: none"> > Integration in PT supports Bike & PT User-friendliness <ul style="list-style-type: none"> > Integration of smartphones required rather than usage of an integrated tablet Subsidies <ul style="list-style-type: none"> > Subsidies can only be justified by reduction of MIT –accompanying research about effects on MIT required Network Density <ul style="list-style-type: none"> > Network density needs to be higher to increase rentals 	<p>  </p> <ul style="list-style-type: none"> Network Density <ul style="list-style-type: none"> > Critical mass of stations and pedelecs enables high adoption Integration into Urban Identity <ul style="list-style-type: none"> > Design elements and visibility on streets makes Velib part of daily life Smartphone integration <ul style="list-style-type: none"> > Users can charge their smart devices on the move Safety & Security <ul style="list-style-type: none"> > Safety accessories (Helmet, knee pad...) required User-friendliness <ul style="list-style-type: none"> > Descriptive subscription scheme required 	<p>  </p> <ul style="list-style-type: none"> Bottom up innovation <ul style="list-style-type: none"> > Grass-root innovation can solve large scale problems > Low policy interference Job creation <ul style="list-style-type: none"> > New technologies can lead to increase in employment and social empowerment Importance of training <ul style="list-style-type: none"> > Lack of institutional mechanisms for training can compromise safety > E.g. education instead of penalties Infrastructure development <ul style="list-style-type: none"> > New means of transport require supporting infrastructure (like lanes, parking spots) otherwise they may lead to chaos

Best Practices for Global Scalability & Discussion

- High population density and low private vehicle ownership support adoption.
- Electric mobility is viable and scalable for both high and low per capita income economies, if adapted to local conditions.
- Infrastructure development and integration of the system in city scape promotes acceptance and usage.
- Such systems can be implemented with a sustainable business model through corporations or individual entrepreneurs.

References

1. The article of IEEE Spectrum, 2017 By Lucas Laursen <https://spectrum.ieee.org/cars-that-think/transportation/alternative-transportation/danish-electric-bikesharing-dodges-failure>
2. Visit Copenhagen, 2017
3. Bycyklen.dk, 2018 <https://bycyklen.dk/en/the-bycykel/>
4. Website of Velib
5. Velib Wikipedia <https://www.velib2018.com/>
6. Case Study by 'C40 Cities'
7. Article in tripsavvy 'Complete Guide to Velib' Bike Rentals in Paris' by Courtney Traub <https://www.tripsavvy.com/velib-bike-rentals-in-paris-1618445>
8. Electric rickshaw, Wikipedia
9. The article of The Indian Express 'E-rickshaws versus Auto-rickshaws' <http://indianexpress.com/article/cities/delhi/e-rickshaws-vs-auto-rickshaws/>
10. Deepanjan Majumdar, Tushar Jash, Merits and Challenges of E-Rickshaw as An Alternative form of Public Road Transport System: A Case Study in the State of West Bengal in India
11. The article of Business Standard 'Easy economics: Guess how much an e-rickshaw driver in Delhi earns daily'

TU Campus EUREF Student Poster

www.mobility2grid.de