

## Smart Cities in India: Branded or Brain-dead?

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### 1 ABSTRACT

The notion of ‘smart cities’ is increasingly visible in discourses on the future of cities but Change is coming to transportation, whether we are ready for it or not. It can be argued that smartening the mobility infrastructure enables the citizens to make informed decisions, and this is indeed true- if done well, but it has a big “if.”

Rapid urbanization is leading to an increase in transport issues which is affecting the livelihood of people on social-economic –environmental levels. This research engages with the key drivers of change and provides affirmative aspirations for mobility in the not-so-distant future in order to facilitate conversations about change. However, the development of possibilities (scenarios) for the government policies and business innovation is dependent on the advanced technology and socio-economic values which are embedded in the context and culture. The thesis aims to visualize through foresight by design, plausible alternatives of sustainable future for passenger transport in Delhi to stimulate sustainable innovation developments for transportation and analyze the present innovative influences for smart mobility in Delhi and seek what can accelerate this adoption.

The first part of the paper analyses how do urban planners use the discourse of smart cities and how it has defined in India. Later it describes the transformation of Delhi from 2006 to present and highlights that the future of mobility in Delhi is in question as the capital city is immersed in pollution and congestion by private as well as public transport vehicles and an everyday increase of private vehicle population. The challenge is to cater to existing problems like increasing levels of air pollution, traffic management crisis and urban population growth; analyze the drivers of change with limited infrastructure to integrate the policies, technologies, and businesses in order to develop a sustainable transportation model which fulfills the existing needs and is flexible enough to accommodate for future.

The paper reveals the personalized mobility experiences of the existing users and their perspectives in order to search the greater effectiveness, efficiency, and safety through digital capabilities and services. Though future is fiction and it is a story which each of us writes every day but the changes in how people move from one point to another and their levels of ‘digital mobility interest’ would determine the openness of the users for the future mobility solutions. The three for the future will be empowered users, changing mobility models and transforming eco-system where intelligent connectivity would unite varied range of emerging technologies to enable smarter, healthier and more resilient and economically vibrant urban life. This research considers smart mobility by outlining current challenges, suggesting technological, infrastructural and policy solutions and distilling explorations of the future into a series of ‘user journeys.’ Further visionary examples of citizens (User personas) experiences for intelligently connected Delhi in 2050 is projected in possible pathways for an inclusive mobility design differs in significant ways from today’s systems. The report seeks to answer if ‘branding of technology’ can be used as a tool for create a new identity for mobility of Delhi or ‘upgrade’ the existing situation? How can the context of Delhi be decoded to describe the perceptions of the people?

Keywords: Liveability, Automotive Mobility, Sustainable Transport, Challenges, Narrative transportation

### 2 INTRODUCTION

Future is fiction, but the cities of the future will be ‘smart.’ ‘Smart cities’ is the most fashionable concept in urban policy nowadays but the meaning of the term is often obscure in a different context. But is a “smart city” just another buzzword or does it have some meaning? Smart City is considered like a winning urban strategy using information and communication technologies, business models, and solutions to increase the operational efficiency, share information with the public and improve both the quality of services and citizens welfare. However, according to Hollands (2008) generally, there is a complete disagreement about what a smart city is or should be, which mystifies public debates and obscures the current interests.

Mobility shapes the cities, but cities are not static, they change and adapt like living organisms over time. The city is a paradox which is overwhelmed by the increasing number of challenges but also provides ways

to find opportunities for the future, and by improving the urban mobility, our cities will allow them to thrive. Mobility reinforces everything we do as individuals; as communities; as regional, national and international economies. Though people need to move around as essential human need mobility is also considered as a luxury for contributing to the quality of life by enabling the exploration, leisure, and recreation. Mobility is also one of the stiffest and universal challenges faced by cities all over the world. Existing and emerging cities are facing challenges due to rise in urban population, global urbanization trends and influence on climate change causing problems for efficient mobility with the limited access to the capacity of physical infrastructure. Simultaneously, the expectations of the citizens are continuously changing with the global trends and are influenced by the constant innovations around low carbon or sustainable, efficient transportation technologies and by growth in infrastructural management.

Though historically, mobility was primarily viewed as a 'product' that includes vehicles, physical infrastructure, fuels required to move around but now mobility is approached as a 'service' for seamless movements from place to place. These new capabilities are based on physical and digital infrastructure and provide opportunities to improve the mobility services for the citizens, manage the physical transportation network demand in order to generate wider economic and environmental value. Focus on smart infrastructure projects are becoming a commonplace where entrepreneurial business models are disrupting the transportation sector by recognizing the patterns of mobility for the under-utilized capacity of the existing infrastructure as 'wasted assets' and thus providing 'information everywhere' for its services.

Thus, smart solutions can help to improve the efficiency of the system and redistribute the demand across modes, routes and time to solve the challenges faced by the city governments causing economic, social and environmental implications. Therefore, strategies for measurable economic and environmental sustainability and improved traveler experience would be achieved by reducing the use of fuel and power consumption for vehicles, reduction in congestion and traveler frustration and promoting the efficient, cost-effective system to eliminate adverse impacts on health and environment and would provide improved accessibility and affordability of transport providers and travelers.

However, if "smart cities" is the answer, then what was the question? We need to rethink how to tackle the demands of the city caused by the rising trend of urbanization and population increase. How can technology and intelligent design be used for creating a better world for people? Therefore technology will be used in a manner which is no longer isolated in different devices or services; rather it would be used to surround us, support us and promise us for a better urban experience. Cities of the future will only become smart if caters the need to know who we are, where we are, what we are and with whom we are. New technologies, internet of things, big data and artificial intelligence thus promises to provide an adaptable and efficient public transportation system, but there are significant loopholes which rise to questions related to privacy, equality, and ethics. Will everyone can benefit the technological transportation advances or will it be accessible only to those who have the resources or knowledge to use them? Therefore, 'how' is the crucial key for smart city/mobility solutions.

