

Smart Maps for Smart Cities

Urban India's
\$8 Billion+ Opportunity



Confederation of Indian Industry

Dalberg

Preface

This is an independent study conducted by Dalberg Global Development Advisors in association with the Confederation of Indian Industry (CII) and supported by Google, from September 2014 to April 2015. The team comprised Gaurav Gupta, Ya'ir Aizenman, Sanchali Pal, Sneha Iyer, Ahmed Nadeem Khan, and Aditi Singh. We would like to thank Dr. Anand Arni and Mr. R. Swaminathan for their advisory support on the study. Additionally, this research would not have been possible without the assistance of a number of contributors and experts. We are grateful for the critical input provided by Aejoy Alias, Dr. G.V. Ramana Rao, and Siddhartha Bhattacharya of GVK; Amit Prasad of SatNav; Anokhi Parikh of London School of Economics; Ashwin Mahesh of Mapunity; Dale Kunce of American Red Cross; Dhananjay Parkhe formerly of TNT; Elsa D' Silva of Safecity; Fabien Mendez of Loggi; Harkabir Jandu of Snapdeal; Husein M. of Terralogiq; Jagir Rathore of Smart Freight Center; numerous contributors from Google; Dr. Lavanya Marla of UIUC; Maneesh Prasad of Directions Magazine; Manish Dubey and Vasim Qureshi of Ziqitza Healthcare; Mayank Banerjee of Delhivery; Mikel Maron of Map Kibera; Neeraj Singhal of Uber; Primoz Kovacic of Spatial Collective; Professor Mukund Rao of ISRO; Rajesh Aggarwal, the IT Minister of Maharashtra; Sandhya Guntreddy of Microsoft; Sarah Hughes, Jer Thorpe, Ben Rubin, and Noa Younse of the Office of Creative Research; Dr. Sean Qian of CMU; Sophia Tan of IBM; Adam Frank of Palantir; Anita Patil-Deshmukh and her team at Pukar; Bharti Sinha and Yogita Shukla of Association of Geospatial Industries; Charlotte Baumert, Carlo Ratti, and Carlotta Sillano of MIT Senseable City Laboratory; Manish Sharma of PwC; and Simarprit Singh of Compare Infobase Ltd.

This study was also invaluablely shaped by the design expertise offered by Dalberg Design Impact Group (DIG) colleagues Montana Cherney, Melanie Kahl, and Robert Fabricant; editorial input provided by Urvashi Gulia; communications support by Anja Tranovich; and thought partnership of several colleagues at Dalberg.

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Executive Summary

Smart Maps are critical tools to accelerate progress toward India's social and economic development agenda. Maps answer the basic questions that come up in our daily lives – for citizens, for businesses, and for governments. Maps help us search for places we are interested in, pinpoint their locations, optimize routes to get there, understand surrounding neighborhoods better, and communicate better with others. When maps cannot answer these questions, we rely on other sources that may be costly, time-intensive, or incomplete. Smart Maps use cutting-edge technology to enable users to quickly and effectively achieve their day-to-day and long term goals. Smart Maps capture detailed data for a broad range of inputs; present data in a user-friendly, intuitive format; are dynamically maintained in real time; and allow individuals to add additional information, creating a platform for innovation.

Smart Maps have a range of applications across sectors and regions of India, but hold particular promise to help achieve the Government of India's ambitions around Smart Cities. India will see the greatest migration to cities of any country in the world over the next 35 years, with over 400 million new inhabitants flooding into urban areas. Infrastructure will grow too: from 2007 and 2013, India's road network expanded by one-quarter, while the number of total businesses increased by one-third. As India's cities continue to grow, even painstakingly compiled maps will be outdated within a year or two. Cities have the greatest density of Internet users, the most infrastructure and road information to capture, are changing at unprecedented rates, and are driving India's social and economic growth. Smart Cities is a particularly pertinent lens through which to understand the value of Smart Maps.

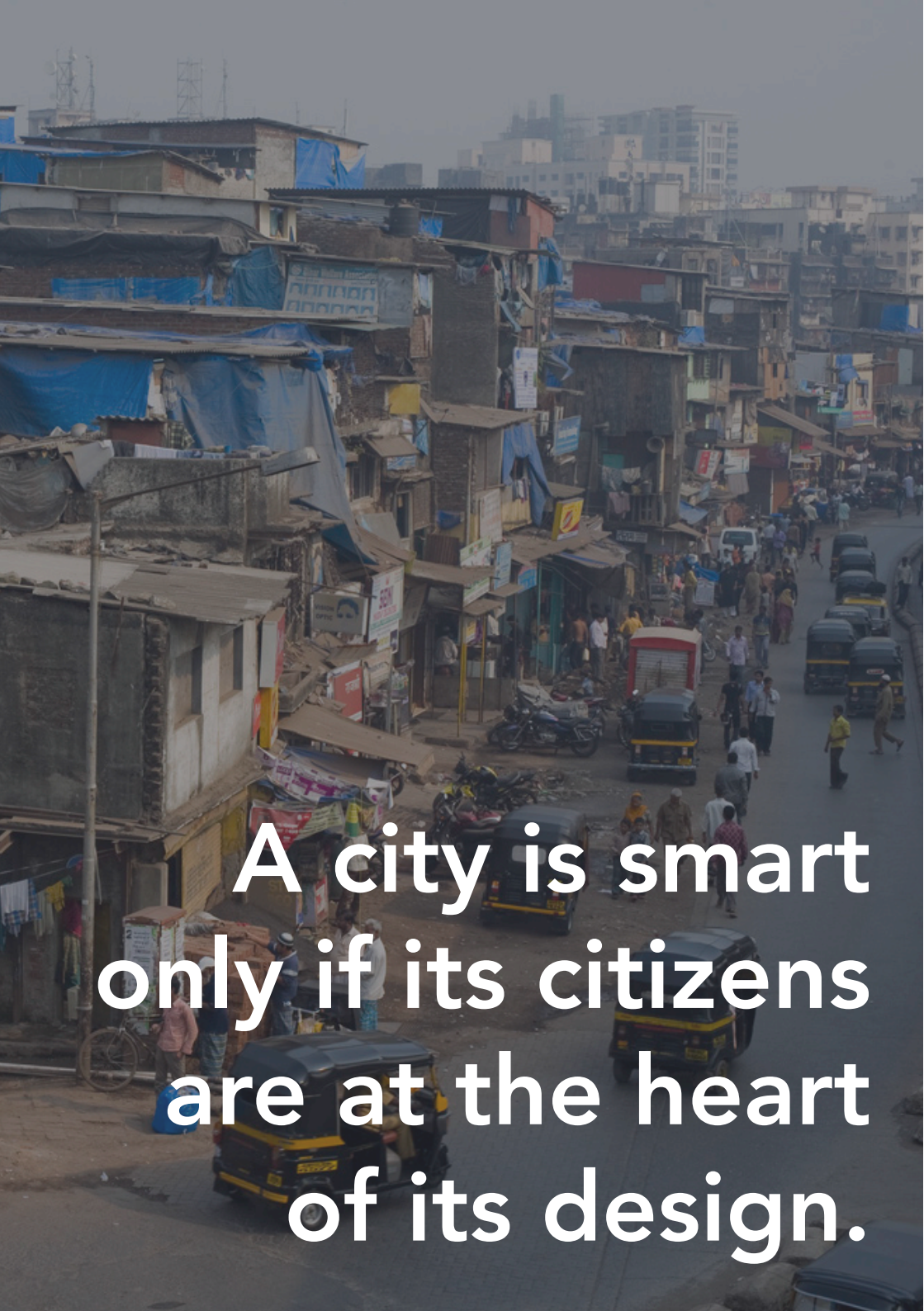
We find that Smart Maps can help India gain upwards of USD \$8 billion in savings and value, save 13,000 lives, and reduce 1 million metric tons of carbon emissions a year, in cities alone. The broader economic and social benefits of Smart Maps for citizens, businesses, and the government are likely many times greater. To arrive at these estimates, we analyzed the value of a set of nine high-potential uses of maps in Indian cities. For each of these use cases, we assessed the current base case scenario without Smart Maps, identified a realistic improvement based on cross-country comparisons of map improvements, and finally estimated the value that would accrue to Indian citizens, businesses, and government as a result.

