NAVIGATING NAIROBI

Digital Innovation in Urban Transport and Logistics in Kenya

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THE FLETCHER SCHOOL
TUFTS UNIVERSITY

THE INSTITUTE FOR
BUSINESS IN THE
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ABOUT

The Institute for Business in the Global Context

THE INSTITUTE FOR BUSINESS IN THE GLOBAL CONTEXT

The Fletcher School's Institute for Business in the Global Context (IBGC) was founded in recognition of the need for a new approach to the study of international business and capital markets—one that prepares global business leaders with essential "contextual intelligence."

Through four core activities—research, dialogue, education, and lab—the Institute provides an interdisciplinary lens through which global markets and the underlying drivers of change can be understood. IBGC's Inclusive Growth Initiative aims to explore the potential trade-offs and innovations needed to disrupt classical business and economic frameworks and create truly sustainable prosperity for individuals, communities, and private enterprise.

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The MasterCard Center for Inclusive Growth was created to foster collaborative relationships between academia, governments, nonprofits, the social design community, and the private sector. Through the advancement of research and strategic philanthropic investments, the Center will support and enable those historically excluded from financial services and serve as a catalyst for change.

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Since 2009, the Institute for Business in the Global Contest at The Fletcher School and MasterCard's Center for Inclusive Growth have collaborated to pioneer new models and experiential learning in international business through collaborative research projects.

The IBGC-MasterCard Research Fellowship in Inclusive Growth offers the unique opportunity to engage exceptional Master's candidates in cutting-edge research in frontier markets, on issues related to inclusive growth and business. This program supports research innovation, allowing students to push beyond the scope of traditional market research by engaging high-touch, in-field methods to uncover important aspects of industry or economic development in the emerging and frontier economies.

This report is the result of this innovative collaboration.

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She is passionate about in technology and entrepreneurship in emerging markets. She has worked in Africa previously as a Business Teaching Fellow at the Meltwater Entrepreneurial School of Technology, Ghana. She has also researched and published a paper on the role of information and communications technology for growth of microenterprises in Indonesia.

Julia Leis

Julia completed her Master's in Law and Diplomacy at The Fletcher School at Tufts University in Boston in May 2014, specializing in urbanization and development. Her capstone project addressed the effectiveness of scenario planning in Nairobi and its potential in supporting urban disaster risk reduction.

Julia has prior experience living in Africa, first in Dakar, Senegal, and most recently in Ouagadougou, Burkina Faso, with Millennium Challenge Corporation as a graduate intern working on diversified agricultural activities. She is passionate about grassroots approaches to social and economic change and the power of ICT to transform the base of the pyramid. She now works for an international relief and development organization.

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Image: Matatus near Kibera

EXECUTIVE SUMMARY

Nairobi, the capital of Kenya, is facing critical transportation challenges. Traffic-related congestion, high road fatality rates and an unregulated mass transit network have been critical issues for a long time in East Africa's most populous city. Rapid urbanization has aggravated these problems, resulting in a highly inefficient and inequitable transport system.

Government action to improve urban transport infrastructure, planning, and regulation remains inadequate in meeting the rising demand for transportation and logistics services. Well-funded corporate initiatives too have struggled to make an impact. In contrast, technology startups have developed services that are alleviating pain points in urban transportation.

Our team interviewed 65 key informants and completed 16 observations in Nairobi in June-August 2014 to understand the role of startup innovation in improving transport and logistics. We found 30 technology-for-transport (TFT) startups with creative innovative services in the taxi market, in cashless payment systems for public transport, in last-mile delivery, and a host of other areas.

TFT startups played a unique role vis-à-vis government and other private sector players by plugging information gaps inexpensively. Their frugal innovations helped commuters and consumers of logistics services to work around the inefficiencies in the transport system.

The value of information generated by TFT startups had varying impact, captured in a framework called the 'impact pyramid'. On a scale of low to high impact, innovations ranged from knowledge creators, to decision enhancers, to trust builders. Startups had to address the large trust deficit among Kenyans to create high-impact innovations. For this, they were adopting different approaches, from building capacity to leveraging community networks.

Our research also showed that the benefit of digital mobility services was restricted to high-income consumers with quality access to Internet, especially via smartphones. Looking to further understand consumers of transport and logistics services, we built typologies of the three kinds of commuters in Nairobi – taxi users, *matatu* users, and walkers. The typologies shed light on commuters' pain points and unmet needs, pointing to potential business opportunity.

Recommendations are made to state actors and the innovation ecosystem to make the enable more 'inclusive design' of digital mobility services. Inclusive innovation can transform the role of tech-for-transport startups from providing symptomatic relief to sustainably bettering transportation in the long term.

CONTEXT

Home to the mobile payments revolution, Nairobi, the capital of Kenya, is one of the most promising frontier markets in the world.

Multilateral agencies and non-profits have served East Africa for many years from Nairobi. Now, many multinational companies, technology startups, and social enterprises are setting up operations and research labs in Africa's 'Silicon Savannah'. Nairobi's economic growth has been accompanied by a surge in urbanization and consumer demand. One sector that has been profoundly impacted by these changes is transportation.

Rising Challenges in Transportation

With increased people and goods movement, Nairobi has become one of the most congested cities globally (IBM Global Commuter Pain Survey, 2011). Traffic costs the city $570,000 a day in lost productivity (Bloomberg, 2014). Nearly half the population is unable to afford motorized transport and only a third use *matatus* (ITDP, 2013) despite 70 percent having access to them (Nyasetia, 2013). Traffic-related road accidents are the third leading cause of death after malaria and HIV/AIDS (Nyasetia, 2013).

Figure 1: How Do People Commute in Nairobi?

- WALK
- PRIVATE VEHICLES
- *MATATUS*
- MISCELLANEOUS (*BODA-BODAS* AND BICYCLES)
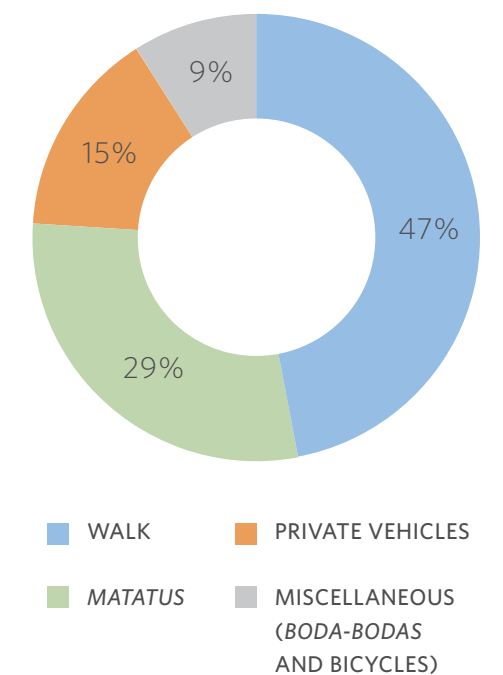
Source: ITDP, 2013

URBANIZATION, TRANSPORT, AND DIGITAL INNOVATION

Kenya's urban population is growing much faster than the global and African averages, putting pressure on the transport systems.

In 2010-2015, Kenya's population grew by 2.7 percent annually. In the same time period, urban population grew by 4.4 percent, twice the rural population growth rate (UN Data, 2015). This was greater than the world and African average of 2 percent and 3.6 percent, respectively. As a result of this rapid growth, 25 percent of the population, or 12 million Kenyans, now reside in urban areas. (UN Data, 2015)

By 2033, it is expected that half of Kenya's population will be living in cities (Bloomberg, 2014). By 2045, Kenya's population is expected to double while its urban population will more than quadruple (World Bank, 2011).

As the economic and political capital of the country, Nairobi sees a large influx of immigrants and great increases in population. While the permanent home of 3.3 million people, the city has a daytime population of 4.1 million (World Bank, 2012; French Embassy in Nairobi, 2012; Ottichilo, 2010) due to incoming workers from peripheral villages. This has put immense pressure on the urban transport system.

Inadequate Urban Road Infrastructure

Despite the proactive attitude of policymakers, improvements in infrastructure have been slower than the rate of urbanization. Projects for transport corridors linking highways, new roads and by-passes, metro railway lines, a bus rapid transit, and new bus and matatu terminals have not started on schedule or have very long lead times. See Appendix II.