However, in a rush for the smart cities, we are seeking for wrong questions. "Smart cities" has become a buzzword in India since Prime Minister Narendra Modi outlined his vision. According to the international Bar association (2018), India's ambitious 'smart cities mission' embraces 100 cities which aims to develop the entire urban eco-system institutionally, physically, socially and economically. The rapid increase in India's urban population from 222 million in 1990, to 410 million in 2014 and is forecast to increase to 814 million by 2050 has put significant pressure on the existing urban infrastructure and services. But the smart cities ambition remains elusive in the Indian context as cities in India face a range of challenges to meet demand and supply gaps in urban regions in areas such as water, waste management, energy, mobility, the built environment, education, healthcare and safety and if timely and adequate action is not taken, these challenges may worsen and could derail India's growth (world economic forum, 2016). Ironically, this is precisely why India desperately needs a system of smart(er) cities. Therefore, India's smart cities should strive to differentiate themselves to become India's model for urban development and growth as "innovative," "sustainable," "ecologically-friendly," resilient," "liveable" and of course, "smart." However smart cities is not a magic wand to mask Indian city's problem.

If change is coming to transportation whether we are ready for it, then we need to rethink what digital technology can do to smart mobility? As digital technologies, lifestyle expectations and personal mobility

options are changing the outlook on how users will move around. The idea of the thesis is to gain an understanding from product and process thinking into customer-oriented thinking and where the most significant challenge lies in the transformation from the system driven into a customer-driven organization. With rapid economic, political, social, environmental and technological changes, there is a need to proceed with the strategic foresight to embrace the creative thinking beyond projecting the present into the future. The research considers smarter cities in terms of smart mobility, outlines the current challenges, suggest technological, infrastructural and policy solutions for exploring the future of mobility of Delhi for 2040 with a visionary series of ‘personas, user journey and scenarios’ to make Delhi as an intelligent and connected city. This research focuses on providing the alternatives for the future of mobility of Delhi from the lessons learned through the failures of existing mobility pilot projects of Delhi and reflecting on the learnings from the smart mobility solutions which can be transferable to the local context of Delhi. The passenger and user experience imagined in the thesis is intended to generate conversation about the future to provide a bigger picture in the context for future of mobility by the government for safer, better and healthier and efficient mobility systems. It focuses on evaluating the user experience of interactive systems in challenging circumstances to fulfill the research gap of how to evaluate the user experience in practice.

Delhi, which is a second most populous city in the world (world population review, 2019) has a car-centric landscape with trends of rapid urbanization, rapidly growing economies and high level of transport related problems such as pollution, accidents, and congestions which has an adverse impact of urban quality of life. Negligence of the access and transportation demand of the economically disadvantaged groups of society who rely mostly on public transportation, walking or bicycling have made an impact on poverty and social inclusion. The various modes of urban transportation-BRT, metro, bicycle, etc. have been discussed in this research in the context of urban transport characteristics, public transport, and non-motorised traffic. Delhi tends within the citizens to travel in increased comfort and showcase a status of the symbol which alters the basic norms around the transportation and causes vehicular congestion, reduced average speed and pollution level in the city.

Due to rapid urbanization and image making of the city to become a global city, external pressure is put on the mobility which raises the concern if ‘smart city’ can positively impact the future? Can technology allow us to rectify the mistakes of the past? What new possibilities will exist with the creative use of technologies? What is the ‘value’ which smart mobility will provide to Delhi? The pilot projects included indicates the trends are taking place in mobility in Delhi and the study of user experience would show the early signs of possible directional change and reveal the directions in which the future could move forward with innovation. With the increasing pace of technological change, it is important that the decisions are made not only on past experiences but also on the future possibilities and preferred outcomes. To accomplish the inclusivity in mobility, we need to ask if this is the role we want mobility to play then how do we ensure things are in place for this to happen? Smart mobility for whom? Cities for whom? The question is not ‘How do I make my city smarter by smart mobility?’ or even ‘how do I make it more efficient?’ Rather we should ask, ‘how can smart mobility be implemented in the places like Delhi where planning is both essential and broken? How can the gap between the bottom up and top-down initiatives be reduced? Does smart mobility provides solutions for the transportation problems in Delhi or does it raise the questions of resistance of being ‘alternative smart’ with a power of ‘image’?

### 3 DEFINING SMART CITIES

Despite the ongoing discussions over the past few years, there is no agreed definition of a ‘smart city.’ The label “smart city” is a fuzzy concept and is used in ways that are not always consistent. There is neither a single template of framing a smart city, nor a one-size-fits-all definition of it (O’Grady and O’Hare, 2012).