Smart Maps are even more important for India than for other countries. First, India has the second-largest population in the world and the seventh-largest land area. Simply put, there is an enormous amount of data that our maps must capture, and we need advanced technology to do this effectively. Second, this gap in map coverage will expand further as India's cities continue to grow at a rapid pace and development accelerates. Third, India has an extremely diverse population. With over 100 languages spoken across the country and a wide array of cultures, maps must respond to a variety of user needs. While the quality and features of map have improved significantly over the years, maps need to be updated faster and have better coverage of local features and businesses to make them as helpful as possible for users.

With the second-largest smartphone market in the world and one of the fastest-growing internet economies, India is in a unique position to tap into the value of Smart Maps. India needs a policy framework that encourages scalable solutions and unleashes the latent value that maps hold for Indian users. A mapping policy that encourages innovation and scalable solutions can help the private sector create a world-class mapping and GIS industry that benefits Indian citizens, businesses, and government.

A map is only
as good as
the benefits
it provides its
users.





**A city is smart
only if its citizens
are at the heart
of its design.**

01

Smart Maps
can redefine
India's urban
future.

Online and digital maps have improved significantly in India but need a lot more innovation and functionalities to serve Indian users and keep pace with a fast changing urban landscape.

Maps have come a long way. From being a basic tool for identifying addresses and roads, they now shape myriad ways of understanding and communicating with our environment. In India, the quality and features of maps have improved significantly over the years. However, in a dynamically changing and complex landscape like India, continuous innovation is needed to drive locally-relevant and effective solutions. Smart Maps go far beyond providing a simple view of what the world around us looks like or the distance between point A and point B. They cover a broad range of detailed data, allow users to interact with information easily and intuitively, are built to update quickly and correctly as our environment evolves and changes, and form a platform for new and innovative applications. Whether it is informing commuters of real-time traffic

restrictions, offering tailored suggestions about points of interest based on previous user behavior, or enabling businesses to add their own details to reach more consumers, Smart Maps fundamentally enrich our daily interactions. Their universal reach and intuitive user interface allow all users, even those with limited digital experience, to access all types of information quickly and effortlessly.

What defines a Smart Map?

Smart Maps capture a **broad range of detailed data**, such as roads (with details including lanes, speed limits, and turn restrictions), shops, offices, points of interest (types, user ratings), and other information (bike and transit routes, building shapes, etc.).



DETAILED DATA CAPTURE

What defines a Smart City?

Fundamentally, a **Smart City is one that unifies data** from a wide range of sources – embedded sensors, public services, citizen reports, telecom companies, and more – **to inform decision-making** by policymakers, businesses, and citizens.

Smart Maps are designed so that **users can quickly and intuitively interact** with them despite having virtually no training, ensuring that information reaches the **widest possible audience**.

Smart Maps are **built to update quickly and correctly** as cities change and evolve.



e.g., road blockages, business closures and openings, new infrastructure

Smart Maps encourage invention and innovation by making it easy for **users or enterprises to add additional layers of their own data**, either for private use or for sharing with the public.



CITIZEN-CENTRIC APPROACH

Smart Cities' systems are **built around the needs of their citizens**, providing the data they need in a usable format.



DYNAMIC UPDATING AND ADAPTATION

Smart Cities adapt in real-time as the city's fabric changes:



*Everyday events
(transit, street closings, grid outages)*

*Rarer events
(disasters, foreign summits, sporting events)*

*Long-term changes
(new neighborhoods, roads, services)*



PLATFORM FOR INNOVATION

The ultimate goal of a Smart Cities approach is to build cities that provide the tools and environment to **enable citizens to develop their full potential**.

The scale of smart India.

India has
5 million
kilometers
of road and
45 million
businesses.¹



DETAILED DATA CAPTURE

“Smart Cities integrate and analyze massive amounts of data to anticipate, mitigate, and even prevent problems.”⁴

CISCO SMART + CONNECTED COMMUNITIES

10-15%

of roads have some change in status – e.g., name, conditions, limits – each year.²

20%

of all Internet searches ask “where” something is; Google Maps has 1B users.³

1 million

businesses use Google Maps as part of their websites.³



CITIZEN-CENTRIC APPROACH

“Smart Cities are needed to handle changes in the environment... and shifts in the lifestyle values of residents... Smart Cities are always evolving.”⁵

HITACHI Smart Cities



DYNAMIC UPDATING AND ADAPTATION

“Cities need to apply advanced IT, analytics and systems thinking to develop citizen-centric approaches.”⁶

IBM Smart Cities



PLATFORM FOR INNOVATION

“Smart Cities attract investments, experts, and professionals...to offer economic opportunities to all their citizens.”⁷

MoUD, GoI

1 IndiaStat.com transportation statistics.

2 Olson, Parmy. “Q&A With Waze CEO Noam Bardin.” Forbes. June 2013.

3 Google.

4 Clarke, Ruthbea Yesner. Smart Cities and the Internet of Everything. Cisco. 2013.

5 Hitachi's Vision for Smart Cities. Hitachi. 2013.

6 Dirks, Suzanne et al. Smart Cities for Smarter Growth. IBM Institute for Business Value. 2010.

7 Draft Concept Note on Smart City Scheme. Ministry of Urban Development, Government of India. October 2014.

02

Smart Cities
are the future
of India.

Cities and development are taking center stage in India.

Indian cities will grow faster than those of any other country in the coming years. By 2050, India will add over 400 million urban inhabitants, while China will see an increase of 290 million inhabitants over the same period.⁸ By 2030, seven Indian cities will have a population of over 10 million; in 2011, only Mumbai and Delhi had populations over 10 million. This amounts to a 37% increase in India's urban population. Cities will generate over 70% of the GDP and 70% of new jobs by 2030, driving a four-fold growth in per capita incomes nationwide. Indian cities are projected to require 700-900 million square meters of new commercial and residential space by 2030, or the size of a new Chicago every year.⁹ Overall, 2.5 million square meters of roads and 7,400 kilometers of metros and subways must be added to India's urban expanses. This is 20 times the capacity that has been added over the last decade.

To complement this rapid and inevitable growth, the government has set an ambitious goal to develop

"100 Smart Cities." This plan was supported by a public investment of over \$1.2 billion in the 2014-2015 fiscal year, with additional funding from private investors.¹⁰ Several top technology companies including Cisco and IBM are already working alongside the government to upgrade India's technology systems. Not surprisingly, the government's report on Smart Cities asserts, "to accommodate this massive urbanization, India needs to find smarter ways to manage complexities, reduce expenses, increase efficiency and improve the quality of life."¹¹ In India, the Smart Cities push is drawing attention to the larger, critical need for better, more thoughtful urban growth and development. In this study, we focus on the potential that Smart Maps hold to help address this need.

8 World Urbanization Prospects 2014. United Nations Department of Economic and Social Affairs. 2014.

9 Sanke, Shirish et al. "India's Urban Awakening: Building inclusive cities, sustaining economic growth." McKinsey Global Institute. 2010.

