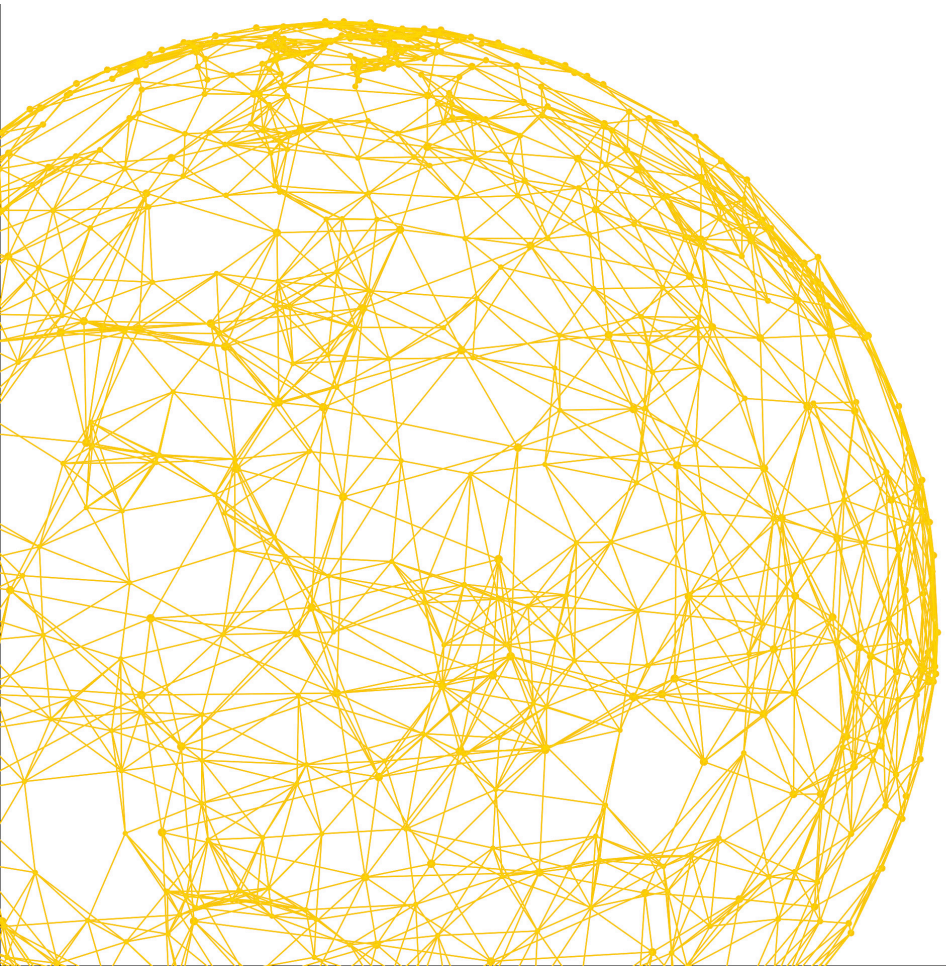
Visa
Economic
Empowerment
Institute

Imagining an open
future for payments

Reimagining ridership:
Open-loop payments and the future of urban mobility

Around the world, cities are taking decisive steps to help make their urban mobility ecosystems frictionless, sustainable, and inclusive. For many of them, implementing contactless, open-loop payment systems is a crucial part of this process. This paper presents results from a survey of 75 transit agencies and 3,000 transit riders from cities around the globe, and concludes that contactless, open-loop payments help to reduce carbon emissions and promote financial inclusion—among other important benefits.



VISA

Synopsis

Around the world, cities are taking decisive steps to help make their urban mobility ecosystems frictionless, sustainable, and inclusive. For many of them, implementing contactless, open-loop payment systems is a crucial part of this process. Digital payment in transportation networks can be implemented on open-loop or closed-loop systems. Open-loop payment systems use international standards and universal technology to enable payments at most transit providers. Closed-loop systems are limited to particular providers and usually apply specific standards and proprietary technology. To understand the benefits of open-loop systems, the Visa Economic Empowerment Institute (VEEI) partnered with ThoughtLab, a global research firm, to survey 75 transit agencies and 3,000 transit riders from cities around the globe. Together, we found that transit systems offering contactless, open-loop payments provide widespread benefits to riders, agencies, and cities. Among other benefits, 80 percent of transit agencies in our survey that had already implemented these systems saw increased ridership following adoption. Agencies who had adopted open-loop payments less than two years ago saw an average total increase of 6 percent, while agencies with two or more years of experience saw an average increase of 10 percent. This paper explores the findings of our survey, and concludes that contactless, open-loop payments help to reduce carbon emissions and promote financial inclusion.

Imagining an open
future for payments

Reimagining ridership:
Open-loop payments and the future of urban mobility

Visa Economic Empowerment Institute

VISA

Acknowledgments

This study was authored by Hannah Keyes from Visa Global Urban Mobility and Jacob Levy from the Visa Economic Empowerment Institute. The authors thank the following colleagues for their input and review: Molly Battles, Stephen Cooles, Marshall Eudy, Thea Fisher, Tania Garcia-Millan, Hal Hodes, Yoon Kay Khong, Barbara Kotschwar, Nick Mackie, Josh Martiesian, Carin Mccullagh, Meg Omecene, Natalia Sifuentes, Pavlo Skit, and Ted Waddelow. The survey and research were conducted by ThoughtLab. Closeup Content provided editorial assistance and 451 is our digital design agency.

About the Visa Economic Empowerment Institute

The VEEI is a non-partisan center of excellence for research and public-private dialogue established by Visa.

The VEEI's overarching mission is to promote public policies that empower individuals, small businesses, and economies. It produces research and insights that inform long-term policy within the global payments ecosystem. Visa established the VEEI as the next step in its ongoing work to remove barriers to economic empowerment and to create more inclusive, equitable economic opportunities for everyone, everywhere.

Visit: visaeconomicempowermentinstitute.org

Index

Introduction 7

Open-loop payments benefit transit riders 9

Ensuring no rider is left behind 12

Open-loop payments benefit transit agencies and cities 15

Open-loop payments help reduce carbon emissions 20

Challenges remain, but the benefits far outweigh them 24

Conclusion 26

Sources 28

Annex 1: Survey methodology 30

Annex 2: Text description of figures and tables 31

Introduction

The COVID-19 pandemic upended mobility in cities, as many riders eschewed traditional public transit for mobility options that would allow them to socially distance. Riders have also begun to adjust their expectations about the level of safety and convenience that public transportation systems should offer. As people's expectations and behaviors continue evolving, cities must also evolve to create sustainable, inclusive, and rider-friendly urban mobility ecosystems. These ecosystems should offer a variety of transit options—from buses and trains to scooters and bicycles—in order to meet the diverse needs of a city's population.

One way that cities can ensure a safe and convenient rider experience is by adopting contactless, open-loop payments systems. These systems allow users to tap their everyday credit, debit, or prepaid card (or use a payment-enabled device such as a smartphone) to pay for transit fares. Closed-loop systems, by contrast, require riders to purchase and reload a special card that can only be used for making payments to a single service provider. While closed-loop systems have been the standard for many years, some transit agencies—such as the Metropolitan Transportation Authority in New York City—have adopted open-loop payments and seen many benefits.

As part of its Building a Future-Ready City project in 2022, ThoughtLab, a global research firm, found that many people planned to use multiple modes of mobility more often over the next five years. In particular, people expected to walk and bike more, increase their use of environmentally friendly transportation, and rely more heavily on public transit (see Table 1).

Table 1: How people plan to change their transportation habits over the next five years

ACTIVITY	% planning to increase
Walk/bike/scooter around the city	45%
Use private transportation (owned/rented car, bike)	44%
Use environmentally friendly motorized transportation (electric vehicles/bikes/trams)	42%
Use public individual transportation (bike rental, taxi)	32%
Use public mass transportation (metro, bus, train)	24%

Source: : *Building a Future-Ready City* (ThoughtLab, 2022)
Question: "Compared to before the pandemic, are you more likely to increase or decrease the following activities over the next five years?"

The study also revealed that many residents are not entirely satisfied with their city's existing transit options. Nearly one third of survey respondents saw traffic congestion and inadequate public transit as two of the biggest challenges facing their city over the next five years (ThoughtLab, 2022). Urban leaders are aware of these problems; 45 percent of city officials surveyed cited traffic congestion as one of their city's biggest challenges and 19 percent cited inadequate public transportation. Additionally, about one quarter of city officials expressed that their city's mobility and transportation approaches will need a significant overhaul to be better prepared for the future.