Though “smart city” gains wider and wider currency, there is still confusion about what a smart city is, especially since several similar terms are often used interchangeably. The terms “smartness” or “intelligence” usually represent an individual mental ability. Human intelligence has some key specifications like perception, communication, learning, memory, and planning. Artificial intelligence is the study of intelligent components that perceive their environment and make the right decisions. On the other hand, collective intelligence is the intellectual cooperation of the community in order to create, innovate, exchange knowledge, learn and invent. Combination of human, artificial and collective intelligence creates smart

environments (Mitchell, 2008). Collective smartness is an important aspect of smart cities because it supports creative human capital, learning, technological development, and citizen participation. In recent years, with the help of ICT, social media has become a hub for agglomeration of collective intelligence, a collaboration that supported by internet and different forms of participation opportunities (Komninos, 2008). The definition of ‘smart city’ is not just based on the use of ‘ICT.’ According to Hollands (2008), the smart city is based on “urban labeling” phenomenon that downplays some of the adverse effects networked infrastructures on cities. Cities by nature are supposed to be smart, creative and cultural, and by using this marketing label a disjuncture between reality and image is created (Hollands, 2008). There are several operational definitions which have been used for practical and academic purposes which have diverse meanings and credited by different authors to interpret ‘smart city.’

### 3.1 Frameworks of Smart City

Smart city is defined in three ways- technology- oriented vision, approach oriented vision and service oriented vision.

- ICT oriented vision system which interconnects to promote optimum performance & efficiency to create ‘systems of systems’ and are based on core-system which are composed of networks infrastructures, environments for citizens and city services.
- Service oriented vision which further consists of dimensions of Smart Economy, Smart Governance, Smart Mobility, Smart Environment, Smart People and Smart Living for self-decisive, independent and aware citizens.
- Approach oriented vision which empowers the collective intelligence and in co-creating capabilities of the users while encouraging co-operative strategies of the 4P model public, private, people and partnership.

## 4 UNDERSTADING THE INDIAN CONTEXT

### 4.1 Urbanisation in India

According to the World economic forum (2016), the urbanization is one of the biggest challenges (depending upon the regional and development factors) which both developed and developing countries across the world are facing. In 2015, the urban population in India was 410 million people (32% of the total population) and was expected to reach 814 million (50%) by 2050. Three of India’s metropolitan areas are among the most populous in the world: Delhi (25 million), Mumbai (21 million) and Kolkata (15 million) rank 2nd, sixth and 14th, respectively (WEF, 2016). This ‘disordered urbanization’ is indicative of the failure to adequately address congestion constraints that arise from the pressure of urban population on infrastructure, essential services, land, housing, and the environment (Velmurugan, S. et al., 2016).

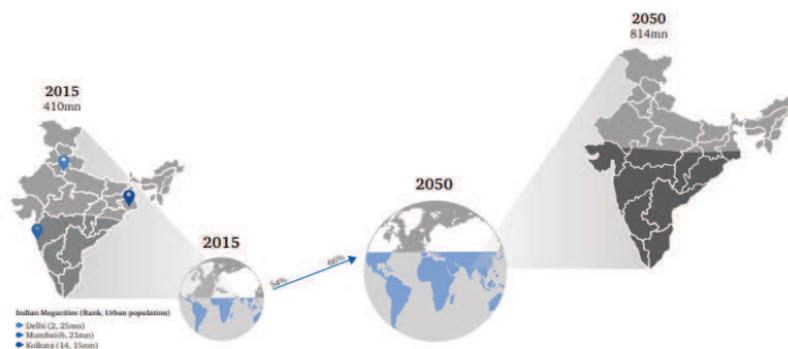


Fig. 1: Global and Indian urban population trends. Source: World urbanization prospects, the 2014 Revision

### 4.2 Emerging urban landscape of India

According to World economic forum (2016), the landscape of India has undergone a dramatic change between 2004 -2014 where India witnessed an increase in urban population from 14% to 27% while the rural population grew only 8%. Urbanization in India is occurring due to the migration of rural population to cities or existing semi-urban areas in search of opportunities. This shortcoming is due to the weak local

governments and the complex urban regime which prevails in the cities and faces challenges related to land use, water availability, power, infrastructure, and climate.

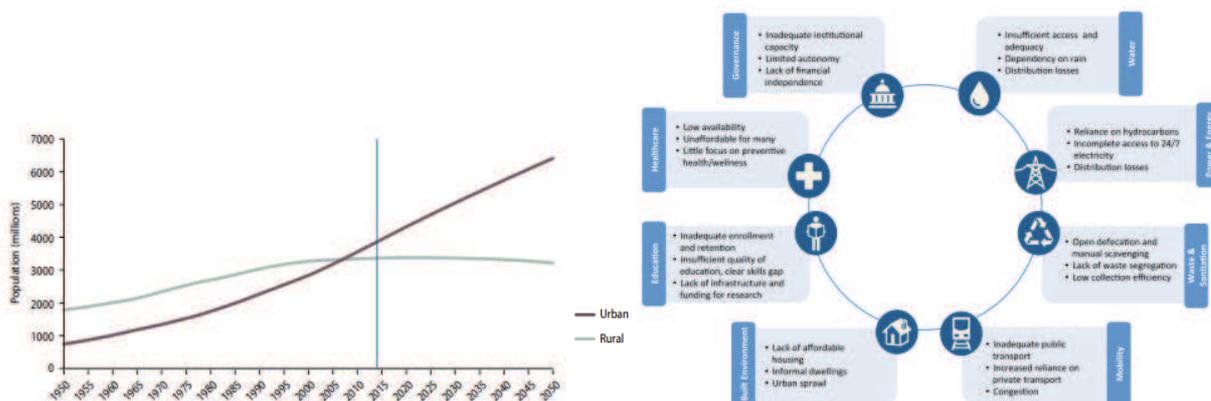


Fig. 2: Urban and rural population of the world. Source: World urbanization prospects, the 2014 Revision. Fig. 3: Challenges in Urban India. Source: World economic forum, shaping the development of urban services and futures

## 5 WHY DELHI IS A SPECIAL CASE

New Delhi, India's capital, is of particular interest not only because of the high level of air pollution and traffic congestion but also because of the exposure levels experienced by a population of 18.6 million. Delhi has astounded the World with its transformation, from feudal backgrounds to Modernity, Delhi with its rich past is the perfect contrast between Occident and the Orient. It is a relevant example of a city that responds to the dualities of urban India while keeping its physical form legible.