10 Tolan, Casey. "Cities of the Future? Indian PM pushes plan for 100 Smart Cities." CNN. July 18, 2014.

11 Government of India. "Smarter Solutions for a Better Tomorrow." September 2014.

The Rapid Urbanization of India

By 2050, India will add

400

million urban inhabitants.

For comparison, China will see an increase of

290

million inhabitants in the same period.⁸

By 2030, cities will generate over

70%

of the GDP and new jobs.⁹

By 2030, 7 Indian cities will have populations over **10 million**⁹

Indian cities are projected to require

700-900

million square meters

of commercial and residential space by 2030.

(That's the size of a new Chicago every year.)⁹

Smart Maps are a critical tool for development in cities.

Cities are a useful lens through which to analyze the value of improvements in maps. Cities have a high volume of internet users – at least 140 million of India’s 240 million estimated internet users are urban.¹²

Cities have greater and more complex density of physical infrastructure (roads, shops, restaurants, addresses, etc.), which better maps can help people navigate. Additionally, cities are experiencing change at unprecedented rates as urbanization skyrockets, making accurate, up-to-date geospatial information even more critical. And finally, cities are today, more than ever before, engines of economic and social development in India.

The same characteristics that define a Smart Map can be applied to a Smart City. A map is only as good as the benefits it provides its users; a city is smart only if its citizens are at the heart of its design.

First, a Smart City unifies

data from a wide range of sources, such as embedded sensors, public services and infrastructure, citizen and community reports, companies, and more. This data informs decision-making processes for policymakers and everyday choices for businesses and citizens. Second, Smart Cities develop infrastructure and services around the needs of their citizens. They are designed to best serve the wide array of demands that a diverse and densely concentrated citizenry expresses, placing the people who live in the city at the heart of its design. Third, Smart Cities develop systems to learn and adapt in real-time. Smart Cities are able to adjust the way they execute, whether these changes result from daily events (e.g., daily changes in transit due to street closure), long-term changes in the environment (e.g., new neighborhoods, roads, demographic shifts), or one-off rare events (e.g., natural disasters, health crises, political upheaval, foreign summits,

sporting events). Ultimately, the goal of a Smart Cities approach is to build cities that provide the tools and the environment to enable citizens to innovate, progress, and develop their full potential. The Ministry of Urban Development has helped to advocate for this change: “Smart Cities attract investments, experts and professionals...to offer economic opportunities to all their citizens.”¹³

Smart Maps are an important tool for creating and managing Smart Cities. All major characteristics of Smart Cities described above are supported and enhanced by the widespread availability of Smart Maps.

¹² Internet and Mobile Association of India. November 2013.

¹³ Draft concept note on Smart City scheme. Ministry of Urban Development, Government of India. October 2014.

¹⁴ Berst, Jesse. “Why Rio’s citywide control center has become world famous.” Smart Cities Council. September 4, 2013.



Learning from Brazil

In 2013, Rio de Janeiro won the Smart City Expo World Congress “Best Smart City of 2013” for its use of maps to monitor and deploy city resources. The city has set up an Operations Center with a Smart Map that analyzes 60 different data layers, populated with data gathered from sensors around the city. Information on weather forecasting, traffic and transport, utilities, security, and emergency information is visualized in real-time to inform more efficient deployment of government resources. This and other tools have reduced emergency response times by 30%.¹⁴

03

Smart Maps + Smart Cities

big benefits

Smart Maps increase the everyday effectiveness of users in little ways that add up to huge economic benefits for citizens, businesses, and government.

The value of Smart Maps is far broader than just the direct benefits of the geospatial industry, which contributes over three billion US dollars in direct revenue to India's GDP.¹⁵ Accurate and real-time road and traffic updates can help commuters select the fastest routes, save time, and reduce fuel consumption and carbon emissions. Precise information on roads, traffic conditions, road restrictions, and landmarks can help ambulances find patients faster, shaving critical minutes off their response time. When users are able to find local businesses on maps, they not only save time and money they would have otherwise spent attempting to physically find what they are looking for, but also gain access to a wider choice of products and vendors. Businesses, on the other hand, gain new customers and increase revenues. Map Kibera and Slum Dwellers International, among other organizations, have shown that maps can provide an element

of legitimacy to marginalized citizens and communities, who are otherwise willfully or implicitly rendered invisible by the government and the private sector. Being on the map enables them to gain access to critical services such as public utilities and bank accounts. Map-based applications also empower citizens to inform the government of critical needs in infrastructure and service provision, enabling faster and more efficient resolution of civic issues.

¹⁵ "Putting the Indian Geospatial Services Industry on the Map." The Boston Consulting Group. January 2013.



Maps answer basic questions daily, adding up to enormous benefits for society.



Where should I go to find the product or service that I am interested in? Which places will have what I am looking for? Which ones are best, and which are nearest?

Where exactly is it located? What is the exact site I need to go to? What does it look like?

How do I get there? Which turns should I take? How can I avoid traffic jams or other problems? How long will it take?

What is the local neighborhood like? What is the road network like nearby? What other goods and services are available? What is new or different?

How do I communicate and coordinate with others about where I am? How can I tell others where I am going? How do I communicate what my experience is like?

04

Economic and social benefits of Smart Maps

The benefits of Smart Maps are extensive.

For this report, we examine four high-potential Indian use cases of Smart Maps in detail:



1
Traffic and
Commuting



2
Emergency
Services



3
Local
Retail



4
Tourism

We provide a high-level overview of five additional use cases. These demonstrate ways in which Smart Maps improve the fabric of a city and the lives of those within it.



5
Civic
Engagement



6
Logistics
and Delivery



7
Disaster
Response

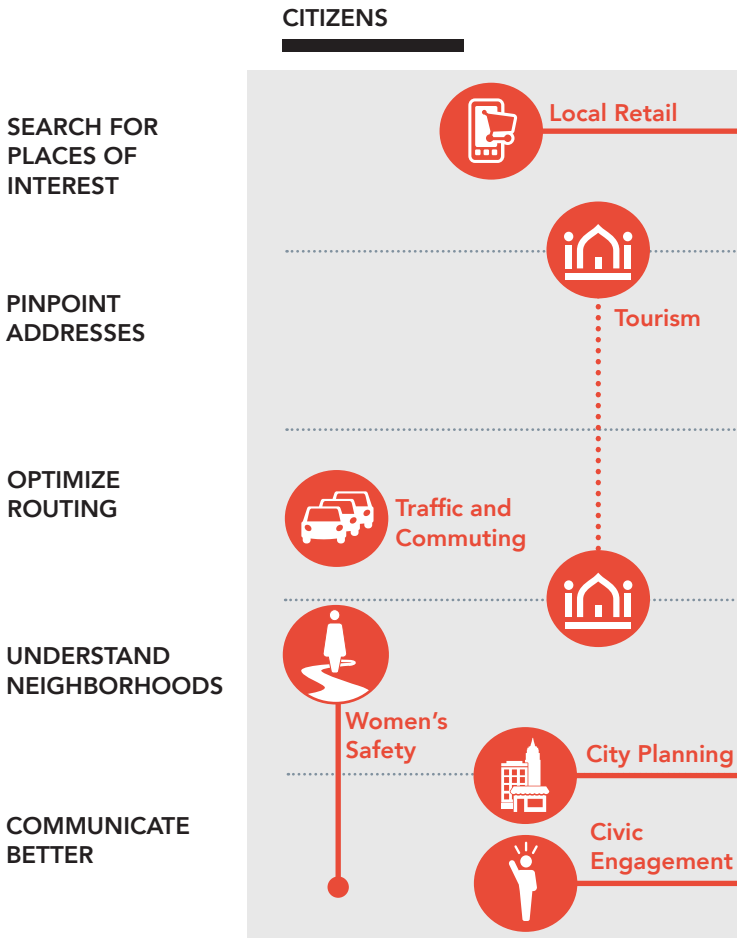


8
Women's
Safety



9
City
Planning

Nine Transformative Use Cases of Smart Maps in India.