Weaknesses in Public Transport System

The matatu industry has struggled with regulatory failures and wide-spread corruption. The $2 billion industry has no state ownership, as it began as an informal commute service. While it accounts for 5 percent of Kenya's GDP (Nyasetia, 2013) and employs 300,000 Kenyans as drivers, fare collectors, and bus stop attendants, among other roles (OBG, 2014), it has been difficult to regulate and systemize. Several reasons, such as the clout of private owners, complex gangs like the Mungiki that extract "protection" fees, failure of commuter-friendly Michuki rules, ill-planned policies, lack of political will, and corruption at all levels have all played a hand in stymieing systemization. As a result, the public has suffered from unreliable and unaffordable service. See Appendix I.

Disadvantaged Bottom of the Pyramid

In many ways, low-income and even middle class Nairobi residents face acute disadvantages in the urban transport system. 60 to 70 percent of Nairobi's population lives in informal settlements, which have been pushed to the city's peripheries – occupying only five percent of the city's land area – as real estate in the CBD and suburban areas has become increasingly expensive (APHRC, 2014; Mutiga, 2014). Residents of informal settlements, largely belonging to lower socioeconomic classes, are forced to travel long distances, putting matatu commutes beyond their range of affordability. Documented accounts show thousands of workers from Kibera walk up to 20 kilometers to work every day (Kenya National Assembly Official Report, 1985; ITDP, 2013).

Additionally, transport infrastructure development differs by the level of affluence of neighborhoods. Roads in low-income neighborhoods like Eastleigh, where majority Somali populations reside, are of much poorer quality than roads in suburban neighborhoods like Lavington, Karen and Kilimani.

Digital Innovation in Transportation

As of June 2014, Internet penetration in Kenya was 47.3 percent (Internet World Stats, 2014) and mobile phone penetration reached 79.2 percent (Capital FM, 2014). Mobile data accounted for 99 percent of all Internet subscriptions, and broadband subscriptions accounted for one-fifth of 14 million Internet subscriptions (Capital FM, 2014). Smartphone sales registered explosive growth: 67 percent of phones sold by Safaricom in 2013 were smartphones (HumanIPO, 2014), with sales expected to double by 2016 (Techweez, 2014).

These trends have catalyzed the growth of technology startups and the innovation ecosystem. Business incubators, innovation and research labs, seed capital, and startup competitions have become ubiquitous. In more developed markets, technology startups such as Uber and Ola have created discernible consumer benefit without any systemic change in transport infrastructure, policy, or planning. In fact, their popularity has sparked regulatory changes, and the data they generate show potential to improve policy and planning.

Could transportation innovations create value for consumers in a frontier market like Nairobi? Could benefits to consumer transcend socioeconomic classes? Could these innovations address a spectrum of transportation challenges? Could they achieve scale and longevity? Could they effect change in policymaking and planning for transport? This led to the central question of our research.

Can technology-for-transport startups in Nairobi create discernible consumer benefit without underlying change in transport infrastructure, policy or planning?

RESEARCH DESIGN

Methodology.
Interview Guide.
Sampling Procedures.
Data Collection and Transcription.
Data Analysis.
Data Visualization.

Methodology

In-depth qualitative interviews with a structured interview guide were conducted. They helped us to draw meaningful conclusions based on standard questions while allowing us to explore new themes raised by participants to draw unique insight. Observations supplemented the interviews and helped us gain an unbiased understanding of several themes.

Observations included events and conferences such as Tech4Africa, VC4Africa, Kenya Internet Governance Forum, FailFaire and Google's #40Forward Women in Tech series. We also tested the mobility apps, software and hardware whenever possible, conducted site visits to see startups in action, and visited corporate premises and incubators on guided tours.

Interview Guide: Focus of Each Cluster

The structured interview guide was customized to different respondent groups. Questions fell within four clusters:

Cluster 1: Trends in transportation and political economy

This focused on understanding how the forces of urbanization had changed the business context for developing digital innovation for urban mobility in Nairobi. Questions revolved around key macroeconomic and sociocultural changes in the last five years that had influenced the nature of innovation.

Cluster II: Opportunities and challenges in technology-for-transport

This examined pain points and unmet needs in the movement of people and goods in Nairobi. The objective was two-fold. Firstly, we wanted to learn what opportunities arose as a result of gaps in the transportation and logistics sector. Secondly, we wanted to understand what considerations startups had to think about in leveraging business opportunity.

Cluster III: Engagement with government and other private sector players

This looked at how startups were engaging with evolving regulatory policy, governance and infrastructure. We sought to understand if startup-led digital innovation had influenced regulations, governance and infrastructural development in any way.

Cluster IV: Consumers, benefit, value chain

This delved into who was benefiting from startup-led digital innovation for urban mobility. Participants were asked about their customers, end users and vendors.

Sampling Procedures

Close to two-thirds of the participants were chosen from tech-for-transport startups and micro-enterprises. Participants from tech-for-transport startups ranged between ages 21 and 39. The remaining participants were in the age group of 21-49 years. Gender was not a criterion for recruitment. Having said that, over 75 percent of participants were male.

Recruitment was done via a two-step process. First, pre-screening was done based on Internet research or word-of-mouth to find stakeholders and decision-makers within target organizations. This applied to startups, incubators, investor, corporate players, consulting agencies and academia. Next, snowball sampling was used to recruit other relevant participants from technology and transport sectors.

In the case of micro-entrepreneurs, we hired a research assistant to recruit participants via local community contacts in Kibera, a large informal settlement in Nairobi.

Table 1: Interview Participant Groups

Participant Group	Total	Male	Female
Private Sector	**49**	**38**	**11**
TFT Startups	30	24	6
Corporate Players	3	3	0
Micro-Enterprises	10	7	3
Incubators	5	3	2
Investors	1	1	0
Public Sector	**1**	**1**	**0**
International Organizations	**1**	**1**	**0**
Not for Profit Organizations	**3**	**2**	**1**
Subject Matter Experts	**11**	**8**	**3**
Academia	6	4	2
Consultants	3	2	0
Bloggers	2	2	0
Total	**65**	**50**	**15**

Data Collection and Transcription

The fieldwork was conducted in Nairobi over a period of eight weeks from June 15, 2014 to August 15, 2014. Interviews lasted 60-90 minutes.

All interviews were conducted in English. 57 interviews were conducted in-person in Nairobi, in public spaces or in the participant's workspace. One interview was conducted via email and six were conducted via phone or Skype. The principal investigator introduced the research topic, gained written consent for the interview after making the participant aware of risks and benefits, and then led the questioning. The interview process was piloted in the first week of fieldwork and refined thereafter.

Interviews were audio recorded with the consent of participants for purposes of transcription. Participants' identities have been kept confidential in line with the consent form. Only those who provided consent to be identified by name and organization have been quoted in this report to illustrate findings.

Data Analysis

Content analysis consisted of transcribing and classifying information according to pre-determined themes. Classification was done via pattern recognition. Comparative analysis was done to trace commonalities and variations in participants' answers, and this generated more findings under each pre-determined theme.