The government of India launched the scheme to create hundred smart cities across the country where the national capital Delhi was chosen to be the frontrunner to decongest national capital and facilitate modern abilities despite its limitations in the current scenario of economic & environmental performances & people's perceptions.

There exists a "total confusion" in the national capital owing to the multiplicity of agencies. "Until and unless we make our governance system smarter, no technology can help us," he said. "We have a Delhi that belongs to the DDA, a Delhi that belongs to LG sahab, one Delhi that is of the Delhi Police, one Delhi that belongs to the NDMC. You need to bring clarity for becoming a smart city," he added. The deputy chief minister said multiple agencies taking decisions for the people of Delhi results in "chaos," Deputy CM Manish Sisodia (2018).

### 5.1 Spatial structure

According to Delhi development authority (2014), Delhi has grown as a borderless city where the urban agglomeration area has increased from an ordinary 43.2 sq. Km (1901) to 888.74 sq. Km (2001) while the density increased from 5501 (1901) persons per sq. Km to 14521 (2001) sq. Km.

### 5.2 Economic Profile

Delhi is India's second largest economy with per capita income of € 4125 (2018) which is three times higher than the national average. The gross state domestic product (GSDP) has recorded a growth rate of 8.14% and presently is € 93.2 billion.

### 5.3 Governance complexities

Delhi faces complex issues in an administration were at the macro level, the broad structure for planning and management is split between the central government, state government and the local body (urban and rural) which is supported by various regional bodies and other technical institutions. The New Delhi municipal council is one of the five urban local bodies in the national capital territory (NCT) of Delhi, while the central government has most of the controlling power over NDMC except that the government of NCT of Delhi can also advise flexible functions for the committee through general or specific orders. NDMC is responsible for providing essential civic amenities and ensures various social, cultural, educational and medical facilities.

## 6 URBAN TRANSPORT SCENARIO IN DELHI

Delhi seems to lack an institution that holds an overarching responsibility for managing and coordinating the entire transport sector. Delhi is in a situation where things need to move quickly for the present as well as precisely for the future for the safe travel with reduced level of pollution and congestion.

### 6.1 Emerging patterns and characteristics

#### 6.1.1 Vehicle ownership

According to Delhi Statistical Handbook 2011, the vehicles in Delhi have grown at the rate of 7.41% per annum between 2003-04 and 2010-11 where the number of private vehicles has increased substantially from 3.98 million to 6.52 million during that period where the growth rate of commercial vehicles (9.42%) is higher than the growth rate of private vehicles (7.29%).

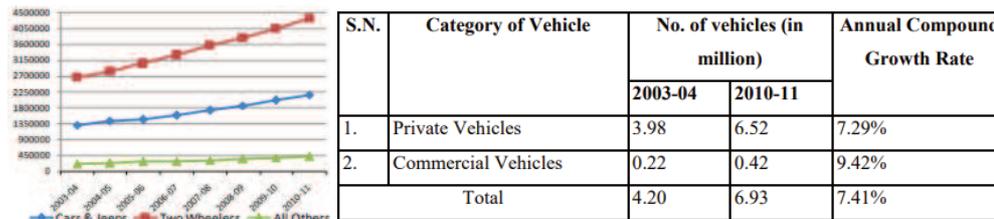


Fig. 4: Vehicular growth in Delhi. Source: Census of India, 2011

#### 6.1.2 Vehicle density

The vehicular population of Delhi has increased by more than nine times from 1971 to 1991 whereas the road length increased by only 206 times which has resulted in high vehicle density because of reduced vehicular speed which causes more extended time travel, more accidents and extra fuel consumption (Kumar et al., 2002).

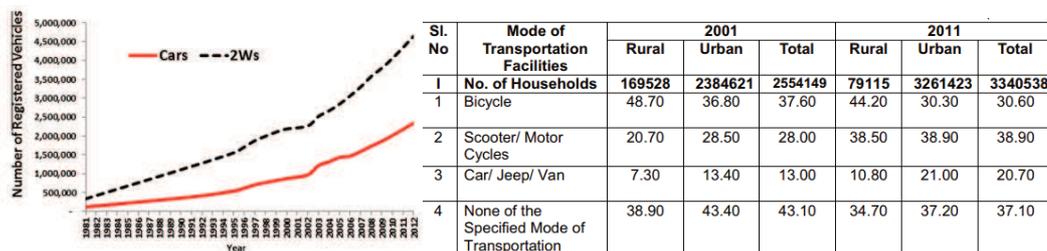


Fig. 5: Vehicle registration in Delhi. Fig. 6: Distribution of mode of transportation in Delhi. Source: Census of India, 2011

#### 6.1.3 Travel demand

The travel demand arose from 4 million trips per day (1994) to 20 million trips per day by 2011, in which the road based transport need to fulfill 12 million trips (403% increase) while the daily trips were 22.5 million in 2011(Kumar et al., 2002).

## 6.2 Transportation problems in Delhi

#### 6.2.1 Road congestion

The increases in population directly co-relates to the average travel distance and intensity. The average trip length for Delhi is around 22 km and this trend in trip length and frequency is only expected to increase with an increase in income levels, migration, participation of women and service-oriented economy but since more people travel over longer distances on a regular basis for employment and education purposes, it leads to road congestion (IIHS, 2015).