BUSINESSES

GOVERNMENT



Emergency Services



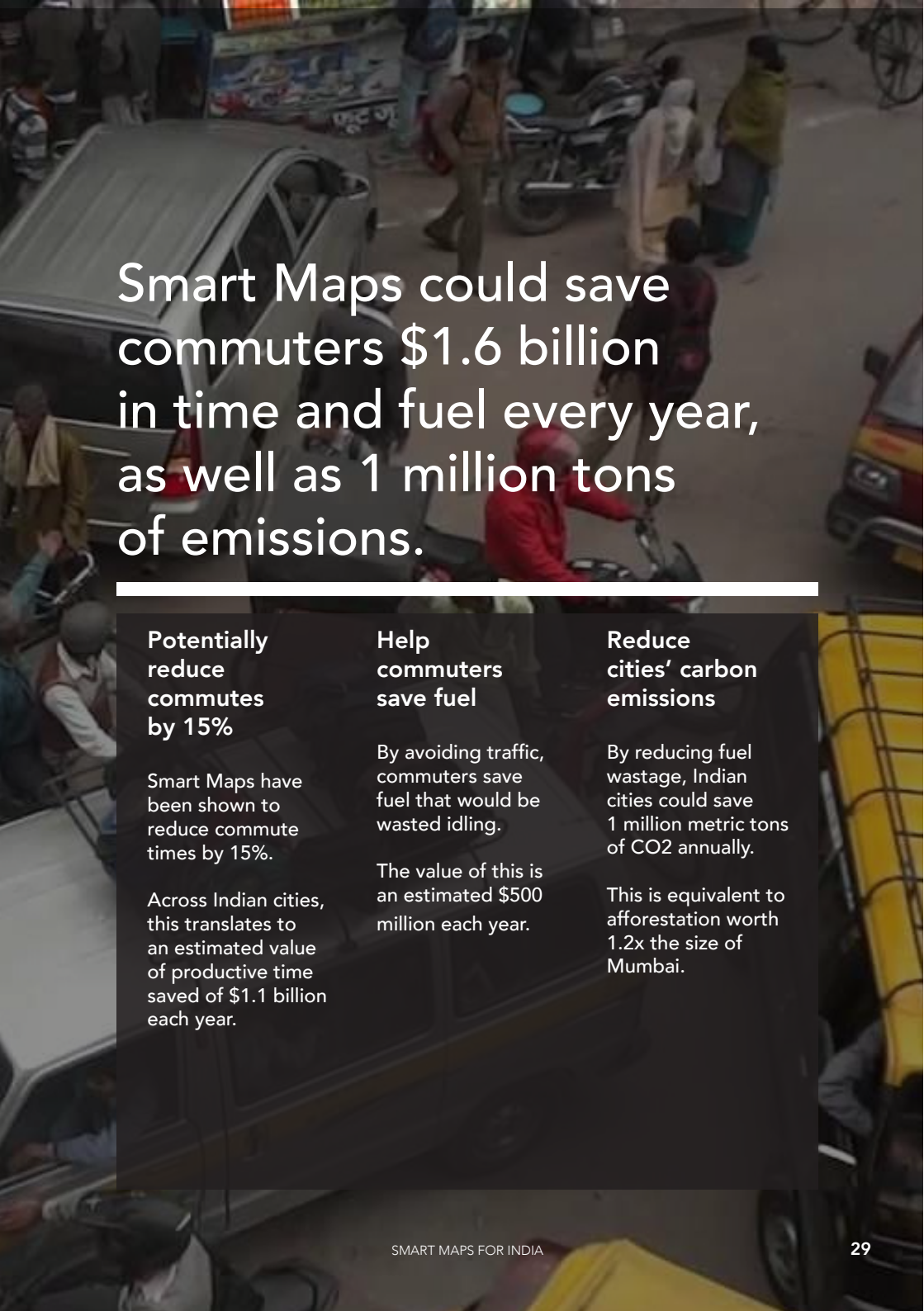
Logistics and Delivery



Disaster Response

A high-angle, slightly blurred photograph of a busy street in India. In the foreground, a green three-wheeled truck is loaded with several large cardboard boxes and a white patterned cloth. To its left, a yellow and green auto-rickshaw is partially visible. In the middle ground, a person is pushing a handcart loaded with several red and blue gas cylinders. Other people are walking and standing around, some with bags or items. The background shows more street activity, including a white van and a person pushing a cart. The overall scene depicts a bustling, everyday urban environment.

1 | Traffic and Commuting



Smart Maps could save commuters \$1.6 billion in time and fuel every year, as well as 1 million tons of emissions.

Potentially reduce commutes by 15%

Smart Maps have been shown to reduce commute times by 15%.

Across Indian cities, this translates to an estimated value of productive time saved of \$1.1 billion each year.

Help commuters save fuel

By avoiding traffic, commuters save fuel that would be wasted idling.

The value of this is an estimated \$500 million each year.

Reduce cities' carbon emissions

By reducing fuel wastage, Indian cities could save 1 million metric tons of CO₂ annually.

This is equivalent to afforestation worth 1.2x the size of Mumbai.



1

Traffic and Commuting

High traffic congestion is a major problem in Indian cities. In a new study by the Ford Motor Company, 49% of respondents in India spent more than half a day every week behind the wheel. This is significantly more than counterparts in China (42%), Thailand (37%), and the Philippines (31%) spend.¹⁶ Not only does traffic congestion create frustrations for individuals, but it also has extensive negative effects on the economy, health, and environment. An estimated one in four urban Indian workers commute over 90 minutes each day, leading to huge losses in productive time.¹⁷ The Transport Corporation of India estimates that India loses \$11 billion annually due to traffic congestion on highways alone.¹⁸ Furthermore, vehicles in idling and slow-moving traffic emit nearly four times more pollution per mile than when they are moving at an optimum pace, acutely affecting air quality and health in cities.¹⁹ Pollution has serious effects on respiratory functions and morbidity. A 2008 study by the Central Pollution Control Board found that Delhi residents had significantly

higher incidence of coughing, wheezing, breathlessness, asthma, reduced lung function, chronic headache, and eye and skin irritation associated with greater pollution.²⁰

Improved maps have the potential to help shorten commutes by providing real-time updates and better traffic information. Smart Maps provide more accurate base road information on existing and new roads, road restrictions, speed limits, etc. In addition, they can incorporate live information crowdsourced from thousands of travelers on the road each moment to alert users in real-time about accidents, traffic jams, oil spills, flooding, and construction work. This allows users to optimize their commute by planning their way around gridlocks and slowdowns. Smart Maps can also provide users with a more accurate sense of when they should leave and when they might arrive, allowing commuters and businesses to better plan their trips and anticipate delays.

For example, Waze, a community-based traffic and navigation app, analyzes user input to calculate near-accurate travel time estimates and identify the fastest routes. With more than 50 million users worldwide, Waze crowdsources all its data, creating highly customized, user-centric maps. Waze studies have found that commuters have experienced a 15% reduction in travel time by using improved maps.²¹ Moreover, the app has widely been used by governments in times of disasters and major events to ensure efficient traffic control. For example, when fuel shortages hit New York after Hurricane Sandy in 2012, the White House asked Waze to identify which petrol stations were open.