Data Visualization

Data for figures and tables in the following sections was coded based on answers to open-ended questions. They represent unaided opinions of participants who thought to deliberate upon them in the course of the interview.
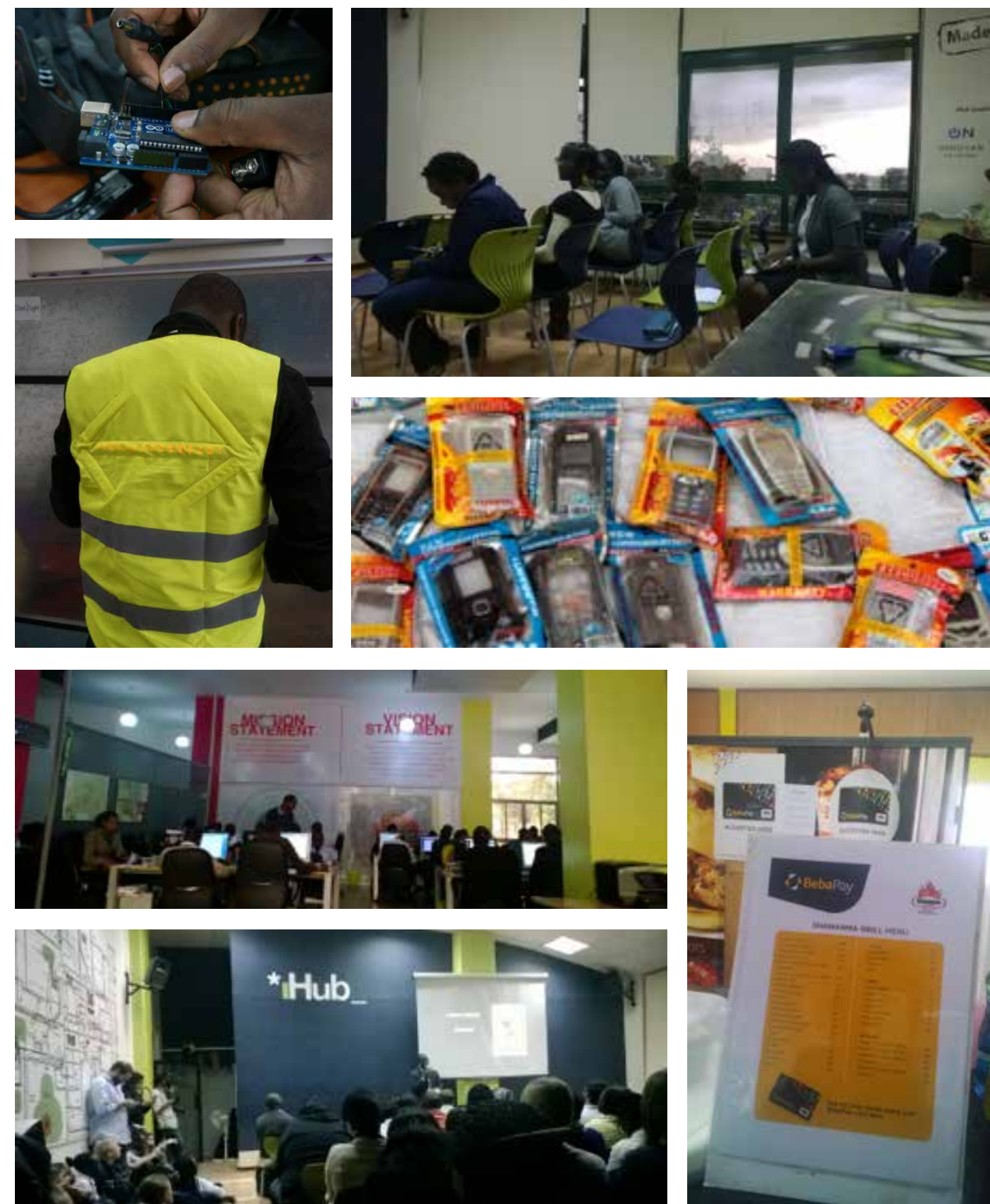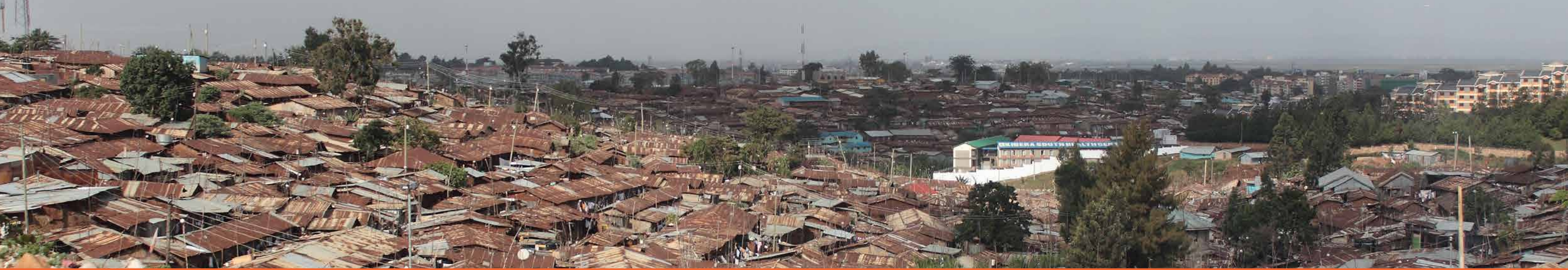
FINDINGS

Can technology-for-transport startups in Nairobi create discernible consumer benefit without underlying change in transport infrastructure, policy, or planning?

To answer this central question sufficiently, we broke down our analysis into three segments:

Abundance of Digital Mobility Services

How many innovations were directed at resolving transportation issues, and did they address a broad range of problems?

Quality of Tech-for-Transport Innovation

What unique consumer benefit did startups create, was the benefit not only unique but also incremental or value-adding, and did a large number of consumers (i.e. households) of different socioeconomic classes benefit?

Effect on Policymakers and Other Private Sector

Did the presence of tech-for-transport startups compel the government or private sector players to drive fundamental change in infrastructure, policy, or planning?

An Abundance of Digital Mobility Services

In our research, we interviewed 30 tech-for-transport startups and found 15-20 additional digital mobility services in market. The sheer number of innovations showed there was energy in the innovation community to find solutions to transportation challenges. It was also indicative of the market potential of mobility services.

Services addressed a wide range of transportation problems. Figure 2 on the following page shows the breakdown of the 30 startup interviewees by the type of value proposition.

In terms of product type, 67 percent of innovations were apps, 20 percent software, and 13 percent hardware. The startups were between six and 24 months old. Interviewees said that the mobility services market was exciting and dynamic. They saw immense business potential in applying technology to Nairobi's transportation woes. Furthermore, they saw opportunities to learn from successful digital mobility services and reapply those solutions in foreign markets. As a fertile testing ground for mobile payments-enabled services, successful Kenyan innovations could also be taken to other emerging markets. These potential synergies attracted non-Kenyans and Kenyans to work with each other. A majority of startup teams – 17 of 30 – encountered in this study had a mix of Kenyans and non-Kenyans working together. Nine startups were comprised

of all Kenyan members, while four startups had all non-Kenyan members.

While most startups were yet to break even, there was great confidence that they would achieve scale and sustainability. Fourteen interview participants had plans to expand across East African cities, notably Kampala (Uganda) and Dar-es-Salaam (Tanzania). Eight participants had plans to scale within Kenya, to Mombasa, Kisumu, Naivasha, and Kisumu. Three participants said they would look to global markets because the problem they were addressing was applicable to emerging cities in other parts of the world too. Two participants said they planned to explore other markets within Africa, such as Cairo, Lagos, and Johannesburg. Three participants had no plans for expansion.

Improvements in road and ICT infrastructure were the top reasons for optimism regarding the local digital mobility services market. Twenty-one startups said marked improvement in road infrastructure since 2012 was a huge positive step forward. Sixteen startups mentioned advancement of ICT infrastructure. Other reasons included anticipated rise in smartphone usage (not only ownership), wide base of consumers accustomed to using mobile money, presence of a large expatriate population with high disposable income, and growth of e-commerce.

Unique Benefit to Consumer

The role of startups was considered unique as compared to that of the government and corporates. Startup innovation in transport was plugging information gaps, inexpensively. Elaborating on this, participants made two points.

Firstly, a host of transportation challenges arose from the lack of information. For instance, information on traffic conditions could help drivers plan their travel routes and times better. Pricing information, especially in real time, could help commuters choose the best taxi operator. Information on geo-locating destinations could help courier companies optimize time and effort. Therefore, tremendous business opportunity for startups existed in providing data and analytics.

Secondly, startups lacked access to capital due to low investor presence in Nairobi. Hence, startups developed low-cost solutions. For instance, a successful local app called Ma3Route provided information about road congestion via crowd-sourcing. This was more economical than the offering from a project with similar intentions, IBM's Twende Twende.