To further this line of research and explore the role of contactless, open-loop payments in public transportation, the Visa Economic Empowerment Institute (VEEI) partnered with ThoughtLab to conduct a new survey of 75 transit agencies and 3,000 transit riders from cities around the world (see Annex 1 for a description of the survey methodology). The results of this survey confirm prior findings: Many people believe that their local government should invest in more sustainable and effective forms of public transportation. Moreover, the survey found that contactless, open-loop payment systems have benefits for transit riders, transit agencies, cities, and the environment.

For riders, open-loop systems offer a payment experience that is faster, safer, and more hygenic. They also promote more inclusive public transit. Making transportation affordable and accessible to all is central to the equitable transformation of cities toward a sustainable future. This means ensuring that transit systems meet the needs of people with varying levels of financial stability and access. Contactless, open-loop payments contribute to this goal by promoting access to transit even for those without a formal financial account, through solutions such as prepaid cards. These systems not only reduce barriers to entry and offer a more user-friendly experience to riders, but enable transit agencies to introduce fare-capping and other concession or incentive schemes, which can increase affordability without sacrificing ease of use.

For transit agencies and cities alike, open-loop payment systems offer financial and payment benefits, strategic and operational benefits, and customer service and ridership benefits. And by promoting increased public transit ridership, these systems also help drive sustainable outcomes. Cities, home to more than half the world's population, consume 78 percent of the world's energy and produce over 60 percent of its greenhouse gas emissions (United Nations [UN], n.d.). Transportation—chiefly road transportation—is the largest source of these emissions. By using contactless, open-loop payments, cities can improve the overall quality of their urban mobility ecosystems, thereby reducing the need for vehicular road transport (particularly private cars), the number of vehicle miles traveled (VMT), and the resulting CO_2 emissions.

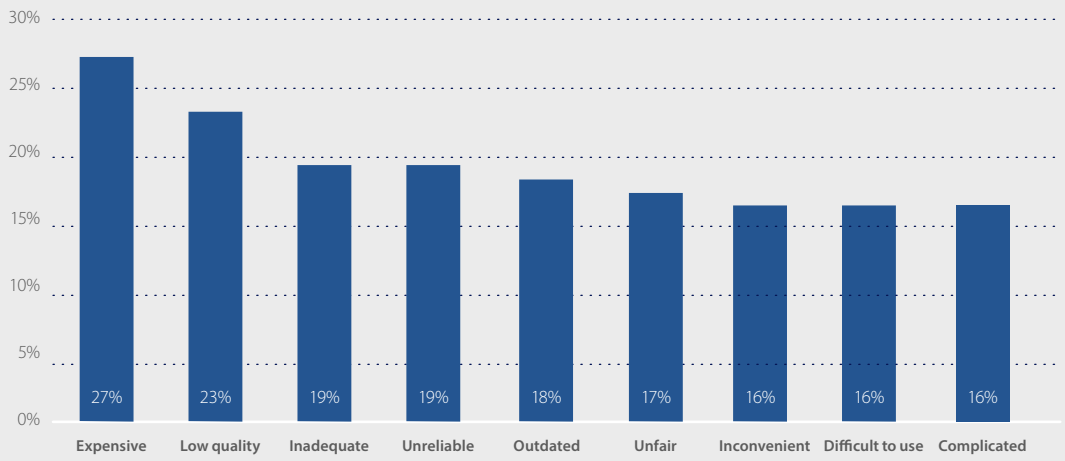
The following sections address each of these benefits in greater detail, illustrating how contactless, open-loop payments will continue to play a pivotal role in the future of urban mobility.

Open-loop payments benefit transit riders

The state of urban mobility today

In our survey of 3,000 transit riders, we found that residents are not entirely happy with the state of mobility in their cities. Around a quarter of respondents said they find public transit in their city to be expensive and low quality, and nearly 20 percent said they find it to be unreliable, inadequate, and outdated (see Figure 1).

Figure 1: Top complaints from riders about their city's transit system



Source: VEEI and ThoughtLab survey of transit riders (2022)
Question: "Which of the following do you agree or disagree with?"

Transit riders also said they want their city to invest in more environmentally friendly forms of public transit, and to make it easier to move around the city. They would like urban governments to do this by making the use of multiple modes seamless, providing better first-mile and last-mile connectivity, and offering a wider variety of transportation options (see Table 2). These responses were common regardless of the age or income level of the transit rider.

Table 2: Where transit riders agree their cities should make changes to transportation

STATEMENT	% agreeing
My city should invest in more environmentally friendly forms of public transportation	88%
My city needs to make it faster and easier for people to move around the city	88%
My city should support the use of environmentally friendly private transportation	87%
Using multiple modes of transportation in one trip needs to be a more seamless experience	87%
My city needs to provide better connectivity from transit stops/stations to final destinations (first/last mile solutions)	86%
A wider variety of transportation options (e-bikes, car shares, etc.) would make it easier for me to travel throughout the city	85%

Source: VEEI and ThoughtLab survey of transit riders (2022)
Question: "To what extent do you agree with the following statements about your city?"

Our survey of 75 transit agencies found that many are taking proactive steps to meet rider expectations. "We want a city that is oriented for the citizen," said Alessandra Gallio, a member of Guatemala City's municipal council. "We have a united and integrated vision with the city that includes allying with a variety of different partners in a transparent way." This new transportation approach includes buying electric buses, installing new parking meters, and implementing contactless, open-loop payments.

Transit riders prefer contactless, open-loop payments

Open-loop systems can replace—or complement—closed-loop card payment systems such as Seoul's Upass, Hong Kong's Octopus, and London's Oyster card. Closed-loop cards, which have been the standard in transit systems around the world for many years, require customers to load value either directly on their cards or on an account that is electronically linked to the card. The value can then be used for travel across the transit network.

Before open-loop transit payment systems became available, closed-loop systems were an improvement over tokens and paper tickets, enhancing convenience for the rider and increasing effectiveness for the transit agency. These closed-loop systems often offer discounted cards for low-income riders, senior citizens, and students and have been particularly helpful to riders lacking access to credit or debit cards.

However, closed-loop systems also have drawbacks. They add complexity for transit riders, who need to obtain cards or download apps—sometimes for more than one system if fares are not integrated across providers. Customers must remember to reload their card or buy tickets on an app. Worse yet, value added to a closed-loop system is not transferable to other systems, and it can be lost along with the card. For those struggling with financial insecurity, having money tied up in a transit-only card can cause undue hardship.

Contactless, open-loop systems, by contrast, allow riders to use their everyday contactless cards or mobile wallets without having to purchase tickets or reload a card. The popularity of contactless payments has skyrocketed around the world, and consumers have grown more comfortable using debit, credit, and prepaid cards for low-value transactions. Our transit rider survey validates this trend; tapping a contactless, open-loop card was the method of payment preferred by the greatest percentage of respondents (see Table 3).

Table 3: How transit riders prefer to pay

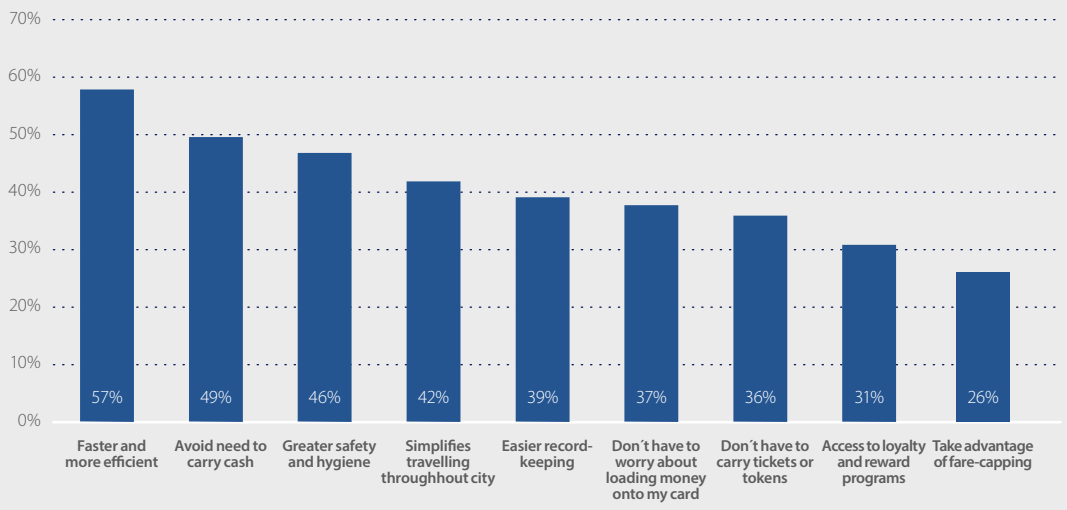
METHODS	% preferring
Tapping a contactless credit/debit/prepaid card	42%
Tapping my mobile phone wallet (Apple Pay, Google Pay, etc.)	39%
Transit agency issued card (Oyster, Octopus, Clipper, etc.)	38%
Cash	31%
App-based payment	29%
Inserting or swiping a credit/debit/prepaid card	28%
QR code	28%
Barcode	23%
Paper tickets	20%
Tokens	19%

Source: VEEI and ThoughtLab survey of transit riders (2022)
Question: "Which of the following method(s) do you typically use to pay at the turnstile or on board for various modes of public transportation? Which do you prefer to use?"