#### 6.2.2 Parking problems

The acute shortage of parking spaces both on and off the street in Delhi increases the time spent in searching for a parking spot which induces traffic congestion. 14% of road length in Delhi used on-street parking, and the public parking charges are fixed and low (€ 0.13 for 8 hours) (IIHS, 2015).

### 6.2.3 Air pollution

Delhi's air quality has become worse than before. According to the Environment Pollution Control Authority (EPCA) report for the decade 2002 to 2012 shows that the number of vehicles increased by 97 percent, contributing enormously to pollution and direct exposure to vehicular toxic fumes to nearly 55 percent of Delhi's 17 million people who live within 500 meters from any roadside (CSE, 2014).

### 6.3 Barriers

Based on the literature study and expert interviews, the barriers (Rana, NP et al., 2018) which hinders the smart mobility in Delhi.

Category	Key Barriers	Description
Governance	Lack of cooperation and coordination and confused priorities	Lack of co-ordination and confused priorities
	Institutional gap	Multiple agencies with multiple mandates
	Unclear vision for IT management	Lack of vision on how IT management can be effectively imposed for the development of smart DELHI.
	Political instability	Until there is political stability, smart cities Delhi cannot become a reality.
	Lack of trust	Lack of trust between the government & the people can obstruct the development.
	Poor private-public participation	Poor PPP interaction creates negative impact for the development of the projects
	Lack of development of common information system model	To ensure end-to-end visibility using common IS model is missing to manage the smart city infrastructure and services.
Economic	Shortage of High IT infrastructure and intelligence	Lack of IT infrastructure (e.g. solar based electrical systems, cloud computing) and capabilities of artificial intelligence (e.g. intelligent transport system, smart communities, smart grids, smart energy solutions etc.)
	Lack of competitiveness	Lack of competitiveness lies within the local firms (to deal with the challenges that emerge in the development)
	Cost of IT training and skills development	High cost of IT training and skills development programme to the IT professionals
	Global economy unpredictability	Increasing instability and uncertainty in the global economy
Social	Higher operational and maintenance cost	Cost of IT, professionals, consultancies, installations, operation, maintenance and training is high which increases the concern for the development.
	Lack of citizens participation/sense of ownership	Lack of citizen's engagement in realising the smart cities according to their experience. Citizens should be encouraged to submit and evaluate the ideas for the innovation
	Low-level community awareness	Lack of understanding among the public towards the idea of smart city and its implications on their quality of life
	Geographical diversity	Obstruction due to unbalanced geographical diversity
	Degree of inequality	High degree of inequality lies within citizen's education, income, skills etc.
Technology	Rise in traffic congestion	Increase in the usage of private transportation
	Changing lifestyle, demand for customer groups	Cause poor customer experience if their demands are not met.
	Lack of technological knowledge among the planners	Lack of enabling or transformative technological knowledge within planners and policymakers.
	Lack of access to technology	Lack of access to modern digital technology to majority of citizens can be a barrier toward smart cities development
	Privacy and security issues	Issues related to privacy and security (e.g. threats from hackers and viruses, low privacy, high costs etc.) tend to be a major concern for smart cities development
	System failures issues	Failure in public Wi-Fi systems
	Lack of Integration of IT solution with public transportation	Integration of IT solutions with public transportation is missing
Environmental	Poor data availability and scalability	lack of specific data and corresponding scalable methods
	Growing population	Rapid increase in population
	Lack of ecological behaviour in practise	Lack of ecological view in pro-environmental behaviour toward consuming energy
	Influx of Intermediary public transport (IPT)	IPT services like auto rickshaws, e-rickshaw, and cycle rickshaws adds congestion – flouts traffic and parking norms because some of them are not registered.
	Rising vehicular Pollution	The ever-increasing number of diesel vehicles due to subsidies on diesel has again led to high levels of air pollution.
	Urban sprawl & mobility needs	Expansion of Delhi (geographical) from NCT to NCR
	Lack of sustainability considerations	Lack of awareness about sustainability (e.g. available parking, reduce gas emissions etc.)
Legal and Ethical	Carbon emissions effect	lack of strict and periodic emission checks and control have led to increased carbon emissions and noise pollution
	Cultural issues – demographic pattern	Lack of inflow of creative and sharing culture of the people living together

	Perception of the status & aspirational nature	Especially for car ownership. Using sustainable modes such as bicycling is looked down upon whereas
	Women and road safety	Lack of gender based infrastructure and increased number of deaths due to road infrastructure.
	Lack of standardization	Lack of standardization across indicators (e.g. smart technologies, security, privacy, quality of life, etc.)
	Issues in openness of data	Open data and its accessibility can obstruct the smart city services delivered to cities residents and business
	Lack of transparency and liability	Lack of transparency and unclear lines of political accountability in delivering services
	Lack of regulatory norms, policies and directions	Lack of appropriate laws, regulations or directives
Physical (inefficiency)	Insufficient infrastructure capacity/supply	Lack of efficiency also causes parking problems
	Incomplete last mile connectivity	Causes Insufficient cost advantage for efficient modes of transport
	Poor infrastructure for NMT	Unsafe and inadequate infrastructure for walking and bicycling

Table 1: Barriers for implementing smart mobility in Delhi

### 6.4 Megatrends influencing smart mobility

Networking the following key technologies can bring a range of new functionalities to reduce congestion or delays, bring the social and economic changes with improved travel effectiveness and efficiency to develop the scenarios for the future of mobility 2040 for Delhi.