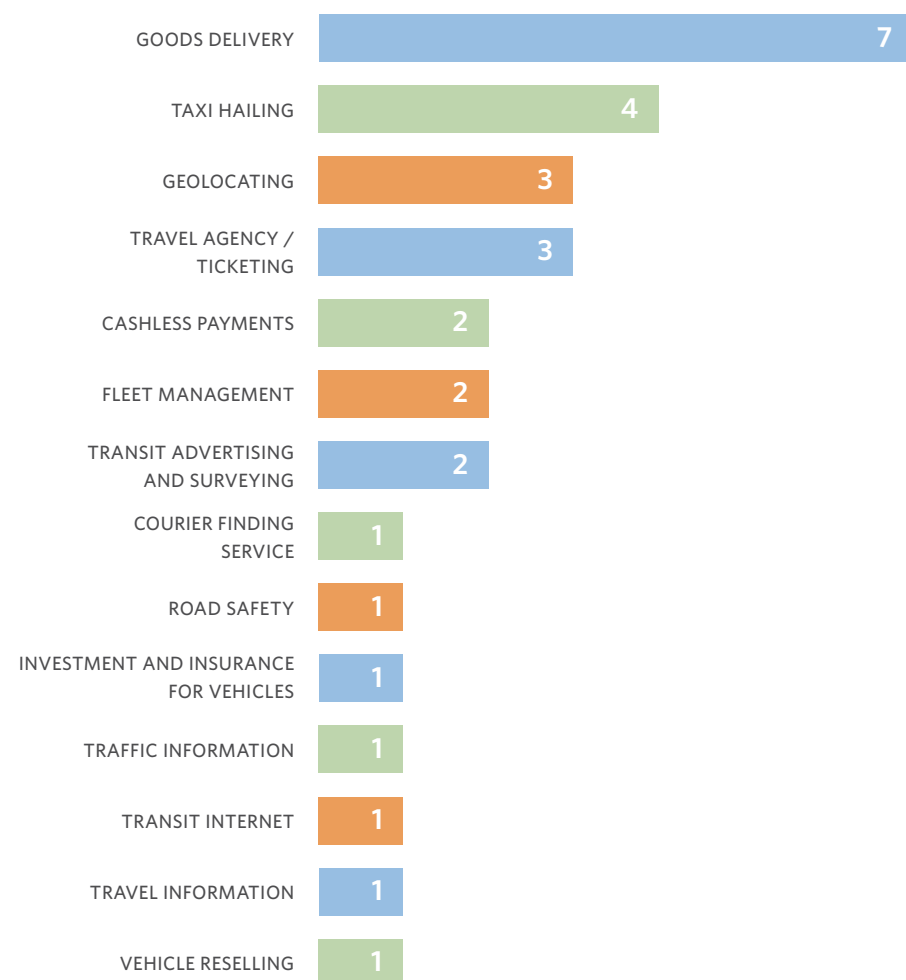**Figure 2:** Digital Mobility Services: Value Proposition

GOODS DELIVERY	7
TAXI HAILING	4
GEOLOCATING	3
TRAVEL AGENCY / TICKETING	3
CASHLESS PAYMENTS	2
FLEET MANAGEMENT	2
TRANSIT ADVERTISING AND SURVEYING	2
COURIER FINDING SERVICE	1
ROAD SAFETY	1
INVESTMENT AND INSURANCE FOR VEHICLES	1
TRAFFIC INFORMATION	1
TRANSIT INTERNET	1
TRAVEL INFORMATION	1
VEHICLE RESELLING	1

Table 2: Comparison of Roles of Government, Corporates and Startups in Mobility Services Market

Sector	Nature of Innovation
Government	• Design of infrastructure • Development of regulatory policy
Corporate Players	• Development of large-scale 'smart' solutions • Development of go-to-market mechanics for infrastructure development
TFT Startups	• Plugging information gaps inexpensively

'Impact Pyramid'—From Low to High-Impact

The impact of mobility services varied as they scaled. This is captured in a framework called the 'impact pyramid', based on participants' perceptions. Impact was conceptualized as a multiple of scale (i.e. profitability) and sustainability (i.e. long-term relevance in market).

At the base of the 'impact pyramid' are innovations that are knowledge creators. Information they provide makes consumers more aware and enables them to communicate better. Innovations such as apps that provide real-time information to a courier company about its fleet's whereabouts are at this level. A great number of innovations were expected to be at the base of the impact pyramid, i.e. plentiful in number but lowest in impact.

At the next level are innovations that are decision enhancers. The key difference between knowledge creators and decision enhancers is that the ability to act upon information provided by the innovation is greater with the latter.

Therefore, such innovations also have greater impact. Innovations such as taxi apps that provide price information and allow the user to book the taxi with the lowest quote enhance decision-making.

At the peak are innovations that are trust builders. These innovations go beyond knowledge creators and decision enhancers because they are able to gain consumers' trust. Thereby, they become not only scalable but also sustainable. These innovations are high-impact and transformative.

Tackling the Trust Deficit

Trust building was an imperative for scaling sustainably. Participants spoke about the deep sense of mistrust Kenyan consumers shared regarding transportation services. News media illustrate this point. Nairobi is often notoriously referred to as 'Nairobbery' (South China Morning Post, 2014; UrbanAfrica, 2014; AlJazeera, 2013; The Economist, 2002). On average, the city witnesses three car-jackings a day (SCMP, 2014).

TRUST BUILDERS	LOW NUMBER OF STARTUPS
DECISION ENHANCERS	
KNOWLEDGE CREATORS	MAJORITY OF STARTUPS
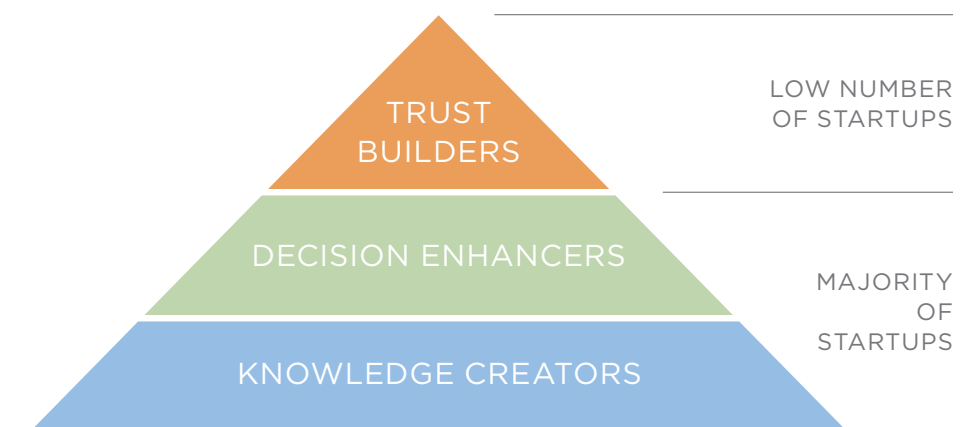
Impact of Startup Innovations in Transport in Nairobi

As one participant termed it: *"There is a huge trust deficit among Nairobi's commuters and logistics' consumers. It is built over years of thefts, accidents, fraud and petty lies when it comes to transportation services." – Bryan Kariuki, Country Manager of East Africa, TravelStart*

The trust deficit manifests itself in different ways. One taxi startup described facing operational glitches as neither the drivers nor the passengers trusted strangers on the road. Another startup faced issues of untrustworthy staff. Their drivers, when equipped with smartphones or given valuable products for delivery, could not be trusted to safeguard the assets. In extreme cases, some had stolen the products.

Startups experimented with a few approaches to reduce the trust deficit. The first approach was to leverage M-PESA since it was a trusted brand. The second approach was to build 'offline' capabilities to support the 'online' value proposition. Participants were training partners and contract staff to provide quality customer service. For instance, an e-ticketing agency had set up retail operations so that customers could visit and feel confident about doing online transactions with them. The third approach leveraged community networks.

"We know how important community is to Kenyans. Our marketing model is therefore built around community relationships. We are just slipping technology into how the traditional taxi sharing system works in Nairobi society, rather than changing their cultural habits." – Interview Participant (Startup)

Figure 3: Digital Mobility Services: Target Market
According to Startups and Other Interviewees

HIGH INCOME	MIDDLE CLASS	LOWER INCOME
72%	**28%**	**0%**
56%	39%	6%

■ ENTREPRENEURS   ■ OTHER INTERVIEWEES
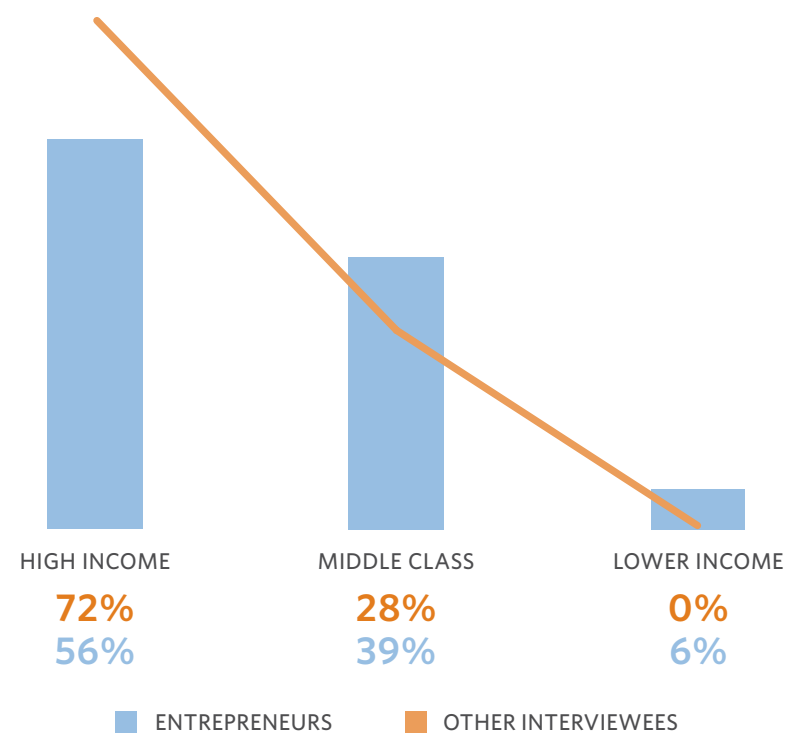
Who's Benefiting?