Additional rider benefits

Transit riders experience many additional benefits from contactless, open-loop payment systems. Our rider survey found that the top benefit was a faster and more efficient payment experience—cited by 57 percent of respondents (Figure 3). This was followed by avoiding the need to carry cash (49 percent) and improving safety and hygiene (46 percent). Not only does reducing cash use lead to better hygiene, but it can also alleviate concerns among riders about safety and potential theft. In addition, transit riders say that contactless, open-loop payments simplify traveling throughout the city and eliminate the need to load money on cards or carry tickets or tokens.

Figure 2: Top benefits to riders from using a contactless card or mobile phone wallet



Source: VEEI and ThoughtLab survey of transit riders (2022)
Question: "What are the benefits of paying your fare by tapping contactless credit/debit/prepaid card or mobile phone wallet?"

Ensuring no rider is left behind

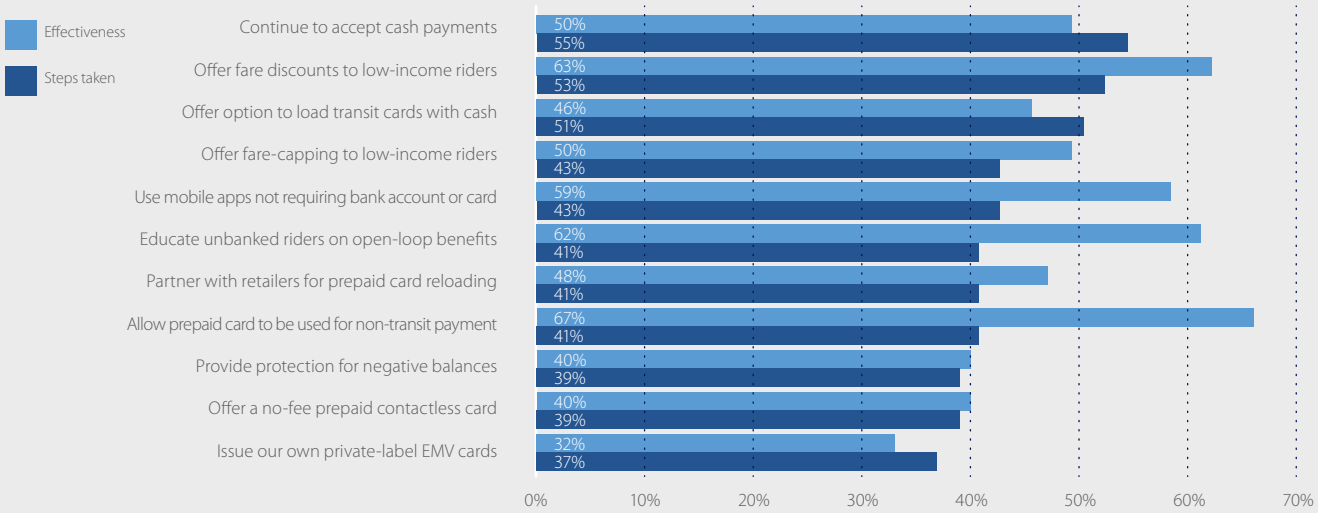
Public transit agencies should strive to achieve accessibility for people of all ages and abilities, regardless of their income or access to formal financial services. Close to a third of adults worldwide—approximately 1.7 billion people—are unbanked, meaning they do not have any form of formal banking relationship (World Bank, 2022). Thus, when agencies enable modern payment systems, including open loop, they should ensure that these systems offer solutions for people who do not have a debit or credit card, such as accepting prepaid cards.

Guatemala City's transit agency, Transmetro, grapples with the fact that 70 percent of the city's residents work in the informal, cash-based economy. Although Transmetro has introduced open-loop payments, only 5 percent of its riders currently use credit or debit cards. For this reason, it continues to accept prepaid cards. "I think people are going to start switching when they see the benefits, but it's a challenge we have to face together with the banking system," said Gallio of the municipal council.

Transit agencies offering open-loop payments take several approaches to ensuring equitable access to all. Over half of the transit agencies surveyed continue to accept cash, offer discounts to low-income riders, and provide the ability to reload prepaid cards with cash. Forty-three percent allow the use of mobile money apps that do not require a bank account or credit card. When asked about the most effective solutions for meeting the needs of the unbanked, over 60 percent of agencies cited allowing prepaid cards to be used, offering fare discounts, and educating the unbanked on the benefits of open-loop payments. Fifty-nine percent cited accepting mobile money apps that do not require a bank account or credit card (see Figure 3).

By saving money on operational expenses, open-loop payments also enable transit agencies to offer more affordable travel through fare-capping—putting a ceiling on the amount a transit passenger pays in a day, week, or month regardless of the number of trips. This means that a rider without financial security, one who might not be able to afford a weekly or monthly pass up front, does not spend more simply because that rider can afford only one trip at a time.

Figure 3: Steps agencies are taking to serve riders who do not use card payments



Source: VEEI and ThoughtLab survey of transit agencies and cities (2022)
Question (dark blue bars): "Many riders do not have, or may prefer not to use, debit, credit, or prepaid cards to pay for transit fares. When you moved to an open-loop EMV contactless system, which steps did you take to serve this population?"
Question (light blue bars): "How effective have these steps been in serving riders without debit, credit, or prepaid cards, or who prefer not to use these methods to pay for transit fares?"

Guatemala City: An open-loop pioneer in Central America

As part of its broader strategic plan to become a smart and sustainable city, Guatemala City is modernizing its transportation system. "Because of the pandemic, we have accelerated our digital transformation," said City Councilor Alessandra Gallio. "We have implemented several new initiatives like the adoption of digital signatures, a new system of traffic lights, new parking meters, and a new line of electric buses." With the purchase of 24 buses, in 2023, Guatemala City will be the first city in Central America to build an entire line of electric buses.

To modernize and digitize its public transport system, the city is eschewing cash fares and moving to a frictionless digital payment system. Guatemala City recently became one of the first cities in Latin America to move to an open-loop system, allowing customers to use their existing contactless credit or debit card to pay for a journey.

The new open-loop system connects more lines and stations as well as different neighborhoods. Passengers can tap directly on the payment terminal with their credit, debit, or prepaid card or smart device. Terminals are equipped with turnstile validators and are installed at the entrances and exits of train stations. In 2021, 400 contactless payment terminals were installed across the city. The city's new electric buses also accept open-loop payments.

However, as a city with many unbanked residents, it was critical for Guatemala City to keep a closed-loop payment option available. Only 5 percent of residents use credit cards in the transportation system; 95 percent use prepaid closed-loop cards. The city has around 1.1 million of these closed-loop cards in circulation. The prepaid cards are color-coded for some categories of riders, such as people with disabilities, the elderly, or municipal government employees.

Although most riders will continue to rely on prepaid cards, use of the open-loop option is expected to double to 10 percent over the next one or two years. "The open-loop system is widely used by the middle-class portion of the city," said Gallio. "We really hope that more people will be able to use credit and debit cards, but we face very low bank registrations."

The city has encountered other challenges to moving away from cash to a digital payment system. Not only is a large part of the population unbanked, but convincing residents to use any cashless system is not an easy task. The city organized a big advertising campaign when the new system was launched and hired crews of assistants to help new users in the stations.

"Encouraging our customers to switch to cards was difficult," said Gallio. "We also had technical difficulties in the initial deployment stage during the first three or four months. We were working 24/7 to solve all those problems."