- Automated Vehicles
- Next generation connectivity using ICT
- Intelligent processing using Big Data and User applications
- Internet of things
- Innovative materials and Sensors in infrastructure
- User centred
- Pricing and payments
- Public and private innovation

## 7 ANALYSIS

### 7.1 Annual household disposable income

	2015-2025	Category	Income	Characteristics	Means of earning /categories
1	-13%	Deprived	<\$ 1969	Poorest Group (under official definition of poverty-2100 in urban area)	Engaging in un-skilled or low-skilled activities Part time/ seasonal worker
2	-7%	Aspirers	\$1969-\$4376	Spend half of their income on basic necessities Struggle to live comfortably	Small-time shopkeepers/ service workers
3	+13%	Seekers	\$4376-\$10,941	varied in terms of employment, attitude, age and other factors	Mid-level government official Traditional white collar jobs/ business people
4	+8%	Strivers	\$10,941-\$21,882	Considered very successful in Indian society Reasonable wealth base Financially stable	Businesspeople/ traders Established professional/ senior government official/medium scale industrialist/
5	+1%	Global Indians	>\$21,882	Cream of the country New breed of upward mobile-mid-level executives or graduated from top college Enjoys high standard of living and truly global in tastes and preferences	Senior corporate executives/large business owners/ politicians/ top tier professionals

Table 2: Based on the data from Deloitte and McKinsey & Company, Rise of Indian consumer market 2007

## 7.2 Existing Personas

After the analysis of the existing user journeys of the commuters with varying needs, goals, transportation experience, frustrations and needs 10 users were identified with their potential goal from the smart mobility in Delhi.

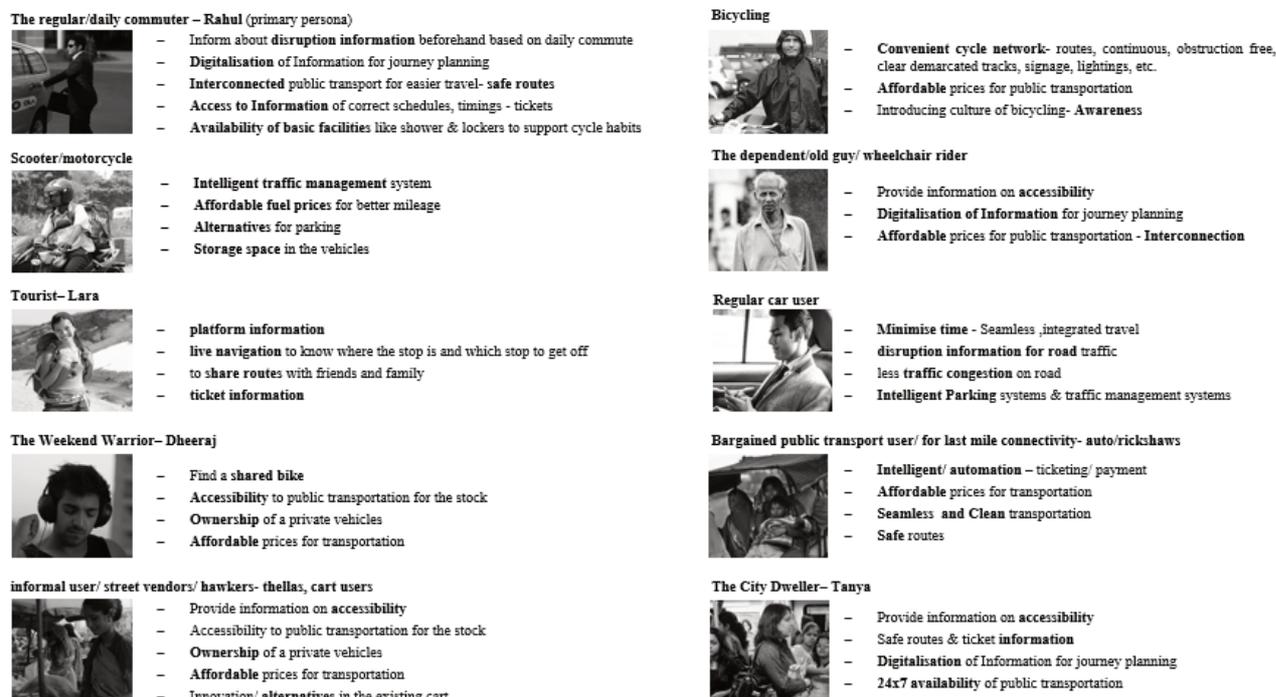


Fig. 6: Analysis of existing users. Source: Author,2019

## 8 RECOMMENDATIONS

### 8.1 Future Scenario: Live Glocal

Though it's difficult to make detailed predictions for the future of mobility, but it's not so hard when current trends are grouped with features of being enormously networked, integrated, dynamic pricing, user-centered with the development of both public and private stakeholders since we have to recognize that no single solution would save transportation from in this rapidly urbanizing and complex world. This scenario is notable by the lower per capita travel and the high use of digital substitution of ICT, user applications and internet of things for travel. Changes in the environmental and social behavior for travel demand is visible with focus on uplifting the informal transportation, increased employment, and last mile connectivity. In this scenario, automation is not widely adopted by the public. The future of mobility is likely to be fundamentally based on broadly connected vehicles, or “the internet of cars”, prices as per demand and supply; and transportation decision making through social networking but would be highly dependent on the interplay of various stakeholders from public (government, institutions) and private sector (manufacturers, entrepreneurs) as reflected in the scenario below. What will be the possible steps to reach there?

#### 8.1.1 Economic Trends

11,000 new e-rickshaws are expected to ride on the streets of Delhi every month by 2021 where annual sales are supposed to increase by 9 percent making it €132 billion markets (Economic times, 2018). However, with increased demographics by 2040, the demand for informal transportation using ICT would be increased and thus encouraging an affordable ecosystem of technology.