Smart Maps can benefit Indian commuters by saving time, fuel, and reducing carbon emissions. Based on 2011 data from the Census of India, 7.7 million households have at least one car. Given the average Indian commute time of 60 minutes,

if Smart Maps could reduce commute times by 15% as experienced by Waze users, this pegs the potential value of productive time saved at \$1.1 billion each year across Indian cities. By avoiding traffic, these commuters reduce fuel that would be wasted idling – an estimated \$500 million each year.^{17,22} Finally, the reduction in fuel could reduce CO2 emissions by one million metric tons annually. This is equivalent to afforestation worth 1.2 times the size of Mumbai. These estimates are conservative as they do not take into account broader health and environmental impacts and only account for the potential impacts in Indian cities.

16 Ford Driving Habits Survey. Ford Motor Company. December 2014.

17 "1 in 4 workers in India commute over 90 mins/day." Survey by Regus. 2010.

18 "India loses \$10.8bn annually due to traffic congestion." Transport Corporation of India. 2012.

19 Croitoru, Leila and Maria Sarraf. "The Cost of Environmental Degradation: Case Studies from the Middle East and North Africa." World Bank Publications. July 2010.

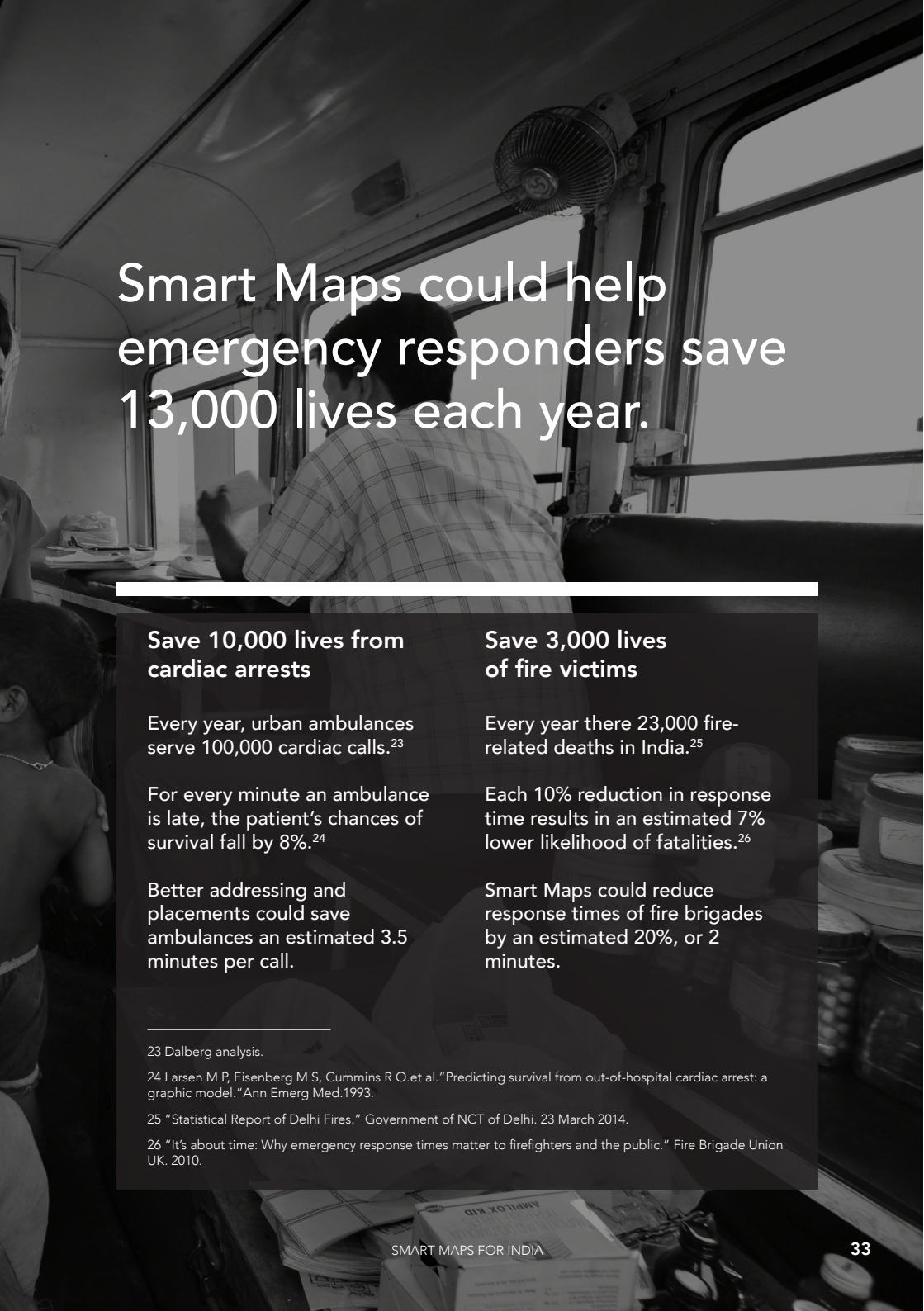
20 Rizwa, SA et al. "Air Pollution in Delhi: Its Magnitude and Effects on Health." Indian Journal of Community Medicine. March 2013.

21 "How The Waze App Can Save You Time on Your Commute." Bloomberg TV. March 2013.

22 Dalberg analysis. Calculation based on current income levels in cities, average commute time, and existing number of cars.



2 | Emergency Services



Smart Maps could help emergency responders save 13,000 lives each year.

Save 10,000 lives from cardiac arrests

Every year, urban ambulances serve 100,000 cardiac calls.²³

For every minute an ambulance is late, the patient's chances of survival fall by 8%.²⁴

Better addressing and placements could save ambulances an estimated 3.5 minutes per call.

Save 3,000 lives of fire victims

Every year there 23,000 fire-related deaths in India.²⁵

Each 10% reduction in response time results in an estimated 7% lower likelihood of fatalities.²⁶

Smart Maps could reduce response times of fire brigades by an estimated 20%, or 2 minutes.

²³ Dalberg analysis.

²⁴ Larsen M P, Eisenberg M S, Cummins R O. et al. "Predicting survival from out-of-hospital cardiac arrest: a graphic model." *Ann Emerg Med.* 1993.

²⁵ "Statistical Report of Delhi Fires." Government of NCT of Delhi. 23 March 2014.

²⁶ "It's about time: Why emergency response times matter to firefighters and the public." Fire Brigade Union UK. 2010.



India's urban emergency services respond to 10.8 million emergency calls daily, half of which are ambulance calls. But emergency vehicles in India spend approximately 25% of their response time attempting to find a patient's exact location after getting to the vicinity from which a call originated.^{27, 28, 29,30}

A lack of accurate, up-to date map information significantly hampers emergency response services in India. Ambulance companies have difficulty precisely pinpointing callers' addresses, often relying on drivers' own knowledge and directions from locals. Police dispatchers struggle to ensure the fastest possible response because they lack visually precise information on where their on-ground cars are located and the exact location that calls are originating from. Sometimes not being able to pinpoint the exact location of a call leads to delays while it is ascertained which police station's jurisdiction applies to a particular caller. Moreover, without real-time

information these first-response vehicles cannot optimize routing to avoid closed streets or traffic jams and subsequent delays. Additionally, because emergency response planners cannot scan a precise history of where emergency calls originated and how long it took to respond and why, they cannot analyze how best to place their vehicles on ground in the future, or establish potential alternative routes.³¹

By tying addresses to locations, Smart Maps can help eliminate the uncertainty about where callers are. Smart Maps can also automate processes, reducing delays throughout the system. Smart Maps can also automate processes, reducing delays throughout the system. They can automatically identify the nearest responder, communicate to them where they need to go, and let managers follow them in real-time. Furthermore, Smart Maps can route responders around road closures, traffic jams, and other obstacles. Smart Maps and smart placements of emergency

vehicles can materially reduce response times and save lives. The average ambulance response time in India is 15 minutes, nearly twice the international standard.³² A pilot conducted by the Emergency Management and Research Institute (EMRI) and Google in Ahmedabad found that smart placements helped ambulances arrive 10-15% faster.