But the benefits are well worth working through the early challenges. Whether from the open-loop or closed-loop system, the city now has access to valuable customer data for planning and decision making. These data help the city track rider behaviors, such as where riders are

traveling and why certain stations are growing more than others. The city plans to share these analytical insights with other parties, such as companies and advertisers, which are interested in knowing about the travel patterns of residents.

"In stations where we projected to have, let's say, 10,000 passengers, we might be receiving 30,000. So that tells us that we should probably expand that station," said Gallio. "All of that information has been crucial for the administrators of the system and the metro company to make decisions and improve our system."

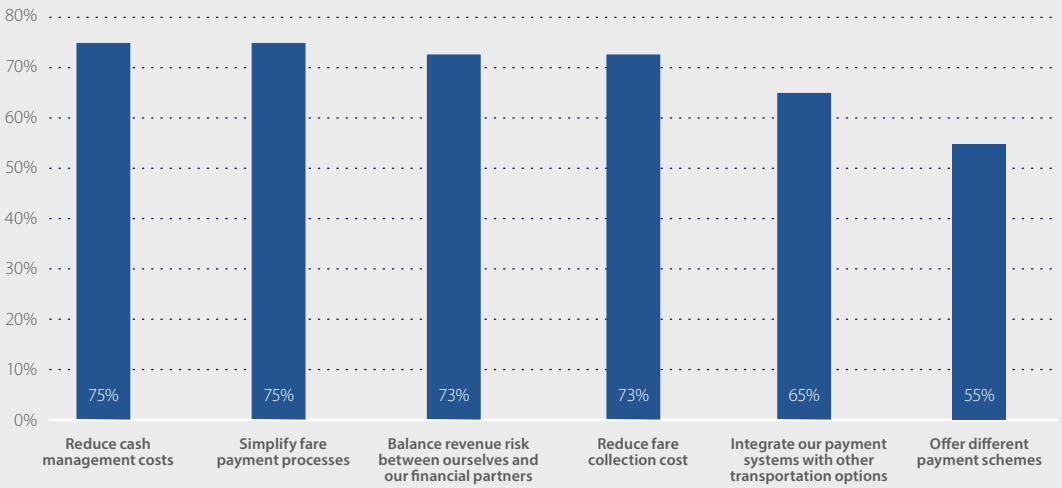
Open-loop payments benefit transit agencies and cities

Of the transit agencies covered in our survey, 68 percent have an open-loop contactless payment system for at least one transit line or route across transportation modes. These agencies reported numerous benefits from moving to an open-loop system, which fall into three categories: financial and payment, strategic and operational, and customer service and ridership.

Financial and payment benefits

Our survey found that contactless, open-loop systems provide a host of financial and payment benefits to transit agencies. By transferring banking and clearinghouse tasks to financial service firms, transit agencies simplify fare payment processes, reduce cash management and fare collection costs, and mitigate financial risks—including the danger of fraud and theft. These systems also allow transit agencies to better integrate with other transportation options through a common payment system. Further, they enable transit agencies to offer varied payment schemes, such as discounts, fare caps, and route-specific pricing (see Figure 4).

Figure 4: Top financial and payment benefits to transit agencies and cities



Source: VEEI and ThoughtLab survey of transit agencies and cities (2022)
Question: "How large of a benefit, if any, has your transit agency seen in the following areas from implementing open loop EMV contactless payment systems?"
Bars represent percentage of agencies reporting each item as a "moderate" or "large" benefit.

Transport for London (TfL), one of the first public transit agency to implement contactless, open-loop payments, has reaped many of these financial benefits. In addition to increasing passenger speed through gates, TfL has experienced a sharp fall in fare collection costs since implementing open-loop payments.

Reduction in risk due to fraud and theft was another major benefit for TfL, according to Shashi Verma, director of strategy and chief technology officer. Open-loop cards offer "incredibly high standards to prevent the risk of fraud and theft," he said. To get the full benefit, TfL agreed on a new set of commercial standards with payment networks and their banks. Under the arrangement, the banks take the first-line risk, and in turn, the transit agency sends an authorization within minutes of the transaction. If the transaction comes back negative, the card is put on a denial list across the entire network, which prevents the card owner from entering the system again.

Strategic and operational benefits

From an operational perspective, the benefit most often cited by agencies is greater flexibility in the type of fare collection equipment. Open-loop payments provide a flexible alternative to the costly and rigid fare collection systems offered through single, long-term vendor contracts. Open-loop payments allow a modular procurement approach that enables transit agencies to procure solutions from multiple vendors and tie them together through application programming interfaces (APIs). Such modular payment systems have long been common among retailers.

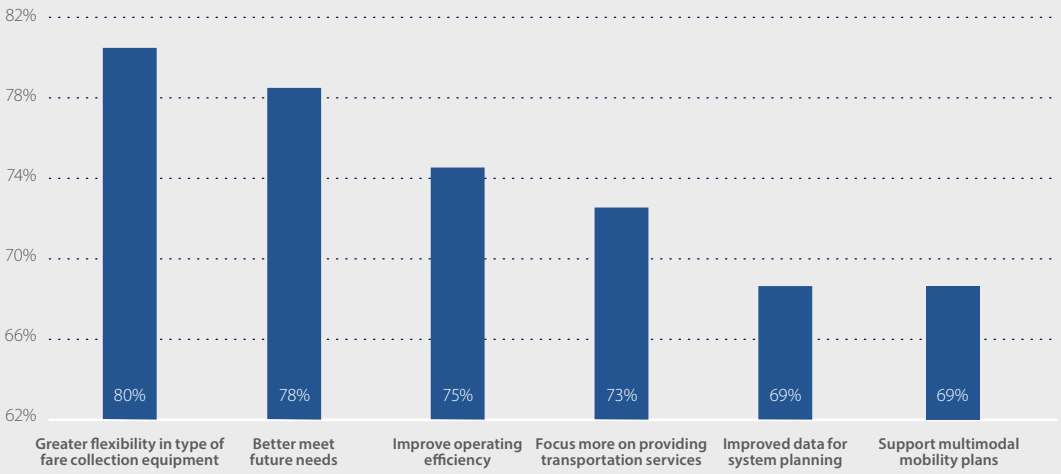
Open-loop systems also provide agencies with aggregate data about transit usage and trends. By providing deeper insights into ridership trends, these data help agencies optimize or create new services to meet rider demand. Nearly 70 percent of agencies cite improved access to data for system planning as a moderate or large benefit of open-loop systems (see Figure 5).

In Singapore, the Land Transport Authority has taken its data approach one step further, creating a "data mall," a platform that contains land-transport-related data sets and APIs for enterprises, third-party developers, researchers, and other members of the public to utilize. The goal of the initiative is to promote collaboration and co-creation of innovative and inclusive transport solutions between the public and government.

For many transit agencies, the biggest benefit of open-loop systems is their ability to improve efficiency. Three-quarters of transit agencies reported moderate or large improvements in operating efficiency from moving to open-loop payments (see Figure 5).

Another advantage of an open-loop system often cited by transit agencies is that it enables them to focus more on their key remit: providing transportation services. Gillian Gillett, program manager for integrated mobility at CalTrans, California's transportation agency, explained: "Open loop gets agencies out of the business of payments so that they can focus on their key job of moving people around. Payments take up an inordinate amount of transit agency bandwidth. Transit agencies are spending a lot of time on something that should be easy for them, but traditionally it hasn't been."

Figure 5: Top strategic and operational benefits to transit agencies and cities



Source: VEEI and ThoughtLab survey of transit agencies and cities (2022)
Question: "How large of a benefit, if any, has your transit agency seen in the following areas from implementing open loop EMV contactless payment systems?"
Bars represent percentage of agencies reporting each item as a "moderate" or "large" benefit.