#### Technology

The E- mobility is shaping the informal transportation for Delhi with the increased use of E-rickshaws, thellas, etc. which play a significant role for enhancing the last mile connectivity and thus improving the air quality of Delhi. Technology-driven trends like electrification, shared mobility and connectivity would be a disruption in this scenario. However, due to several loopholes, initiatives have to be taken by the government to improve the informal transportation sector (Down to earth, 2018).

### 8.1.2 Travel implications

Though the travel will be much more expensive by 2040 in this scenario for informal sector due increased road pricing, digitalization, higher travel demands but a change in the acceptance and commuter's behavior would be visible due to improved technological advancement in transportation industry with rising in ride-sharing apps, travel information applications with increased user's experience and seamless travel.

## 8.2 Step: 1- Dynamic payment

Transportation industry is moving towards the notion where services will no more be priced statically due to widespread of mobile technology, location-based services, and predictive forecasting will allow to pay actual costs of the services used where the price (supply) would be based on the demand which will allow the users to make better decisions about their travel as per their needs to optimize the increased efficiency in the transportation system. This will allow the commuter to choose their between the lowest cost and quickest routes with the help of real-time reporting traffic conditions for their final destination.

### 8.2.1 Concern

- Who would be in charge to determine the difference between the benefits, loses or negative impact of the system where the providers have set the prices according to the demand, congestion, availability and other considerations of the services on their own? What will be the overall impact for setting the prices as per demand which would create the economic divide on the basis of congestion and freedom to drive?
- Should there be a potentially competitive market for the mobility as a service or should the pricing be dependent on the community or economic background of the social group for the commuter?

### 8.2.2 How to get there?

- By exploring new payment business models
- Promoting digital payments
- Predicting about the needs and desires of the future transportation market

## 8.3 Step: 2- Social Move

Existing transportation systems lacks in connecting all the various transportation system directly but with the rise of networked cars, awareness, social network, the future of transportation will be based on socially informed decisions of the communities, government, traffic controllers, real-time travel conditions, people's advice and community values from people who have already used it for experiential travel. Creating gamified experience which encourages fitness, saves money and provide business benefits and loyalty with the users to the services.

### 8.3.1 Concern:

- Difficulties in getting a holistic view as information would be scattered and based on the decisions of various people.
- Might create differences with the people who will not be able to attend the network or lack the ability to influence or engage to become second-class inhabitants. Will these people be able to take the benefit of such social network system?

### 8.3.2 How to get there?

- Analysing the changing behaviour and designing user-centric solutions

Providing social points as incentives and creating a gaming experience for users which allows to compare their social points for changed travel behaviour

## 9 CONCLUSIONS

Cities are dynamic. Cities are its people. It changes and adapts over time in response to economic, political and environmental shifts where the infrastructure is not the driver but an enabler, a side effect or a by-product of people and culture.

However, a city cannot be 'smart' and inefficient at the same time and therefore, high activity is far more important than the big idea for enabling the citizens to make informed decisions. For smart cities, context is more important than the product but can this smart city be simply rebooted through the integration of digital technologies? Is this 'smart urbanism' branded, exaggerated in offering 'new possibilities' for the future transformation of cities or it is a brain-dead idea of 'business as usual' value propositions for tweaking the existing scenario through technology and influence from western countries? As emerging technologies receives a lot of attention, this hype machine can be equally misleading in what it chooses to ignore since there is no clear relationship between the amount of talk of how technology could generate the potentials and create values. To access the technology advancements and its potential impacts for the society, monitoring of the future technologies is substantial because technology is not the 'shortcut for development' but it 'can be an accelerator.'

Though the idea of transforming Indian cities smarter opened up the possibilities and new ways of facilitating changes for the sophisticated city like Delhi but the powerful advocacy of political and economic lobbying became a challenge for making Smart Delhi efficient, effective, sustainable, resilient, and safe. However, smart mobility is quintessential due to the values it can provide to Delhi.

As transportation is the backbone of economic, cultural, social and industrial development, the transformation of existing urban areas to mitigate the existing challenges in a traditional society like India was a concern despite its rising economy and therefore understanding the existing spatial dynamics, hopes and fears about the technology, core needs and expectations of the transportation users was accomplished by analyzing the existing user groups to propose the experiential design for users using technology and services. India gives the appearance of just waking up to the urban realities and the inevitable transformation awaiting its cities. India's attempts to urbanization have been at a snail's pace, and the smart cities mission seem to be a knee-jerk reaction to the sudden realization of not wanting to be left behind (Chandrasekar, S. et al., 2016).

Delhi is a paradox where despite the increasing challenges it provides opportunities to shape the future of mobility. No single solution can be recognised for the rapidly urbanising and complex mobility situation of Delhi as the innovations are rarely linked and optimized to provide convenient, practical, affordable and sustainable door-to-door trips for the users. The existing challenges can only be solved for the next generation of urban transportation through connecting transportation modes, services, and technologies and bringing diverse innovations together which increases accessibility and works significantly if the needs of the people are accomplished with the rising economy. Complex challenges like urbanization, globalization, congestion, climate change, increasing social disparity, economic hardship, etc. affect the transportation fundamentally but due to emerging global trends, new modes, services, and technologies developed worldwide, there is no shortage of innovation in transportation

Connectivity is the key, but accessibility is the goal for the future of mobility as transportation is a system, or rather a 'system of systems' which connects modes, services, technologies, and designs according to the purpose and needs of the people. Therefore the transportation system should interact like the universal and customized system of 'plug and play' using technology. For the future of transportation system, it is essential to ask for what purpose the systems are optimized and connected because transportation is not an end in itself, but it is a means to an end for meeting our needs. Therefore, the approach should not be in improving the mobility but rather accessibility for an organized and efficient journey.