Cardiac calls and fires are two specific situations in which faster response times could have enormous implications for health and safety. Every year, urban ambulances serve 100,000 cardiac calls.³³ For every minute that an ambulance is late, the patient's chances of survival fall by 8%.³⁴ The combination of better addressing and improved placements could save ambulances an estimated 3.5 minutes per call. This could potentially save 10,000 lives from cardiac arrests alone. In addition, there are 23,000 fire-related deaths in India every year.^{35, 36} A 10% reduction in response time results in an estimated 7%

lower likelihood of fatalities.³⁷ Smart Maps could help reduce response times of fire brigades by an estimated 20%. This could potentially save the lives of 3,000 fire victims. We find that Smart Maps have the potential to save 13,000 lives in Indian cities each year from fire and cardiac emergencies alone.

27 Dalberg interviews with Dr Ramana Rao, Siddhartha Bhattacharya, and Aejy Alias, GVK EMRI. November 2014.

28 "Statistical Report of Delhi Fires." Government of NCT of Delhi. March 23, 2014.

29 Dalberg analysis.

30 Dalberg interview with Manish Dubey, Ziqitza Health-care, October 2014.

31 Ibid.

32 "Emergency Management and Research Institute Newsletter." GVK EMRI. April 2014.

33 Dalberg analysis.

34 Larsen M P, Eisenberg M S, Cummins R O, et al. "Predicting survival from out-of-hospital cardiac arrest: a graphic model." *Ann Emergency Med.* 1993

35 "Statistical Report of Delhi Fires." Government of NCT of Delhi. March 23, 2014.

36 Dalberg analysis.

37 "It's about time: Why emergency response times matter to firefighters and the public." Fire Brigade Union UK. 2010.



AMER ROAD,

3 | Local Retail



Smart Maps could help local businesses earn \$2.2 billion and save shoppers 12 million hours from wasted searches.

Local purchases, driven by smartphone searches, rise by 10%

India has 116M smartphone users, out of which 78% search for local business at least once a week.

However, only 20% of these searches in India result in an in-person purchase, as compared to 73% in the US.

Even if better maps can increase this rate by 10% in India, it can lead to an increase in smartphone driven in-person retail by \$2.2 billion.

Millions of users waste less time being lost

If more accurate maps could help users save just 5 minutes per journey, it could save users 12 million hours per year.

This is almost equivalent to a day's worth of productivity for Kolkata's working population.



3

Local Retail

Local Indian businesses lose customers to larger retailers every day, partially due to the frustrations that potential customers encounter trying to find them. In India, 78% of smartphone users use maps on their phone to search for local businesses or services at least once a week. However, only 20% of those searches result in an in-person purchase, as compared with 73% in the USA. This can be largely attributed to the fact that between 80-90% of Indian businesses are not listed on online maps today.³⁸ As business addresses and road names are often not prominently displayed on the street itself, Indian users rely on referential landmarks for locating places. 360-degree panoramic street level imagery can make viewing of areas possible and enable users to navigate unfamiliar areas more confidently. Even when maps list shops, often the locations are off: either by a little, i.e., in the wrong part of the neighborhood – or by a lot, i.e., in the wrong part of town. As a result, despite

consumer interest, only a few searches convert into an in-person purchase.

Improved maps can help consumers make informed and efficient retail decisions and enable local retailers to increase their revenue. Smart Maps help users to preview shops, read reviews by previous customers before visiting, and to contribute their own afterwards. Using Smart Maps saves time and money for users by helping them avoid wasted trips. Local businesses, meanwhile, earn from higher footfalls resulting in better revenues. Widespread crowdsourcing lets local and small business owners list their businesses, making their goods and services visible and therefore accessible to potential customers.

The quality of maps and functionalities like mobile navigation, place search, rich information about places have improved over the last ten years. But with thousands of small

retailers and rapid development of new and existing neighborhoods, faster and better coverage of local businesses are needed to make maps most relevant for users. The unique challenges of dealing with India's diverse addressing structure offer opportunities for mapping companies to innovate and create locally relevant solutions and make maps easy and useful for citizens. While only 5-6 % of SMEs in India have a website, 10-20 % of businesses are available on online maps. Online maps provide a unique opportunity to bring many more SMEs on the Internet. Multi-pronged efforts to create awareness amongst SMEs, crowdsourcing and government and private sector partnership can accelerate this.

As of conservative 2014 estimates, India has at least 116 million smartphone users.³⁹ With more accurate maps, these users would be able to better find what they are searching for when they search for a local retail establishment. Even if

better maps could facilitate a 10% improvement in users being able to find what they are looking for and make a purchase, when they search for a local business, this could lead to a \$2.2 billion increase in smartphone driven in-person retail. Furthermore, if more accurate maps could help users save just five minutes per journey, it could save users 12 million hours per year. This is almost equivalent to a day's worth of productivity for the entire city of Kolkata.

38 "Our Mobile Planet: India." Google. 2013

39 Meeker, Mary. "Internet Trends 2014." Kleiner Perkins Caufield & Byers. May 28, 2014.



4 | Tourism

A man with a large grey backpack and sunglasses is walking through a market stall in India. The stall is filled with colorful clothing and fabrics hanging on racks. In the background, there are other people and a sign that says "DOORS ANTA 859085".

Smart Maps could increase foreign tourist spending by \$1.9 billion.

1% more foreign tourists visit

45% of Americans surveyed say they plan their trips using online maps. If better maps help bring in 1% more foreign tourists each year, this would directly increase tourist revenue by \$180 million.

Tourists spend \$5 more per day

80% of tourists surveyed say they use online maps while traveling. If better maps could encourage each tourist to make one additional \$5 transaction per day, this would increase total revenue by \$450 million annually.

Revenues increase by \$1.9 billion

Given that each dollar of direct spending in tourism generates \$2 of indirect benefits, the total impact of these two changes would be \$1.9 billion per year.



The Ministry of Tourism's (MoT) report on Competitiveness of Tourism Sector in India cites "lack of proper dissemination of information" as a primary issue.⁴⁰ Further, in the report, 60% of foreign travellers cited the Internet as their primary source on countries to visit – more than any other source. Maps give people the information they need when visiting somewhere new: they help visualize sites, discover new places to visit, and see how cities connect. Before they go, maps help tourists understand a country's road connectivity and opportunities along the way.

While they are in a country, maps help visitors update their plans in real time and even potentially extend their stay as they discover nearby places of interest. Smart Maps also encourage tourists to spend more in a country. Maps help tourists better understand the hotel options available to them and find more local attractions and activities to spend on.⁴¹ Additionally, maps

help tourists find safe areas, identify emergency resources, and feel more confident visiting new areas. Technologies such as Google Street View or 360 degree panoramic imagery serve as important sources of information for prospective tourists and seasoned travelers. They allow tourists to plan their visit, understand a country's road connectivity and local attractions along the way.

40 "Report on Competitiveness of Foreign Tourism in India." Ministry of Tourism. 2012.

41 "The 2013 Traveller." Google. November 2013.





5

Civic Engagement

Smart Maps can facilitate citizen-centric governance.