Customer service and ridership benefits

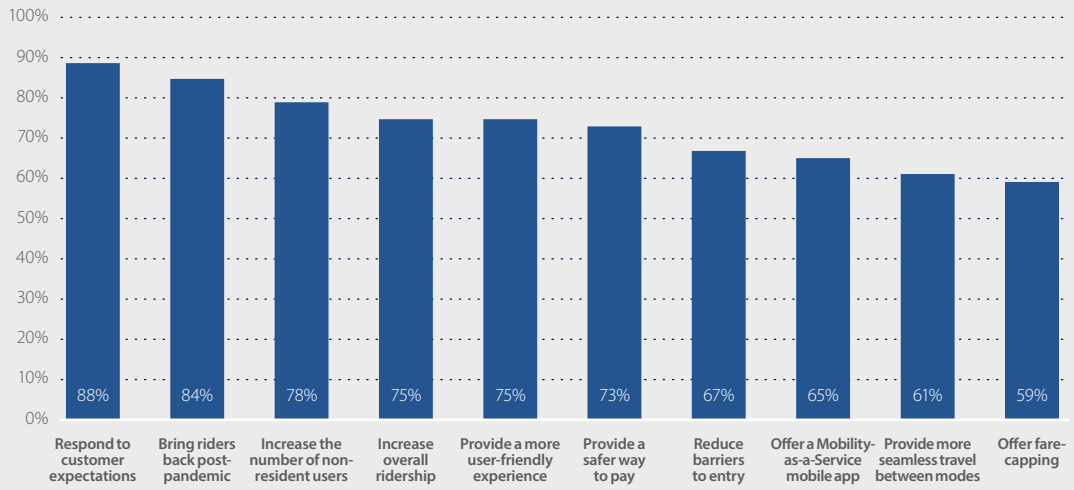
Open-loop payments provide riders with seamless and more predictable transit journeys. Nearly nine out of ten agencies surveyed reported that contactless payments allowed them to better respond to customer expectations, and seven out of ten said open-loop payments allowed them to provide a more user-friendly experience (see Figure 6). Shashi Verma of TfL highlighted the importance of meeting rider expectations, remarking that "you can't get enamored by the technology itself. Agencies need to think carefully about how customers will perceive it."

Contactless payments also provide riders with a safe and secure way to pay. Eliminating customers' need to use cash, kiosks, ticket machines, or sales counters to purchase tickets or add value to their closed-loop cards greatly reduces in-person interactions and contact with surfaces. That became critical for agencies looking to increase safety, convenience, and confidence in transit services, particularly during the pandemic era. In fact, 84 percent of agencies surveyed said that contactless payments were a factor in helping them convince riders to return to public transit as cities emerged from the pandemic (see Figure 6).

By addressing rider concerns about convenience and hygiene, contactless, open-loop payments go a long way in promoting ridership. Nearly one third of transit riders surveyed reported that they started using public transport more often because of the ability to use open-loop payments, 36 percent have encouraged their family and friends to use public transport, and 37 percent are more spontaneous in their use of public transport. The average open-loop user reported having increased use of public transport by almost four rides per week.

Eight out of 10 transit agencies surveyed have seen a climb in ridership following the adoption of open-loop payment systems. Moreover, this benefit continues increasing with time. Transit agencies in early stages of open-loop implementation saw an average total increase of approximately 6 percent, compared to over 10 percent for more advanced agencies.[1] Two main factors affect the timing of ridership growth. First, open-loop initiatives often start as pilots that are then scaled across the entire transit system. Second, to drive results, agencies need to continue to educate riders about open-loop payments and their benefits.

Figure 6: Top customer service and ridership benefits to transit agencies and cities



Source: VEEI and ThoughtLab survey of transit agencies and cities (2022)
Question: "How large of a benefit, if any, has your transit agency seen in the following areas from implementing open loop EMV contactless payment systems?"
Bars represent percentage of agencies reporting each item as a "moderate" or "large" benefit.

[1] In this study, an "advanced" agency is defined as one that implemented open-loop payment systems two or more years ago. A "novice" agency is one that implemented open-loop payments less than two years ago.

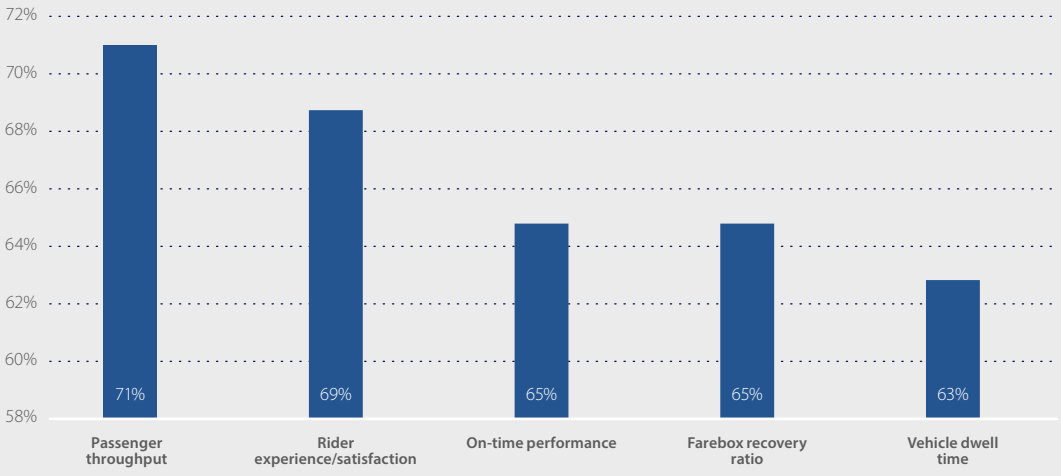
How transit performance metrics improve under open-loop payments

Most transit agencies in our study witnessed moderate to large improvements in a mix of performance metrics from adopting an open-loop payment system. The two metrics with the greatest improvement were passenger throughput and rider satisfaction. A senior executive in Toronto's transit agency told us that "open loop is a game-changer in improving the traveling experience." Another executive, in Almaty, Kazakhstan, said that open loop will "help in boosting ridership growth and resolving interoperability-related issues."

About two-thirds of agencies with open-loop payments saw upswings in on-time performance, which can increase ridership by providing passengers a faster and more predictable ride (see Figure 7). Almost as many transit agencies experienced improvements in dwell time, a performance metric that measures how long a transit vehicle spends at a scheduled stop without moving. Reduced dwell time is a key metric not just because of its impact on on-time performance, but also because of its potential to reduce the emissions generated by transit vehicles (Tang et al., 2018).

The improvements in farebox recovery ratios reported by 65 percent of agencies using open-loop systems underscore the financial benefits generated by such systems. The farebox recovery ratio, a key measure of financial performance, is the percentage of operating costs covered by fare paid by riders. For most agencies, the fares collected do not cover the costs of operating the systems, causing them to rely on government subsidies to make up the difference. By boosting their farebox recovery ratios through open-loop systems, transit agencies can reduce their dependence on government subsidies and generate money that can be invested back into the transit system.

Figure 7: Top improvements in metrics for transit agencies and cities



Source: VEEI and ThoughtLab survey of transit agencies and cities (2022)
Question: "How large of an improvement, if any, has your transit agency seen in the following metrics since moving to open loop EMV contact less payments systems?"
Bars represent percentage of agencies reporting each item as a "moderate" or "large" improvement.

Open-loop payments help reduce carbon emissions

Striving for a greener future

Cities and countries around the world are taking important steps to reduce carbon emissions. Many of these steps came in the wake of the Paris Agreement, the international treaty aimed at holding the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels. In order to meet this target, participating countries intend to "reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by mid-century" (United Nations Framework Convention on Climate Change, n.d.).

At the national level, governments are doing their part by providing transit agencies with funds to modernize their urban mobility ecosystems. One major initiative supporting these goals came from the United States, with the Biden administration's Bipartisan Infrastructure Law. The law includes $1.66 billion in grants for agencies to invest in zero-emissions bus fleets (Federal Transit Administration [FTA], 2022a). Steps are also being taken at the state and local level. Well over half of respondents to our agency survey are forging plans to encourage a shift from personal vehicle use to public transit and invest in low-carbon transportation options within the next five years (see Table 4). The Port Authority of New York and New Jersey (2020), for example, is electrifying its shuttle buses, ground support equipment, and cargo handling vehicles; the new electric bus fleet is expected to eliminate over 1,600 tons of greenhouse gas emissions each year. Other cities seeking to convert their bus fleets include Oslo, Norway, and Guatemala City (Bennett, 2022).

Table 4: How transit agencies are decreasing their carbon footprint

STEPS	Now	Next five years
Develop targets and plans to shift personal vehicle use to public transit	57%	61%
Encourage clean transport options for last mile transport	52%	59%
Set decarbonization targets for our public transit system	49%	59%
Invest in low carbon transportation options (such as electric buses)	48%	59%
Set up low/zero emission zones in the city	48%	56%
Partner with transportation providers to develop EV charging facilities	47%	56%
Implement smart pricing initiatives to promote low carbon travel modes	41%	57%
Integrate EV charging with public transit	40%	57%
Pursue micro-transit options with electric vehicles	33%	56%

Source: VEEI and ThoughtLab survey of transit agencies and cities (2022)
Question: "Which steps is your agency currently taking, and which does it plan to continue or begin to take in the next five years to reduce the carbon footprint of the public transit system?"