Digital mobility services were targeted mainly at high-income and upwardly mobile consumers, as Figure 3 shows.

Entrepreneurs were more likely to see low- and middle-income consumers as part of their target demographic than other interviewees, but most still targeted the wealthiest group.

Innovations were not only limited to high-income consumers, but were also limited to those with quality access to internet. Access to internet is defined as quantity (driven by affordability and availability of internet) and quality (fast, steady and via a smartphone vs. low, intermittent and limited to a feature phone or desktop). Consumers who did not enjoy smartphone data access were getting left behind, as were consumers who 'walked' to work and lived in low-income settlements. Internet access and disposable income were positively correlated, creating and even greater vacuum among those low-income, low-access consumers.

A DAY IN THE LIFE OF NAIROBI'S COMMUTERS

Who are the consumers of mobility services in Nairobi?

This question, looking into which consumers are really benefiting, led us to seek a better understanding those who use mobility services in the city. The typologies described here, help illustrate how commuters experience transport and logistics services, and what motivations influence their use of transport innovations.

WAMBUI: THE TAXI USER

Wambui is 28 years old, and works for a multilateral agency. She is single and earns in the high-income bracket. She owns a high-end Android-based smartphone and is a regular user of Facebook, Twitter, and Whatsapp.

For her, commuting and getting products delivered need to be hassle-free. She wants commute and delivery decisions to be made easy, involving minimal effort.

Commute Patterns

Wambui takes taxis to work and when she goes out with friends. She has a regular taxi driver that her office has contracted. Every day, Wambui "pays in paper," i.e. she signs a paper receipt after the ride. The taxi driver submits the paper sheets to Wambui's employer at the end of the month to get paid.

Wambui uses the same taxi driver after work hours too. She has negotiated lower fares than the ones charged officially to her "international" agency. She trusts the driver as she has traveled with him often. She is confident of her safety with him and does not really care to know his credentials such as past driving record or license.

Wambui calls him whenever she wants to go out—without much advance. If he is available, he picks her up. When he is not, he sends a relative or friend to drive her.

Wambui does not negotiate the taxi fare each time. Since she promises 'repeat' business to the taxi driver, she knows he will give her a competitive price. At the same time, she realizes that he sometimes charges her more than the usual mark-up, but lets it go because she values the convenience of a regular, trusted driver who picks her up when she wants him to, and waits for her when she is running late, much like a chauffeur.

She usually pays in cash immediately after the ride or in the next ride. The driver is accommodating of rolling accounts. There are times when he needs payment immediately, so if Wambui does not have cash, she pays through M-PESA. Each time she does this, the driver asks her to transfer an amount equal to the fare plus the fee Safaricom charges to draw cash out from his M-PESA account. Therefore, Wambui prefers to pay in cash over M-PESA.

Overall, she is satisfied with this system of commuting. However, she wishes a few improvements could be possible.

Pain Points and Unmet Needs

"Sometimes, my driver takes time to come and pick me up, because he is on another job. The wait time can be up to half an hour. I wish I didn't have to wait that long."

"When I use a driver for a long time, his service invariably becomes sloppy because he knows I am dependent on him. He fails to arrive on time, or does not pick up his phone, or starts to mark-up fares more often. I wish I had other trustworthy taxi drivers to choose from,, so that I am not at the mercy of one driver."

"When I pay with M-PESA, I have to pay the drive the extra Safaricom fee to take

cash out of his M-PESA account. This makes the taxi fare expensive. I wish there was a better way to pay the taxi guy even when I run out of cash."

Trial Barriers

Being a savvy smartphone user, Wambui is aware of some of the taxi apps available locally – EasyTaxi, Maramoja and SasaCabs. She has tried a couple of them. She remembers being given a free EasyTaxi voucher at some public event.

Overall, she prefers to use her taxi driver over these taxi apps because:

- Ill-designed mobile sites make her apprehensive to trust the service.

- Her experience using the taxi apps has not been great. Once, when she tried booking a driver through an app, he did not come to pick her up at all. Another time, the taxi driver was unfamiliar with how to use a smartphone and could not find her for a long time. When he arrived finally, Wambui did not feel entirely comfortable traveling with someone she did not know.

- She did not know any friends or family members who were using such apps too.

JOHN: THE *MATATU* USER

John is 33. He is a fruit shop owner in the City Park fresh produce market in Parklands, a posh neighborhood close to Westlands in Nairobi. The market is visited by a large number of well-to-do Indians who live in that area. John lives in Kibera, about ten kilometers away. He lives with his wife and three year-old child. John moved from a village in western Kenya to Nairobi when he was still a teenager to live with a relative in Kibera. He did many odd jobs while growing up, before starting to run his own shop.

John commutes via a *matatu* for a fair distance from Kibera, before walking the rest of the way to the City Park market which is not served by any *matatu* route. Until recently, he used to walk to work. He has had a G-TIDE smartphone for quite some time. He uses it mostly for calling. He uses data sparingly, and converts airtime to data in small amounts such as 10 KES and 20 KES when he needs it.

He is also aware of Whatsapp because his wife likes to see picture messages of new fashion clothes through the app. He does not use any other app much. He really likes Ma3Route, but knows of it only as an information service delivered by Safaricom through SMS.

For John, timely journeys are important. He cannot afford to reach the market late or he will lose business. Therefore, he needs to know that a commute can be made on time, and in a safe manner. He would like to be well-informed in real time about the status of the journey, and therefore seeks as much information as possible. Having information makes him believe that he can make a better decision.

Commute Patterns

John leaves very early every day to take a *matatu* to work. He tries to avoid the morning peak hour when fares are higher. If he gets SMS notifications from Ma3Route that traffic is bad on his route, he either takes a *boda-boda* or walks, depending on how far from the market he is.

If he can, he walks instead of taking a *boda-bod*a because the latter is expensive. He is used to switching his mode of transport often.

On the *matatu*, he usually has no way of predicting the fare on a given day. It changes depending on the traffic and weather. Traffic worsens in a lot of situations - when schools reopen, when there is an event in the city center, when the President is taking out an entourage, and so on.

He has little reason to commute outside of work. His wife and child stay at home, and barring rare circumstances such as when they visit their village, there is not much travel to do.

Pain Points and Unmet Needs

"I wish the matatu *fare were standard so that I would not have to think every single day whether to walk instead of taking the* matatu.*"*

"Commuting takes up so much time because of the distance and traffic. I wish I could get to work faster and reach home faster so that I can run my shop better and spend more time with my family."

"When I am compelled to take a boda-boda, *I am scared because it is unsafe. I wish there was a safer way to travel while having the speed of a* boda-boda.*"*

Trial Barriers

John is not aware of any digital services that address his pain points. He has heard of a way to pay in *matatus* without cash, but has not used it. He does not know what this system is for.

Cashless payment systems can help standardize fares to address John's first pain point, but have faced several design issues in recent past that their awareness and trial is low by the likes of John. Poor design has made registering for the service difficult.

For instance, certain cashless cards (there are seven in operation in Nairobi) require the creation of a new email address when in fact a lot of *matatu* commuters do not use email at all. Another such issue is that some cashless cards require a minimum amount of deposit to be used, which is too high for *matatu* commuters.

OTIENO: THE WALKER

Otieno is 26. He works in the industrial area and lives in Kibera. Daily, he walks to work. He uses a basic phone. He uses Facebook on it. For him, price is the all-important factor in considering any service that improves his commute.