Support effective voting systems

A Dalberg/PUKAR survey found that 10% of residents in Kaula Bandar, Mumbai, reported issues voting in at least one of the past four elections because election scripts could not be delivered to their houses.

Secure utility connections and bank accounts

Addressing the Unaddressed, an NGO in Kolkata, helped residents obtain bank accounts, Aadhar cards, ration cards, and electricity connections directly by gaining a mappable address.

Enable citizens to have a voice

By providing a readily accessible, user-friendly, visual forum for public discussion, maps enable residents, especially the poor, to have a greater voice in local planning and governance.



Smart Maps could save \$1.4 billion for the Indian road logistics industry, primarily benefitting small business.

Road freight is a \$55 billion market

The India road logistics industry is a \$55 billion market, and expected to grow as a proportion of the overall freight industry at a rate of 9% CAGR.^{42, 43, 44*}

Better maps could save 2.5% of costs

Labor and fuel drive approximately half the cost of intra-city delivery. Industry estimates suggest that using GPS technology saves companies an average of at least 10% across labor, fuel, and capital. Conservatively, we estimate that half these savings could accrue directly from the development of Smart Maps.^{45, 46*}

The benefits especially help small businesses

82% of trucking companies have fewer than 20 vehicles. These small operators cannot afford to invest in expensive GIS equipment and must rely on consumer products. Saving money is especially important to them because they only run 4-5% margins – in contrast to the 10-15% earned by bigger players.

* See page 49 for footnotes.



Smart Maps help governments before, during and after disasters.

Before: Plan for disaster

With exhaustive knowledge about road networks, the locations of sites such as police stations or clean water pumps, and the growth of new neighborhoods, governments, and citizens can identify the best evacuation routes.

During: Coordinate their response

With Smart Maps, responders can match addresses and other information to find exactly where people in need are. Smart Maps also play a critical role in helping organizers track and manage their teams, and communicate with other organizations.

After: Rebuild the city

With crowdsourcing approaches, base maps can be rebuilt within weeks instead of years. In turn, leaders can make prompt decisions and begin the process of recovery.



Smart Maps can help women feel safer.

Women can scout locations before they go out

With street-level imagery, crowdsourced safety information, and detail on where important spots like police stations and ATMs with 24-hour guards are, women can visualize the neighborhood before they travel to identify “safe” and “unsafe” spaces.

Women can effectively send alerts when they feel unsafe

With Smart Maps, women can tell their family and friends where they are when they feel in danger. In turn, their loved ones can help them find safe spaces, call for help, or figure out the quickest way to reach them.



A 1% improvement in urban planning due to smarter maps could result in \$270 million in value for municipalities.

Urban planning costs 1.5% of India's GDP

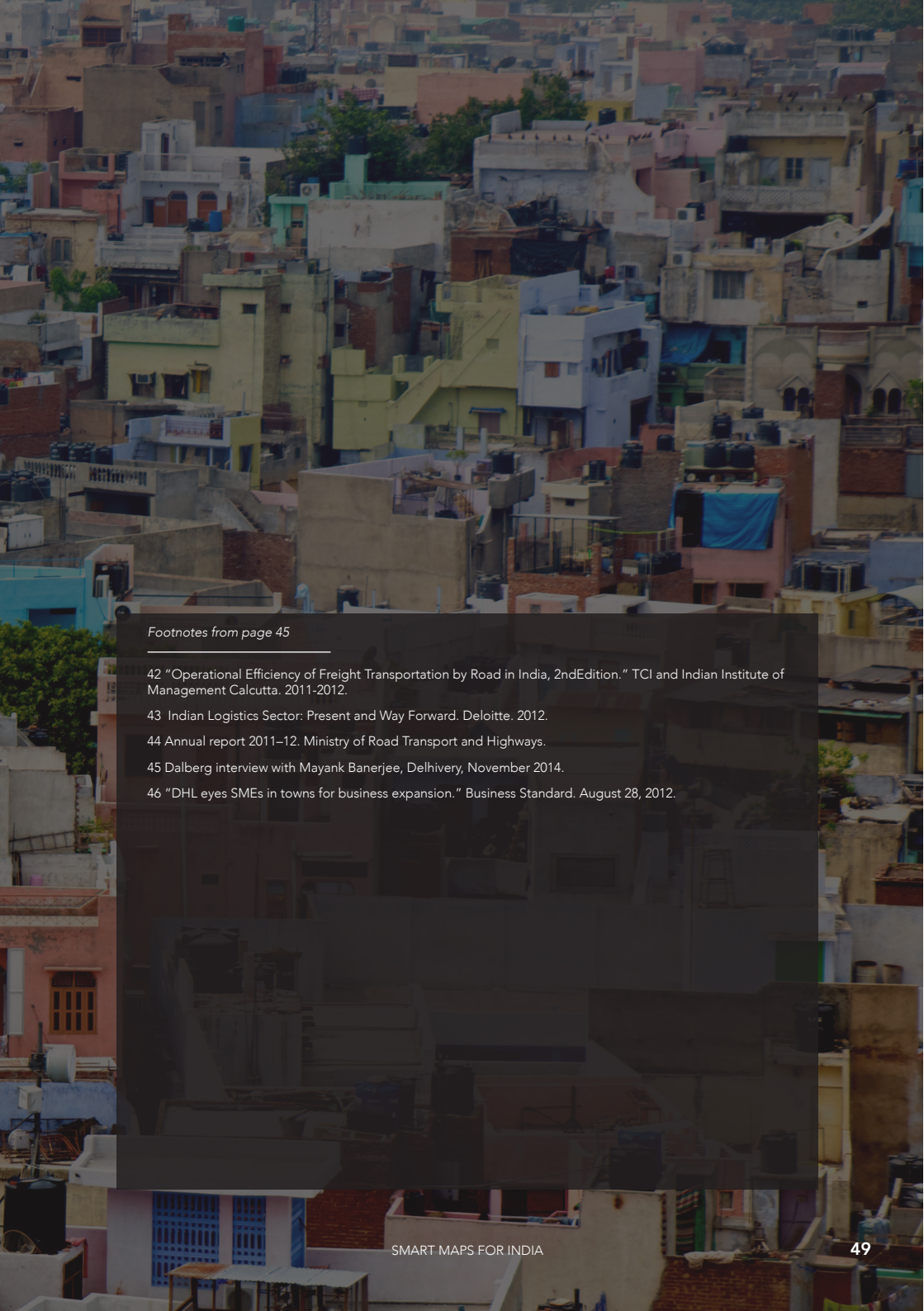
In 2011/2012, the Indian Institute for Human Settlements (IIHS) estimated urban expenditure on infrastructure and services amounts to 1.5% of GDP.

Smart Maps could increase spending effectiveness

Better maps could improve urban management by helping detect violations, improving accountability, ensuring infrastructure and government offices are optimally placed, and streamlining planning processes.

A 1% improvement in planning yields \$270m in value

Even if Smart Maps could provide a 1% improvement in the effectiveness and value of planning processes, this would result in \$270 million of value per year.



Footnotes from page 45

42 "Operational Efficiency of Freight Transportation by Road in India, 2nd Edition." TCI and Indian Institute of Management Calcutta. 2011-2012.

43 Indian Logistics Sector: Present and Way Forward. Deloitte. 2012.

44 Annual report 2011-12. Ministry of Road Transport and Highways.

45 Dalberg interview with Mayank Banerjee, Delhivery, November 2014.

46 "DHL eyes SMEs in towns for business expansion." Business Standard. August 28, 2012.

05

Getting to Smart Maps for India.

Smart Maps in India have a unique opportunity for high-impact growth.