The role of open loop

In addition to the steps described above, transit agencies are implementing contactless, open-loop payments into their transit system modernization plans. Across several major indices, including ridership, vehicle miles traveled (VMT), and carbon emissions, agencies with open-loop payment systems report significant beneficial outcomes. To provide an estimation of these benefits, we assessed the potential impact of open-loop payments for cities with small, medium-sized, and large transit agencies. These size classifications were based on data from the American Public Transportation Association[2]. We also divided the agencies into two groups according to when open-loop payments were implemented: "novice" agencies had less than two years of experience, and "advanced" agencies had two years of experience or more (see Tables 5 and 6).

According to our analysis, the introduction of contactless, open-loop payment systems is correlated with positive sustainable outcomes within the first two years of implementation. Moreover, this relationship tends to grow as the systems become more established. Small, medium-sized, and large transit agencies all reported increased ridership correlated with the introduction of open-loop payment systems. Moreover, ridership continued to grow as the systems became more established—especially in small and medium-sized cities—suggesting that as riders become more familiar with the system, they opt to take more transit trips. As outlined in Table 5, small and medium-sized agencies with less than two years of open-loop experience showed an aggregate growth in ridership of 4 percent, compared with 12 percent total growth for agencies of the same size with more than two years of experience. Large agencies also showed benefits growing over time, with a 6 percent total ridership increase in the first two years growing to 10 percent for more advanced agencies.

Agencies also reported decreases in the number of single-occupancy vehicle (SOV) trips and, in turn, decreases in annual VMT across all agency sizes. Novice agencies saw decreases in SOV trips of 28,000 for small, 644,000 for medium-sized, and 8.7 million for large agencies. This implies that as much as 57 million VMT total were eliminated. For advanced agencies, the impacts were more significant; 46,000 and 989,000 SOV trips were eliminated for small and medium-sized agencies, respectively, and 11.6 million for large agencies—meaning up to 76 million VMT were eliminated in total.

This reduction in VMT also accounts for reduced emissions. As in the case of ridership, we observe a larger impact on emissions for agencies that have offered contactless, open-loop payment solutions for more than two years (see Tables 5 and 6).

[2] We define small cities as those with fewer than 4 million annual riders, medium-sized cities as those with between 4 million and 20 million annual riders, and large cities as those with more than 20 million annual riders.

Table 5: Benefits observed in "novice" agencies and cities after implementing open-loop systems (aggregate change)

	SMALL AGENCIES	MEDIUM-SIZED AGENCIES	LARGE AGENCIES
ANNUAL RIDERSHIP			
Average number of riders	440,000	9,896,000	136,738,000
RIDERSHIP BY MODE			
Bus	100%	87%	64%
Subway/light rail	0%	7%	28%
Commuter rail	0%	6%	8%
INCREASED RIDERSHIP			
Percentage rise[i]	4%	4%	6%
Riders added	19,600	441,600	8,025,000
REDUCTION IN TRIPS PAID IN CASH			
Trips converted	23,088	519,287	7,050,900
TRAVEL TIME SAVINGS			
Total hours saved	129	2,634	29,806
REDUCTION IN SOV TRIPS			
Trips eliminated	28,649	644,368	8,749,246
REDUCTION IN VMT			
VMT eliminated	233,612	3,802,050	57,337,553
POLUTION REDUCTION			
CO_2 reduction (tons)[ii]	58	946	20,444
NOX reduction (tons)[iii]	0.2	3.2	68.6
CRASH REDUCTION			
Crash-related fatalities reduced[iv]	0.0	0.0	0.5
Crash-related injuries reduced[v]	0.1	1.8	39.4
Property damage crashes reduced[vi]	0.2	3.0	65.1

Source: VEEI and ThoughtLab survey of transit agencies and cities (2022); FTA (2022b)

[i] Percentage rise in average daily riders since adopting open-loop payments.

[ii] The CO2 reductions are based on 404 grams of CO2 per vehicle mile traveled.

[iii] The NOx reductions are based on 1.4 grams of NOx per vehicle mile traveled.

[iv] The fatal crash reductions are based on 0.012 fatal accidents per 1 million vehicle miles travelled.

[v] The injury crash reductions are based on 0.858 injury accidents per 1 million vehicle miles travelled.

[vi] The property damage crash reductions are based on 1.417 property damage accidents per 1 million vehicle miles travelled.

Table 6: Benefits observed in "advanced" agencies and cities after implementing open-loop systems (aggregate change)

	SMALL AGENCIES	MEDIUM-SIZED AGENCIES	LARGE AGENCIES
ANNUAL RIDERSHIP			
Average number of riders	440,000	9,896,000	136,738,000
RIDERSHIP BY MODE			
Bus	100%	87%	64%
Subway/light rail	0%	7%	28%
Commuter rail	0%	6%	8%
INCREASED RIDERSHIP			
Percentage rise[i]	12%	12%	10%
Riders added	59,187	1,104,507	12,917,220
REDUCTION IN TRIPS PAID IN CASH			
Trips converted	23,088	519,287	7,050,900
TRAVEL TIME SAVINGS			
Total hours saved	138	2,801	30,911
REDUCTION IN SOV TRIPS			
Trips eliminated	45,829	988,890	11,565,075
REDUCTION IN VMT			
VMT eliminated	373,702	5,834,883	75,790,886
POLLUTION REDUCTION			
CO_2 reduction (tons)[ii]	166	2,598	33,752
NOX reduction (tons)[iii]	0.6	8.7	113.3
CRASH REDUCTION			
Crash-related fatalities reduced[iv]	0.0	0.1	0.9
Crash-related injuries reduced[v]	0.3	5.0	65.0
Property damage crashes reduced[vi]	0.5	8.3	107.4

Source: VEEI and ThoughtLab survey of transit agencies and cities (2022); FTA (2022b)

[i] Percentage rise in average daily riders since adopting open-loop payments.

[ii] The CO2 reductions are based on 404 grams of CO2 per vehicle mile traveled.

[iii] The NOx reductions are based on 1.4 grams of NOx per vehicle mile traveled.

[iv] The fatal crash reductions are based on 0.012 fatal accidents per 1 million vehicle miles travelled.

[v] The injury crash reductions are based on 0.858 injury accidents per 1 million vehicle miles travelled.

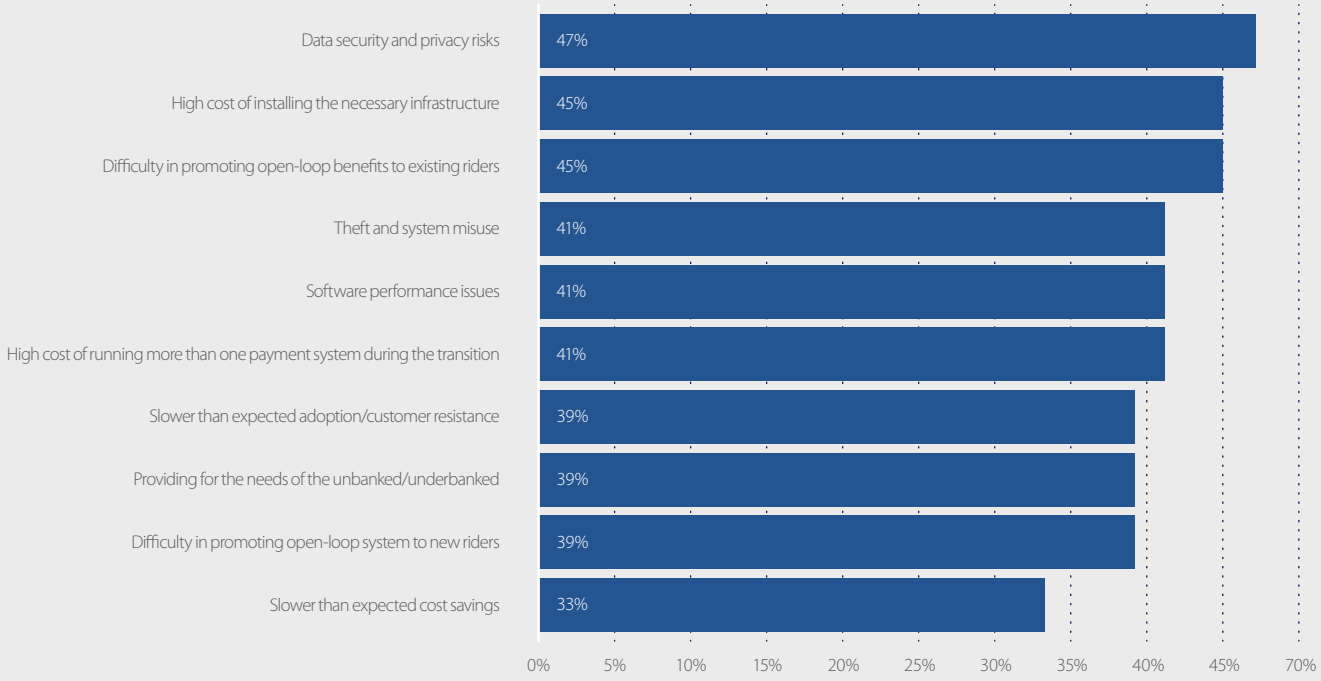
[vi] The property damage crash reductions are based on 1.417 property damage accidents per 1 million vehicle miles travelled.