The future of mobility lies in the seamless transportation experience can be accomplished by physically connecting the transportation modes and services for the community, bringing together the telecommunications framework which offers real-time information of availability (departures and arrivals), access to affordable or convenient ride and quick payments. In some places, it is almost therein Delhi but not evenly distributed. It can be achieved through connecting Spatial (physical linking the transportation modes), component (enhancing the accessibility capabilities with improved infrastructure), technological (technologies to support multi-modal transportation for seamless experience), institutional (transforming collectively on local and regional level with the help of planners, city officials, innovators, etc.) and economic (developing new business models, creating jobs and increasing competitive market) optimisation of Delhi

With the shifting mobility needs and customer expectations, the future of mobility has to evolve and adapt to provide intelligent connectivity for enabling effective, seamless and end-to-end journey experience. The

urban mobility system of Delhi can work cleanly, collaboratively and efficiently only if the transportation system includes new choices for individual trip-making, better information for smarter decision making and system optimization for utilizing the infrastructural efficiency, unified service of seamless travel, safe and sustainable travel experience.

The thesis sought to answer what might be expected for the future of mobility in Delhi 2040 and How can better experience for personalised and on-demand services for travel be envisioned to facilitate the future of mobility by strengthening the robustly multimodal which provides increased resiliency when the passenger perspective is taken into account to create a cohesive and liveable urban fabric of Delhi? Knowing that the future of mobility is uncertain, scenario planning and persona cards were developed which was used to deal with the opportunities and risks of complex challenges in Delhi to identify possible, plausible futures and then explore alternative futures for Delhi 2040 instead of trend analysis or improved travel demand forecast as Flyvbjerg (2009) mentioned that predictions usually deteriorate with time due to unforeseen effects and since the relationship between present situation and future of mobility is hardly linear, the scenarios and personas identified explored the alternative travel behavior outcomes with interconnected impacts of market, policy, and consumer forces. Analysing the existing users' needs and desired helped to explore the future user journey under the themes of user-ship vs ownership, big data eco-system, Bridging digital divide and safe travels to engage the range of issues: enable better choices with smarter decisions; predictive dependable and productive mobility; cybersecurity; public safety; and mobility opportunities for everyone where distinct stakeholders like users, municipalities and owners/operators play a critical role for a safer, healthier and better user journey experience.

Live Glocal scenario describes a future of moderate growth in which incomes do not rise quickly in future informal transportation but high usage of technology for travel steered the economy towards a more sustainable path for growth and enacted constraints on vehicle ownership and driving to try to reduce their negative impacts which results in a future of strong travel demand across all modes of transportation and improved last mile connectivity. Dynamic payment and social transport to widen the recognition of 'information everywhere' to disrupt the transportation status quo and bring new ways of using existing infrastructure more efficiently with high speed and offers the chance to rethink the existing challenges for mobility of Delhi and prepares the eco-system with set of features. Through reshaping how urbanites in Delhi would get around by introducing mobility as a service and collective intelligence of the citizens might help in making better decisions but cities will need to explore the digital mobility platforms to accelerate the realization of the integrated transportation system.

Successful urban planning process can be creative, flexible and democratic because reality comes into being through interaction. However, the more significant question lies in what is next for the smart city in India? Smart cities will not be a recipe for social segregation only if inclusivity is considered along with the booming of technological development has encouraged multiple vision for urban futures of India and analyzed the 'surface' of many cities but there exist troubles with determinism and attitude of government towards the socio-political changes and consequent ways of owning and managing the initiatives as this give rise to the 'classic dilemma' for urban space and governance which affects the lifestyles of the emergence of the information society. Does this 'virtually enhanced city' in which we would live and communicate need more control or does it need more open participation? How can these two aspects be integrated? Should the smart city's ethos be oriented towards service provision with better city management or should it focus on enhancing the social and political linkages for public discourses? Does the policies and technological initiatives aim at the 'end-users,' or it is aimed by the 'actors and owners' of the city?

Technology will only enhance the future of smart mobility if the technology works around the 'existing behaviors'. Technology is interesting and is the future only when it interacts according to the human understanding and therefore, understanding the value exchange is important which can be implemented by encouraging gamified experiences that is helpful to get the loyalty of the services using the long-term relationship and big data. Working towards human experiences will create more business value for the city and of everyday people on the move. Though the future lies in the hidden connections as it is not difficult to change the city but to change their mindsets. Therefore, evolving a mobility landscape after understanding the patterns of consumer behavior and analyzing how to build the services around the existing infrastructure with 'on-demand' and personalized mobility services also known as 'mobility as a service (MaaS)' will unlock the potential for innovation for the city to function on a larger scale.

Things which are hardly mentioned in the ‘smart cities propaganda’ is the ‘other side of the city’ and therefore the ‘branding’ of smart cities have to do by keeping and creating the spirit and emotions of India.

Who wants smart cities and who does not want to be seen as being smart? Does the discourse of smart in India explore the global explorations with the value of smart cities or with the needs and realities or urban India? In order to understand the algorithmic urbanism of smart Indian cities, the examining of the politics of a country is essential. What is next to cities or what could be next for cities if we dare to reimagine ourselves? What is next for the future of mobility? Are we there yet? Will Delhi be a city of things or a city for people?

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