India has the second largest population in the world and the seventh largest land area. Simply put, there is an enormous amount of data that our maps must capture. Also, this gap in map coverage will expand further as India's cities continue to grow at a rapid pace. India will see the greatest migration to cities of any country in the world over the next 35 years. Infrastructure will grow too: from 2007 to 2013, India's road network expanded by one-quarter, while the number of total businesses increased by one-third. As India's cities keep expanding rapidly, even painstakingly compiled maps will be outdated within a year or two. The Government of India's support for Smart Cities will strengthen cities' abilities to accommodate this dramatic expansion. Additionally, India has an extremely diverse population.

With over 100 languages spoken across the country and a variety of cultures represented within every city, maps need to be particularly able to respond to different user needs. And lastly, India has the potential to be a global innovator in the geospatial industry. For a country with a particularly strong information technology (IT) industry, the contribution from geospatial services is a small proportion of the overall IT sector – only 3%, as opposed to 6% in China and 12% in the US. This indicates that much more direct value remains untapped from India's geospatial industry.

Online maps in India have come a long way in recent years, but still lack advanced features and functionalities available to users in more developed markets.

The quality of maps and functionalities like mobile navigation, place search, rich information about places have improved significantly in the last few years. While maps in India have a good coverage of urban roads and highways, the need to keep pace with new roads and flyovers being constructed is critical. Additionally, there is a need for improvement in rural coverage of maps in India. The dynamically transforming landscape of a developing country poses a greater challenge than that of a developed market. The unique challenges of dealing with India's diverse addressing structure

offer great opportunities for mapping players to innovate locally relevant solutions and make maps easy to use and useful for citizens.

There are a number of technologies critical to achieving Smart Maps but are difficult to access under the current policy framework.

Crowdsourcing is an example where citizens contribute local knowledge about by-lanes and smaller roads, establishments (e.g. Business listings, tourist sites), and other useful information (e.g. pedestrian or bike routes). Crowdsourced data is especially useful for identifying changes in local conditions, such as new shops in a locality, or during critical situations like a natural disaster, for instance, for rescuing trapped people at the earliest. Crowdsourcing has been used effectively through OpenStreetMap to map the narrow and complex roads

in the slum of Dharavi in Mumbai and in the aftermath of the 2010 Haiti Earthquake to rapidly gain information on resources, transport, and victims remaining in a devastated landscape, to name just a few examples.

Where such efforts have been undertaken, users have benefitted enormously.

These benefits include the increase in the number of exact addresses mapped, corrected names for a quarter of road segments, and additional details on road access points to markets and hospitals. Even security-concerned countries, such as Israel and Russia, work with mapping companies to carefully manage national strategic interests while still gaining the benefits of new and innovative mapping technologies.

India has an opportunity to embrace the latest in technology, and offer its citizens the ability to play a role in bringing the power of Smart Maps to everyone.

A mapping policy that encourages scalable solutions can help India achieve its ambitious goal of creating 100 Smart Cities. To truly benefit citizens, in cities, and ultimately, across the country, new technologies and techniques will be needed. A modern mapping policy might include measures to encourage widespread use, with limited restrictions, of the government's existing Open Series Maps base dataset; promote crowdsourcing and vehicle-based data acquisition; and create a centralized committee of ministerial bodies

that can set clear policies and serve as a single point of contact with industry. Smart Maps can be a critical and simple first step towards making every city in India smarter and more responsive to the needs of its residents.

India has much to gain from unleashing the potential of smarter maps for smarter cities.

In India today...



1 in 4 urban workers spends over 90 minutes commuting each day.



Ambulances lose precious minutes – up to 25% of response time – locating addresses.



Only 20% of local map searches for businesses convert into an in-person purchase, compared to 73% in the US.



Only 6.6 million foreign tourists visit each year, one-quarter as many as Thailand and Malaysia.



Over half of urban slum residents surveyed did not know the location of their nearest government office.



Logistics companies spend 53% of costs on last-mile delivery.



39 million citizens were affected by natural disasters in the past 4 years, which also caused \$7 billion in damages.



73% of women fear for their physical safety when traveling at night.



Cities are multiplying – by 2030 India will need to add 20 times more urban roads than what it built in the last decade.

Smart Maps can help...

- Save \$1.6 billion in productive time and fuel, and 1 million metric tons of CO2 emissions.
- Save 13,000 lives by reducing emergency response times.
- Increase revenues to local retailers by \$2.2 billion and save users 12 million hours in lost time.
- Increase foreign tourist spending by \$1.9 billion.
- Help 200 million Indians gain addresses, enabling them to access basic civil services.
- Save the road logistics industry \$1.4 billion.
- First responders and relief organizations quickly find people in need, even as the situation changes in real-time.
- Women scout neighborhoods before they go, and send for help when they feel unsafe.
- Gain \$270 million in value for every 1% expenditure on urban infrastructure and services.

Smart Maps will make a smarter, stronger India.

What can you do to help India embrace Smart Mapping technology?

Share widely.

The impact of Smart Maps will have a profound effect on the social and economic fabric of India. Share these insights with your family, friends, and colleagues.

Take action.

How can you help contribute to the development of Smart Maps in your community or organization?

Join the conversation.

Engage with others who are curious about how technology is changing the landscape of urban areas around the world.

[#SmartMapsIndia](#)

[#DalbergCities](#)

[@DalbergTweet](#)



Methodology

Estimating the value of maps through specific use cases

To reliably quantify the significant value of Smart Maps, we drill into a bounded set of applications of maps to a key development agenda in which the value of maps has particular potential: Smart Cities.

To estimate the value of maps in Indian cities, we conducted extensive research and expert interviews to identify nine high-potential applications of maps that represented a diversity of benefits to everyday citizens, businesses, and government. For each of these applications, we developed models to estimate the value that would be likely to accrue to these users as a result of a “realizable improvement” in map quality. These ‘realizable improvements’ were estimated based on quantitative comparisons to the experiences of other countries that have recently achieved improvements in map quality,

Each of the nine models applied the following structure:

1. **Assessment of the base case.** We used industry reports, research, and consultations with experts to estimate the total number of relevant users, the frequency with which they use maps, and the way in which they use maps to understand the relevance of online maps to a particular application today.
2. **Identification of a “realizable improvement” based on cross-country comparison or conservative assumption.** We used the experiences of other countries that have recently achieved improvements in map quality based on the introduction of modern mapping technologies, including those of Indonesia, Brazil, South Africa, and Israel. For most applications in which there was no appropriate parallel experience with robust data, we modeled the potential effect of a 1% or similar improvement, taking an intentionally conservative stance.

3. Estimation of the resulting value to map users. We modeled the results that the above data would be likely to produce over a one-year time period, taking the assumption for calculation purposes that this value would accrue with an instantaneous change to the quality of maps.

There are also other quantifiable benefits of maps that we examined but do not go into depth here. In total the benefits of time saved, increased efficiency and better planning help to achieve \$8 billion+ in value and savings for individuals, businesses and governments.

Our estimates are in line with results from previous research. In 2013, the Boston Consulting Group's study *Geospatial Services: An Emerging Growth Engine for the Indian Economy* identified that geospatial services drive \$40-50 billion in direct revenue and \$70-75 billion in indirect cost savings overall.

In fact, the results presented here likely represent a conservative estimate of the larger societal value of maps to Indian users, as this analysis focuses on rigorously and tangibly demonstrating the value of a limited set of high-potential applications of maps in Indian cities.

For further information on the methodology used, please contact Dalberg Global Development Advisors. For specific questions, contact Sanchali Pal at Sanchali.Pal@dalberg.com.

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