Challenges remain, but the benefits far outweigh them

Open-loop payments play a vital role in modernizing public transportation systems, thus helping them become more sustainable, affordable, and easy to use. That is why 83 percent of surveyed transit agencies that do not have open-loop systems plan to adopt them in the future. Of those agencies, 70 percent intend to do so within the next two years. As agencies prepare for the migration to open-loop payments, they should be prepared for certain challenges.

Among the agencies in our survey who had already adopted open-loop payments, the top challenge cited was data security and privacy risks (see Figure 8). However, as agencies gained experience and comfort with open-loop systems, their concerns about these risks declined significantly. While 55 percent of agencies who had adopted open-loop payments less than two years ago cited data security and privacy as a challenge, only

Figure 8: Top challenges implementing open-loop payments for transit agencies and cities



Source: VEEI and ThoughtLab survey of transit agencies and cities (2022)
Question: "Which of the following challenges did your transit agency experience when implementing an open-loop EMV contactless payments system?"

36 percent of agencies with two or more years of experience expressed the same concerns.

Poor user communication can be another hurdle. Many agencies have had difficulty promoting open-loop payments to existing riders (45 percent) and new riders (39 percent). As transit agencies scale their open-loop systems, these problems can grow: 34 percent of novice agencies find promoting open loop to existing customers to be a trouble spot, compared with 59 percent of advanced agencies. Transit agencies would be wise to consider open-loop communication beyond signs and posters in the stations, especially if they wish to attract new riders and address their concerns about data security and privacy.

Many transit agencies work with legacy technology and infrastructure that is hard to maintain and upgrade. Forty-five percent of those surveyed cited high costs associated with upgrading their technology, and 41 percent mentioned software issues as a roadblock to full open-loop integration. Over time, agencies appear to resolve many of the software issues—although 48 percent of novice agencies in our survey cited problems with software performance, the same was true for only 32 percent of advanced agencies.

Overall, the benefits of implementing contactless, open-loop payment systems far outweigh the challenges. These systems promote ease of use and inclusivity for riders, increase cost savings and logistical benefits for transit agencies and cities, and may even help reduce carbon emissions—all important benefits.

Conclusion

Frictionless access to urban mobility is vital for cities as they strive to be sustainable, inclusive, and better equipped to meet changing travel behaviors. Open-loop payment systems for transit enable seamless access to urban mobility, while freeing transit agencies to do what they do best—provide mobility services.

We are at a global inflection point. Cities around the world now recognize the need to take urgent action to mitigate and reverse the impacts of climate change through changes to the built environment—in part by encouraging the use of mass transit. In this watershed moment, cities and transit agencies are looking for solutions that will entice more riders to choose sustainable modes of travel.

The introduction of contactless, open-loop payments has been shown to have significant impacts on how people choose to move through urban environments. The benefits to transit agencies that adopt contactless payments include improved access to data for system planning, more responsive customer service and improved rider experience, and a growing year-over-year conversion of cash-based fare payments. By removing cash from the system and decreasing the resource impacts of cash handling, agencies become better able to meet the needs of riders.

Riders also benefit from contactless payments. Contactless solutions for urban mobility provide easy access to transit and an improved experience for regular riders, occasional riders, and visitors. People with no or little access to banking services can take advantage of contactless payments by using prepaid cards. Two thirds of transit agencies surveyed said that the use of prepaid cards was an effective solution for meeting the needs of people who are un- or underbanked. These solutions also enable transit agencies to provide concessions and discounts such as fare-capping. Additionally, prepaid cards for transit can support expanded financial inclusion, as these cards may be used outside transit purposes, wherever open-loop card payments are accepted. That makes prepaid transit cards a powerful tool for expanding both financial and mobility access to all.

Cities around the world are taking multipronged approaches to achieving climate goals and meeting the needs of the modern traveler. Open-loop payments are an essential part of this process, and their benefits have been shown to grow the longer they have been a part of a transportation system. This means that there is no better time to implement these solutions than now.

Sources

Bennett, P. (2022, October 18). *Oslo Looks to Become World's First Capital City with All-Electric Public Transit.* EcoWatch. https://www.ecowatch.com/oslo-electric-public-transit.html

Federal Transit Administration (FTA). (2022a, August 16). *Biden-Harris Administration Announces over $1.6 Billion in Bipartisan Infrastructure Law Funding to Nearly Double the Number of Clean Transit Buses on America's Roads.* https://www.transit.dot.gov/1800buses

— (2022b). *The National Transit Database* [Data set]. https://www.transit.dot.gov/ntd

Port Authority of New York and New Jersey (2020, October 15). *Port Authority doubles electric shuttle bus fleet at airports, becoming the largest all-electric fleet on the east coast.* https://www.panynj.gov/port-authority/en/press-room/press-release-archives/2020-press-releases/port-authority-doubles-electric-shuttle-bus-fleet-at-airports--b.html

Tang, C., Ceder, A., & Ge, Y. (2018, August 1). Optimal public-transport operational strategies to reduce cost and vehicle's emission. *PLOS One.* https://doi.org/10.1371/journal.pone.0201138

ThoughtLab. (2022, November). *Building a Future-Ready City.* https://thoughtlabgroup.com/building-a-future-ready-city/

United Nations (UN). (n.d.). *Generating power.* https://www.un.org/en/climatechange/climate-solutions/cities-pollution#:~:text=Cities%20and%20Pollution,cent%20of%20the%20Earth's%20surface

United Nations Framework Convention on Climate Change. (n.d.). *What is the Paris Agreement?* https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

World Bank. (2022, March 29). *Financial Inclusion Overview.* https://www.worldbank.org/en/topic/financialinclusion/overview

Annex 1: Survey methodology

Agency study

For our agency study, we performed a computer-assisted telephone interview (CATI) survey of 75 worldwide transit agencies in 2022. The survey included a mix of transit agencies with open-loop EMV payment systems (67 percent of the sample) and those without open-loop payment systems (33 percent). The transit agencies were in 33 countries. Each survey respondent was selected in advance to participate in the study.

The goal of the survey was to explore urban mobility plans and gather data on the impact of new mobility modes, fare payment systems, and electric vehicle infrastructure. In order to ensure the quality of survey responses, we included a screening question to certify that respondents were knowledgeable about their agency's fare payment practices.

We also conducted interviews with executives from the following transit agencies and departments of transportation:

- California Department of Transportation
- Singapore Land Trust Authority
- Transport for London
- Municipal Council, Guatemala City
- San Francisco Bay Area Rapid Transit

Rider study

For our rider study, we surveyed 3,000 transit riders from six global cities (500 respondents per city) that were in varying stages of implementing open-loop payments in 2022. The cities were Bangkok, Brussels, Bucharest, New York, Rio de Janeiro, and Singapore. The survey probed transit riders' views on open-loop systems, including such systems' benefits to passengers and their impact on rider behavior. The survey also included questions on electric vehicle ownership and electric vehicle charging and payment systems.

Annex 2: Text description of figures and tables

Table 1: How people plan to change their transit use over the next five years
This table displays the percentage of respondents to our transit rider survey who plan to increase their use of various transit types in the next five years. It shows that 45 percent of respondents plan to increase walking, biking, and scootering around the city, while 44 percent plan to increase their use of private transportation, including cars and bikes. Additionally, 42 percent of respondents expect to use environmentally friendly motorized transportation such as electric vehicles. Thirty-two percent of respondents plan to increase their use of public individual transportation such a bike rental or taxi, while 24 percent plan to increase their use of public mass transportation such as buses and trains.