Pain Points and Unmet Needs

"I wish I could get to work faster without spending as much as a matatu *ride costs."*

"I wish I could know when matatu *prices dip so that I can take a* matatu *on days that I can afford it."*

"I wish I could utilize my time better when I walking to work."

Trial Barriers

Commuters like Otieno are a largely underserved segment of the population. Without any digital services being created to make their commute better, the following trial barriers are foreseen:

- Resistant to shift to any new digital service without the promise of cost savings.

- Lack of awareness of new digital service due to low data usage.

- Potentially, low levels of airtime usage too.

DRIVERS OF DEMAND

Expatriates

The presence of a sizable expatriate population encouraged the growth of taxi and delivery services. It led to the evolution of the mobility services market.

A large number of *mzungus* or foreigners reside in Nairobi, working with multilateral agencies, non-profit organizations and social enterprises (Businessweek, 2014). They drove demand for transport and logistics services in Nairobi, based on their prior exposure to innovative digital services in other countries.

The actual and perceived lack of safety on Nairobi's roads drove many foreigners to use taxis. Various taxi apps have arguably come up to cater to their needs (Savannah Fund, 2014), that included transparent prices to eliminate negotiating with drivers, more choice of taxi drivers, and preference for familiar services from home countries.

Similarly, delivery of food and groceries was popular among foreigners. As the cost of delivery services could be recouped only by top restaurants and large grocery stores – which operated on premium, first-world pricing structures – only foreigners and high-income or wealthy Kenyans could afford them.

Therefore, expatriates, repatriates and high-income locals created demand that showed some signs of trickling down to the middle class. It was interesting to note that two of three taxi apps, three of three food delivery startups, and a last-mile delivery startup we interviewed were all led by expatriate founders or CEOs.

E-Commerce

Tthe growth of e-commerce fuelled the demand for logistics services.

A key driver for logistics services in Nairobi was the growth of digital commerce businesses, especially in fashion and electronics. Some e-commerce startups had even set up their own in-house logistics services. Others had employed and trained a fleet of *boda-bodas* or taxis. Digital services had come up around these operational models to help manage fleet, ensure safety of *boda-boda* drivers, monitor drivers real-time to hold them accountable, help manage supply chain, help rate couriers, and help source couriers.

There was still plenty of scope to design innovations in this space. Interview participants spoke of pain points that none of the existing innovations addressed satisfactorily. One of the main challenges that several participants observed was that their couriers – who were often contract staff that worked part-time or on hourly basis – stole products or smartphones (given to them for purposes of communication and information) and disappeared.

Another serious challenge was in making timely deliveries, as Nairobi had a rudimentary physical addressing system which made last-mile geo-locating problematic. As a result, e-commerce startups were still trying to figure out how to deliver on promises of same-day delivery or delivery within the time they 'guaranteed'.

The third challenge that several participants mentioned was that couriers often could not read maps or use informative apps on smartphones. In all, the logistics space for digital commerce had a lot of business opportunity that could be leveraged by startups.

Innovation Ecosystem

The nascent state of the innovation ecosystem promoted building of value chains, which drove growth of transport and logistics innovation.

Nairobi has become the technological hub of East Africa. The iHub on Ngong

Road houses three incubators and a tech community space, as do several other business incubators in the Greater Nairobi Area. The innovation ecosystem is growing, on the strength of ambitious tech enthusiasts and entrepreneurs.

At the same time, the ecosystem is in a nascent stage of growth. Local incubators have to collectively still put out the first generation of successful startups. As entrepreneurs develop innovations, they have realized the more innovation is required to create strong value chains, and close gaps in operational capabilities and supply chain.

Transport and logistics startups are catering to this demand, making useful innovations for startups in different sectors ranging from water to agriculture, education to sanitation, health to financial services.

Cashless Payment

Government support for cashless payment systems on *matatus* is also an important demand driver.

The market for cashless payment systems is currently very small due to resistance from *matatu* operators and commuters to stop using cash on the minibuses.Yet, given the potential

payback due to government interest and investment in making cashless payments a reality, it is a competitive space. More than seven kinds of cashless payment systems were being piloted, from Google's BebaPay to Kenya Bus Service's Abiria.

As entrepreneurs were realizing, a sound cashless payment system could be enforced across the transport network. Beyond *matatus*, parking spaces in malls and office complexes have also introduced cashless payments due to the desperate need to expand parking revenues and improve management. Again, there is strong government support for this given their aim to rein in informal activity and boost tax collection (Nairobi City Council, 2014).

Smartphone Prices

Falling prices of smartphones and increasingly accessibility of low-cost data promoted use of digital transport innovations. It also led to reverse adoption of innovations on basic mobile phones.

Smartphones in 2014 were available for as low as US $40 in Nairobi. Safaricom management has said on various occasions that they expect more and more Kenyan consumers to trade up to smartphones.

Interview participants shared the optimism, albeit cautiously so, that the future of digital innovation in Kenya lay in designing for the smartphone. Rapid adoption of smartphones had allowed startups to provide advanced transport services. Indirectly too, smartphone use had driven up e-commerce (through apps like Whatsapp) which drove demand for logistics services.

Accessibility to low-cost data had also improved. Free wireless internet was increasingly available in cafes, university campuses, mall complexes, and other public spaces. Google's partnership with internet service provider Wananchi Group had created Wazi Wi-fi, a high-speed wireless broadband network in Nairobi. Its hotspots provide free internet access for the first ten minutes, and then charge a nominal fee (Computer World, 2011).

Safaricom had created innovative data packages for as low as 10 KES and 20 KES, and sold them at street stalls alongside similarly priced loose cigarettes, shampoo sachets and newspapers. This too helped increase demand for digital transport and logistics services.

EFFECT ON POLICYMAKING AND OTHER PRIVATE SECTOR PLAYERS

By and large, startups chose not to engage with government and policymakers, as they were seen as bureaucratic and difficult to work with. Several startup participants had tried but been unable to build a relationship with the government, either as partners, clients, or key stakeholders in the welfare of the transport system.

One exception was the Digital Matatus map, a result of a collaborative effort in geo-mapping between researchers from the University of Nairobi and Massachusetts Institute of Technology. For the first time in the history of the

matatu industry, the map helped visualize the network of routes and matatu stops in Greater Nairobi. It was completed January 2014 and unofficially adopted by the government, as per interview participants. However, rich learnings from the project on improving coverage density and planning new routes and terminals remain untapped so far.

The energy in the innovation ecosystem has generated interest among large private sector players to solve problems in transport. IBM's Research Lab in Nairobi – which has a team devoted to understanding and improving 'human mobility' – implemented a technology initiative with Internet service provider Access Kenya called 'Twende Twende' ("Let's go, let's go" in Swahili) in 2012. thirty-six cameras installed on roads with high traffic fed real-time information about traffic to a central control office, which was tasked with disseminating it to the general public (Stanford Graduate School of Business, 2013). The initiative failed as cameras got stolen and sensors did not work as predicted, according to interview participants. Like IBM, several technology companies are realizing the

need for "ground-truthing" initiatives to ensure they work for the local context.

As major players Google and Equity Bank designed a cashless payment system for matatus called Bebapay, the government took interest in adopting the system. Other than standardizing passenger fares and providing safe, reliable service, it could also help boost tax revenue to improve regulation of the transportation sector. Bebapay did not find success, as commuters and matatu operators have resisted adopting cashless payments (Shanghai Daily, 2014), and the service was recently withdrawn.