Figure 1: Top complaints from riders about their city's transit system
This bar plot displays our transit rider survey respondents' top complaints about their city's transit system. Twenty-seven percent of respondents find their city's transit system to be unaffordable, while 23 percent complain that their transit system is low-quality. Nineteen percent complain that their city's transit system is unreliable and inadequate, 18 percent complain that their system is outdated, 17 percent find their system unfair, and 16 percent find their system complicated, difficult to use, and inconvenient.

Table 2: Where transit riders agree their city should make changes to transportation
This table displays the top changes that respondents to our transit rider survey believe their city should make to its transportation system. Eighty-eight percent of transit riders agree that their city should invest in more environmentally friendly forms of public transportation and make it faster and easier for people to move around the city. Additionally, 87 percent of respondents believe that their city should support the use of environmentally friendly private transportation and make the use of multiple modes of transportation in a single trip more seamless. Furthermore, 86 percent of respondents agree that their city needs to provide better first- and last-mile connectivity, while 85 percent agree that a wider variety of transportation options would make it easier for them to travel.

Table 3: How transit riders prefer to pay
The table displays payment methods respondents to our transit rider survey typically prefer when they are using public transportation. The top preference among our respondents is tapping a contactless credit, debit, or prepaid card, with 42 percent preferring this method. The second preference was tapping a mobile wallet, at 39 percent. Thirty-eight percent of respondents prefer to use agency-issued cars like Oyster, Octopus, and Clipper. Additionally, 31 percent of transit riders prefer to use cash, while 29 percent prefer to use app-based payment. Twenty-eight percent of respondents prefer to insert or swipe a credit, debit, or prepaid card or use QR code to pay. Twenty-three percent prefer to pay using a barcode, 20 percent prefer to use paper ticket, and 19 percent prefer to use tokens.

Figure 2: Top benefits to riders from using a contactless card or mobile wallet
This bar plot displays top benefits from using a contactless card or mobile wallet to pay for transit cited by respondents to our rider survey. Fifty-seven percent of respondents feel that using a contactless card or mobile wallet is faster and more efficient—the number one benefit cited. Forty-nine percent see avoiding the need to carry cash as a benefit, and 46 percent cite greater safety and hygiene. Forty-two percent of respondents find that contactless payments simplified traveling through the city, and 39 percent cite easier record keeping. Thirty-seven percent of respondents see not having to load money onto a card as a benefit, while 36 percent cite the benefit of not having to carry tickets or tokens. Thirty-one percent of respondents see access to loyalty and rewards programs as a benefit, and 26 percent cite the advantages of fare capping.

Figure 3: Steps agencies are taking to serve riders who do not use card payments
This bar plot displays steps agencies are taking to serve riders who do not use card payments, in addition to the effectiveness of each step—according to the results of our transit agency and city survey. The three steps taken by the greatest percentage of respondents were continuing to accept cash payments (55 percent), offering fare discounts to low income riders (53 percent), and offering the option to load transit cards with cash (51 percent). However, the top three most effective steps differed slightly. The most effective step was allowing the use of prepaid cards (67 percent), followed by offering fare discounts (63 percent) and educating unbanked riders on the benefits of open-loop payments (62 percent).

Figure 4: Top financial and payment benefits to transit agencies and cities
This bar plot displays the financial and payment benefits of open-loop systems cited by respondents to our survey of transit agencies and cities. Seventy-five percent of respondents cite reduced cash management costs and simplified fare payment processes. Seventy-three percent say implementing open-loop payments helped balance revenue risk between themselves and their financial partners and reduce fare collection costs. Sixty-five percent of respondents say open-loop payments allowed them to integrate payment systems with other transport options. Lastly, 55 percent report that open-loop payments allowed them to offer schemes such as discounts and route-specific pricing.

Figure 5: Top strategic and operational benefits to transit agencies and cities
This bar plot displays the strategic and operational benefits of open-loop systems cited by respondents to our survey of transit agencies and cities. Eighty percent of respondents report greater flexibility in the type of fare collection equipment they can utilize. Seventy-eight percent of respondents report that implementing open-loop payments helped them better meet future needs. Seventy-five percent of respondents said open-loop payments improved operating efficiency, and 73 percent said it allowed them to focus more on providing transportation services. Sixty-nine percent of transit respondents report that implementing open-loop payments improved data for system planning and supported multi-modal mobility plans.

Figure 6: Top customer service and ridership benefits to transit agencies and cities
This bar plot displays the customer service and ridership benefits of open-loop systems cited by respondents to our survey of transit agencies and cities. The top three benefits cited by respondents were the ability to better respond to customer expectations (88 percent), the ability to bring riders back post-pandemic (84 percent), and the ability to increase the number non-resident users (78 percent). Other significant benefits include an increase in overall ridership and the ability to provide a more user-friendly experience—each cited by 75 percent of respondents.

Figure 7: Top improvements in metrics for transit agencies and cities
This bar plot displays the top improvements in metrics transit agencies and cities in our survey have observed since integrating open-loop payments. These metrics (in order) are as follows: passenger throughput (71 percent), rider experience and satisfaction (69 percent), on-time performance (65 percent), farebox recovery ratio (65 percent), and vehicle dwell time (63 percent).

Table 4: How transit agencies are decreasing their carbon footprint
This table displays steps agencies and cities in our survey are taking to reduce their carbon footprint now and in the next five years. The most common steps that respondents are taking now include developing targets and plans to shift personal vehicle use to public transit (57 percent), encouraging clean options for last-mile transport (52 percent), and setting decarbonization targets (49 percent). In the next five years, the share of agencies and cities planning to take these steps increase to 61 percent, 59 percent, and 59 percent, respectively. Fifty-nine percent of respondents also plan to invest in low-carbon transportation options (such as electric buses) in the next five years.

Table 5: Benefits observed in "novice" agencies and cities after implementing open-loop systems (aggregate change)
This table displays the benefits—mainly environmental benefits—that open-loop payments have provided to transit agencies and cities in our survey who adopted these systems in the past two years. These "novice" agencies are further broken into three size-based categories: small agencies, medium-sized agencies, and large agencies. The benefits listed in this table include increased ridership, reduction in single-occupancy vehicle trips, and pollution reduction. For small and medium-sized agencies, the table shows an aggregate increase in ridership of 4 percent. For large agencies, the table shows an aggregate increase in ridership of 6 percent.

Table 6: Benefits observed in "advanced" agencies and cities after implementing open-loop systems (aggregate change)
This table displays the benefits—mainly environmental benefits—that open-loop payments have provided to transit agencies and cities in our survey who have had these systems in place for greater than two years. These "advanced" agencies are further broken into three size-based categories: small agencies, medium-sized agencies, and large agencies. The benefits listed in this table include increased ridership, reduction in single-occupancy vehicle trips, and pollution reduction. For small and medium-sized agencies, the table shows an aggregate increase in ridership of 12 percent. For large agencies, the table shows an aggregate increase in ridership of 10 percent.

Figure 8: Top challenges implementing open-loop payments for transit agencies and cities
This bar plot displays the top challenges transit agencies and cities in our survey face from implementing open-loop payments. The top three challenges cited by our respondents were data security and privacy risks (47 percent), difficulty in promoting the new systems to existing riders (45 percent), and the high cost of necessary infrastructure (45 percent). Forty-one percent of respondents also cited having to run more than one payment system, software performance issues, and theft and system misuse. Thirty-nine percent cited difficulty in promoting the new systems to new riders, difficulty providing for the unbanked and underbanked, and slower than expected adoption. Lastly, 33 percent of respondents cited slower than expected cost savings.

About Visa Inc.

Visa Inc. (NYSE: V) is the world's leader in digital payments. Our mission is to connect the world through the most innovative, reliable, and secure payment network–enabling individuals, businesses, and economies to thrive. Our advanced global processing network, VisaNet, provides secure and reliable payments around the world, and is capable of handling more than 65,000 transaction messages a second. The company's relentless focus on innovation is a catalyst for the rapid growth of digital commerce on any device for everyone, everywhere. As the world moves from analog to digital, Visa is applying our brand, products, people, network, and scale to reshape the future of commerce.

For more information, visit About Visa, visa.com/blog and @VisaNews.

Visa Economic Empowerment Institute