Despite a lack of clear success in creating underlying change, the effect of tech-for-transport startups in generating interest among public and private sector actors is commendable.
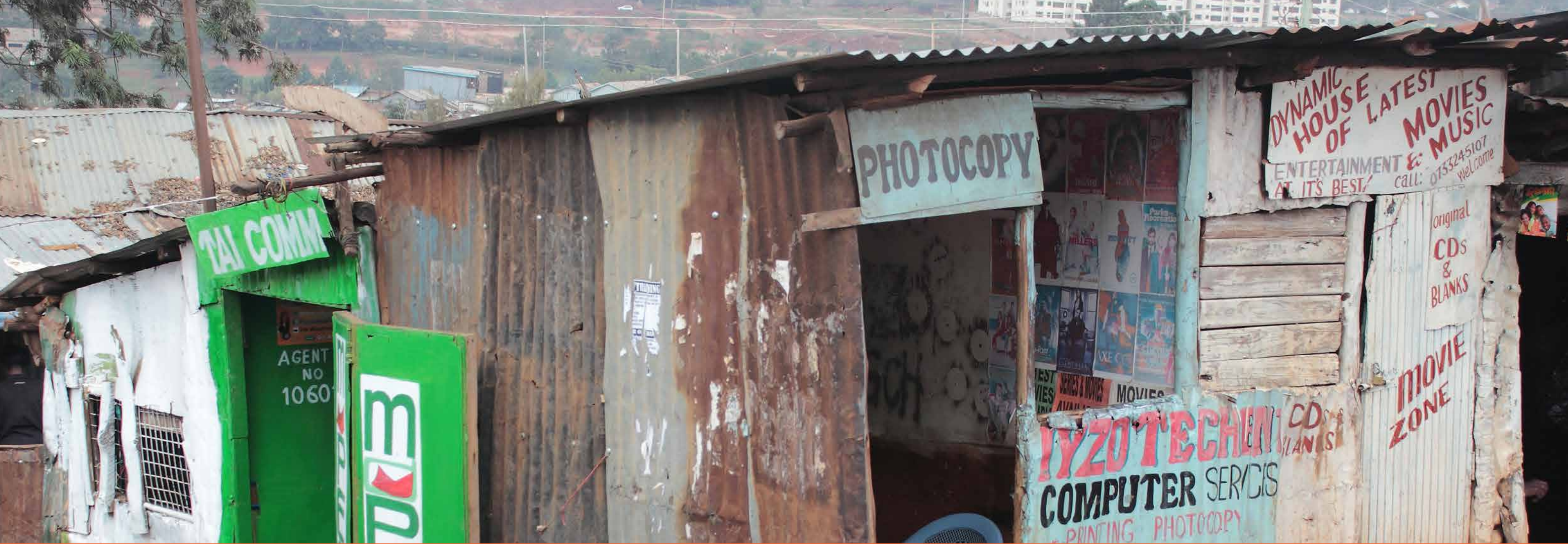
DISCUSSION

Within just five years of significant changes in the political economy – devolution of governance, drafting of a new constitution, laying of undersea fiber optic cables— a profusion of startups have made remarkable strides in identifying and addressing transportation challenges.

Digital mobility services have been innovative, reliable, and cost effective, offering answers to a wide range of problems. While it is too early to quantify their impact in a meaningful way, there is no doubt that they are bringing about positive change.

This report identified the unique place of tech-for-transport startups in the system, and proposed how to think about the nature of their impact. It must be reiterated that these startups play a valuable role by providing information inexpensively, which helps commuters and consumers of logistics services enjoy better awareness, make better decisions, and transform their habits.

Indeed, startups must lay emphasis on building trust through their innovations and operations, so that they can run sustainably and truly have impact on changing how transportation works in a rapidly urbanizing city. To engender

"It takes money, and confidence, for a middle class individual aspiring to become an entrepreneur to walk into one of the incubators on Ngong Road."
—Interview Participant (Blogger)

trust, it is important that startup marketing models engage the community as Nairobi is a city where the stakeholders are numerous.

The typologies show that there is still a lot of room to design solutions better. The taxi user may have several digital innovations targeted at her today, but few are close to understanding what will add most value to her. On the other hand, startups are paying no heed to the *matatu* user's needs in their misplaced enthusiasm to design cashless payment systems. Instead of focusing only on 'smart' systems that align with the

government's goal of boosting tax collection, startups need to develop value propositions to make pricing affordable and transparent for the consumer while creating profitability for *matatu* owners and operators. Once again, community buy-in is important as there are many stakeholders in the *matatu* business model. Startups also need to help commuters travel safely and save time traveling, two issues that cashless payment systems – primary innovation for *matatus* – are not equipped to address. Finally, startups are not designing for the 'walker' today.
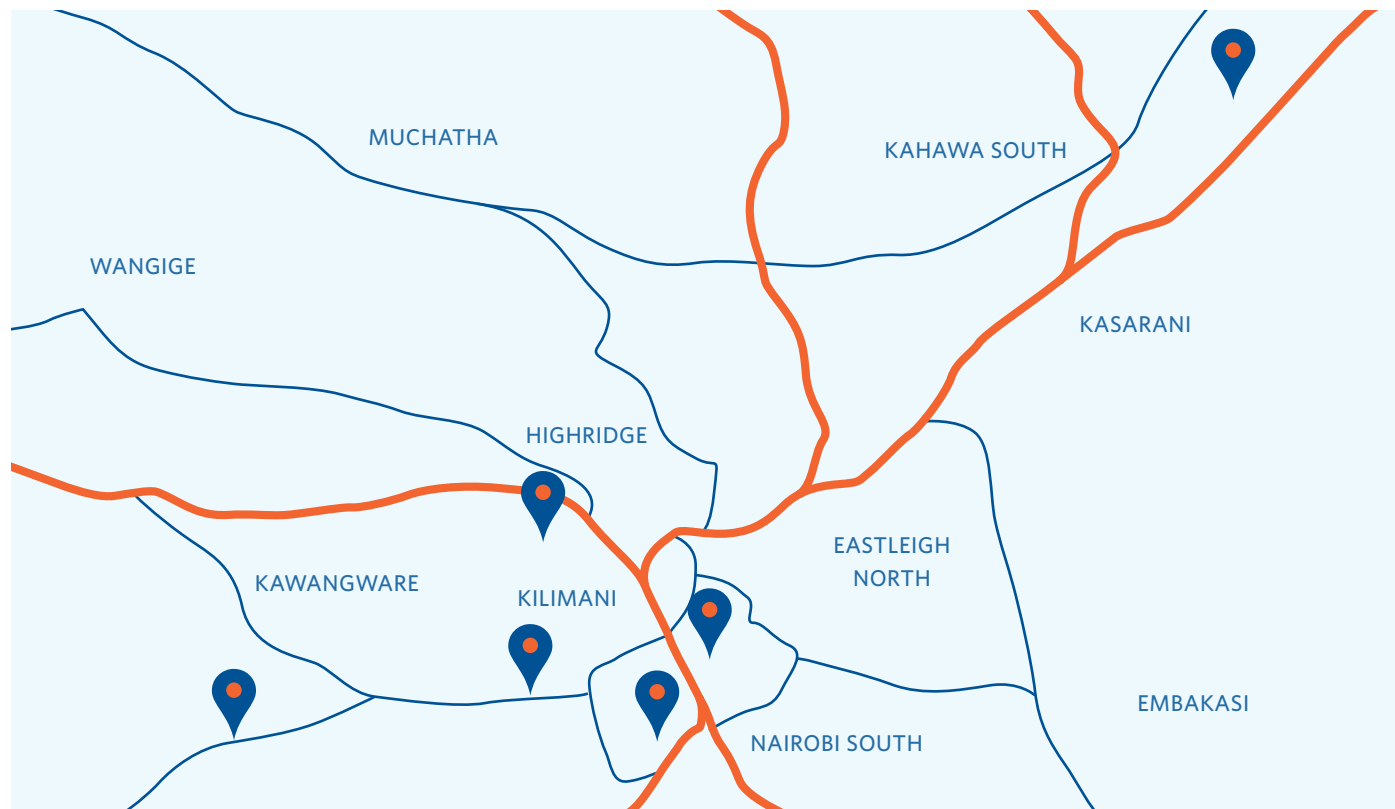
Figure 4: Startup Incubators in Nairobi

This segment represents 47 percent of Nairobi's population or nearly 22 million people who are being left behind in this 'innovation divide'. Considering that this demographic largely belongs to the lower socioeconomic classes that expend a greater fraction of their resources – time, effort and money – to gain work opportunities, the utter lack of innovation for them will only perpetuate more income inequality and systemic inequities.

As the drivers of demand show, there are a few different reasons why 'walkers' are getting left behind, unable to even trade up to *matatus* (which are accessible to 70 percent of the population but affordable to only 30 percent). With expatriates driving demand, digital solutions are limited to high-income and wealthy consumers, referred to as the "creating class" by an interview participant.

The "creating class" turned into entrepreneurs, but was suited to design only for that group. This is because people of the "creating class" reapplied innovations from their home countries, and overlooked the local context. For instance, some innovations banked on people to read and understand maps, whereas most people in Nairobi only used landmarks.

Very few entrepreneurs in our study – which comprehensively covered transport and logistics startups in Nairobi

> *"The creating class is those everyday consumers and earnest individuals who want to expand their ability to secure best value for their hard-earned money and provide opportunity to benefit as sellers from that same marketplace."*
> —Elias Schulze, former Africa CEO, Kaymu.com

> *"We operate a simple SMS-based taxi booking system because even today, not all smartphone owners use internet to order a cab. SMS and calling is simple, and many of our patrons prefer these tools to using the internet and smartphone." – Founder, GariSMS*

> *"Those who are not willing to design for feature phone users and walkers are simply being lazy."*
> *– Mark Kamau, Lead, UX:Lab at the iHub*

– came from the middle class. Mapping the physical locations of startup incubators in Nairobi (Figure 4), we see how they are concentrated in affluent neighborhoods like Kilimani and Westlands. Ngong Road, with its concentration of incubators, has become a converging point for innovators and entrepreneurs. Yet, incubators remain out of reach for a number of local entrepreneurs.

Drivers like e-commerce growth too steer logistics innovations towards consumers with high disposable income. Government support for cashless payment systems on *matatus* and in parking spaces also ignores the 'walker' demographic. The fact that its support has made cashless payment systems a competitive and innovative space shows that similar support can invigorate innovation that improves walkability or enables trade-up to motorized transport. However, the government is not playing this role currently.

Lastly, at least one-fourth of Nairobi's population still used basic or feature phones, and presumably a sizable fraction were low-income 'walkers'. The optimism for smartphone adoption does not capture the fate of these basic phone users. As one interview participant said:

"Those who are not willing to design for feature phone users and walkers are simply being lazy." – Mark Kamu, Lead, UX:Lab at the iHub

Another interview participant warned against misinterpreting rising smartphone ownership for rising data usage:

Recommendations for Startups

- Develop value propositions that truly address the pain points and unmet needs of taxi users and *matatu* users. Tap into community networks and deliver value-add to all stakeholders to create scalable innovation.

- Incorporate human-centered design based on an understanding of trial barriers. Particularly, consider that not all transport innovation is necessarily effective using 'smart' systems like cashless payment systems or advanced technological use such as smartphones or data. Simple solutions are convenient to use, reliable and inexpensive.

- Design operational and marketing models that engender trust among customers. Invest in contract staff by providing training and benefits so that a culture of trust is developed.

Recommendations for Government

- Invest in solving transportation challenges of 'walkers' – how to improve walkability, and/or help them trade up to motorized pubic transport.

- Consider transportation challenges of *matatu* users in a wholesome manner to help implement cashless payment systems. Extend support to problems of variable pricing, changing *matatu* routes and schedules, and *matatu* safety.

- Guide new and existing incubators to ensure their services are more accessible and affordable to the middle class. Engage donors and impact investors to make this a criterion in providing funding to incubators.

> *"We operate a simple SMS-based taxi booking system because even today, not all smartphone owners use internet to order a cab. SMS and calling is simple, and many of our patrons prefer these tools to using the internet and smartphone." – Interview Participant (Startup)*

APPENDIX 1
DEFINITIONS AND ACRONYMS

Definitions

Boda-boda

Motorcycle taxis that are able to weave their way in and out of traffic. They supplement the city's public transport vehicles. Known for their speed, *boda-boda* rides typically cost more than *matatu* rides. *Boda-bodas* have been the cause of a large number of road accidents due to rash driving and unsafe habits like overloading passengers.

Matatu

14 to 28-seater minibuses that are Nairobi's main form of public transport—similar to the *danfos* of Nigeria, *peseros* of Mexico, *otobis* of Egypt, *kombis* of South Africa, and *brousse* in Francophone Africa.

They transport 70 percent of Nairobi's daytime population (Ottichillo, 2010). Across the country, three million Kenyans use *matatus* every day (Mutongi, 2006). The two billion industry (Nyasetia, 2013) contributes five percent to Kenya's Gross Domestic Product (World Bank, 2014) and generates large-scale employment. It is the largest indigenously grown enterprise and the only major business that does not rely on foreign aid or foreign aid workers.

Matatus have contributed tremendously to the socioeconomic well-being of Kenya and become an integral part of its ethos and cultural evolution.

National ICT Master Plan

Innovations in Nairobi whose value propositions are centered on improving commute or goods delivery. They are being launched in the market through both business-to-business (B2B) and business-to-consumer (B2C) models.

List of Acronyms and Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
APHRC	African Population and Health Research Center
B2B	Business-to-business
B2C	Business-to-consumer
CAK	The Communication Authority of Kenya
CBD	Central Business District
GDP	Gross Domestic Product
HIV	Human Immunodeficiency Virus
GOK	Government of Kenya
ICT	Information and Communications Technology
ITDP	Institute for Transportation and Development Policy
JICA	Japan International Cooperation Agency
JKIA	Jomo Kenyatta International Airport
KES	Kenyan Shilling
LAPPSET	Lamu Port and Lamu-Southern Sudan-Ethiopia Transport
MNC	Multinational Corporation
NFC	Near Field Communications
NIUDMP	Nairobi Integrated Urban Development Master Plan
NMT	Non-Motorized Transport
OBG	Oxford Business Group
PSV	Public Sector Vehicle
SME	Small and Medium Enterprises
SMS	Short Messaging Service
SSA	Sub-Saharan Africa
TFT	Technology for transport, or tech-for-transport
TSA	Transportation and Safety Authority
UN	United Nations
UNDP	United Nations Development Programme

The Michuki Rules

John Michuki was the Minister of Transportation under President Mwai Kibaki and helped pass the increased regulations in 2004 on PSVs. The number of traffic fatalities did decrease after implementation of the rules, however, enforcement of regulations was short-lived as fare prices drastically increased after the decrease in number of allowable passengers on a *matatu*.

The Mungiki

A complex gang that emerged in the 1990s, and is known to extract "protection" fees from *matatu* owners, drivers and fare collectors to let them ply on their desired routes (Klopp, 2014).

APPENDIX 2
NAIROBI TRANSPORT INFRASTRUCTURE PROJECTS

National Integrated Urban Development Master Plan (NIUDMP)

Formulated in 2014 after 40 years of operation under the policies and guidelines of the Nairobi Metropolitan Growth Strategy, which was inaugurated in 1973, and updated in 1984-88, 1993 and 2000 (Urban Africa, 2014). The 2014 plan specifically addresses transportation challenges. It recognizes the need to develop infrastructure and new planning guidelines for a fast urbanizing Nairobi.

Decentralization of Central Business District

The plan also states the need to decentralize service from the Central Business District (CBD) to ease congestion (JICA, 2014), which results from the time that Nairobi was first settled as a colonial outpost. Roads then were laid to radiate out from the CBD which leads to traffic from all parts of the city converging in one area and creating bottlenecks. From an investment viewpoint, the government has visibly expanded expenditure on transportation construction.

Nairobi Outer Ring Road

Major transport corridors linking with the Thika highway, Mombasa Road and newly built by-passes; new bus and matatu terminals and a network of metro railway lines are supposed to operate in the city by 2030. The Nairobi Outer Ring Road, for example, which serves as a major arterial road for the city's northern and eastern districts, is set to be upgraded to a dual carriageway, raising the road's average journey speed of 12 km to 15 km per hour. The project was expected to start in October 2014 (OBG, 2015).

Southern Bypass

Nairobi's Southern Bypass, meanwhile, is now expected to be opened to motorists in 2015. The project entails construction of a 28.6-km international trunk road, running from Mombasa Road in southern Nairobi to Limuru Road in Kikuyu Town. The KES 17.2 billion (US $196.08 million) project was awarded to the China Roads and Bridge Corporation, a major player in Kenyan infrastructure, in 2010 and was launched in 2012 (OBG, 2015).

The Uhuru Highway

Other major projects are under way. The Uhuru Highway, or Jomo Kenyatta International Airport-Rironi project includes construction of a highway overpass and southern bypass linking JKIA to metro Nairobi as part of a 30-year concession to be financed by tolls (OBG, 2015).

Lamu Port and Lamu-Southern Sudan-Ethiopia Transport

The enacting of the Public-Private Partnership Act in 2013 opened the door for private investors too to help develop high-profile projects like Lamu Port and Lamu-Southern Sudan-Ethiopia Transport (LAPPSET), the standard-gauge railway project (OBG, 2015)..

APPENDIX 3
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