WORLD ECONOMIC FORUM

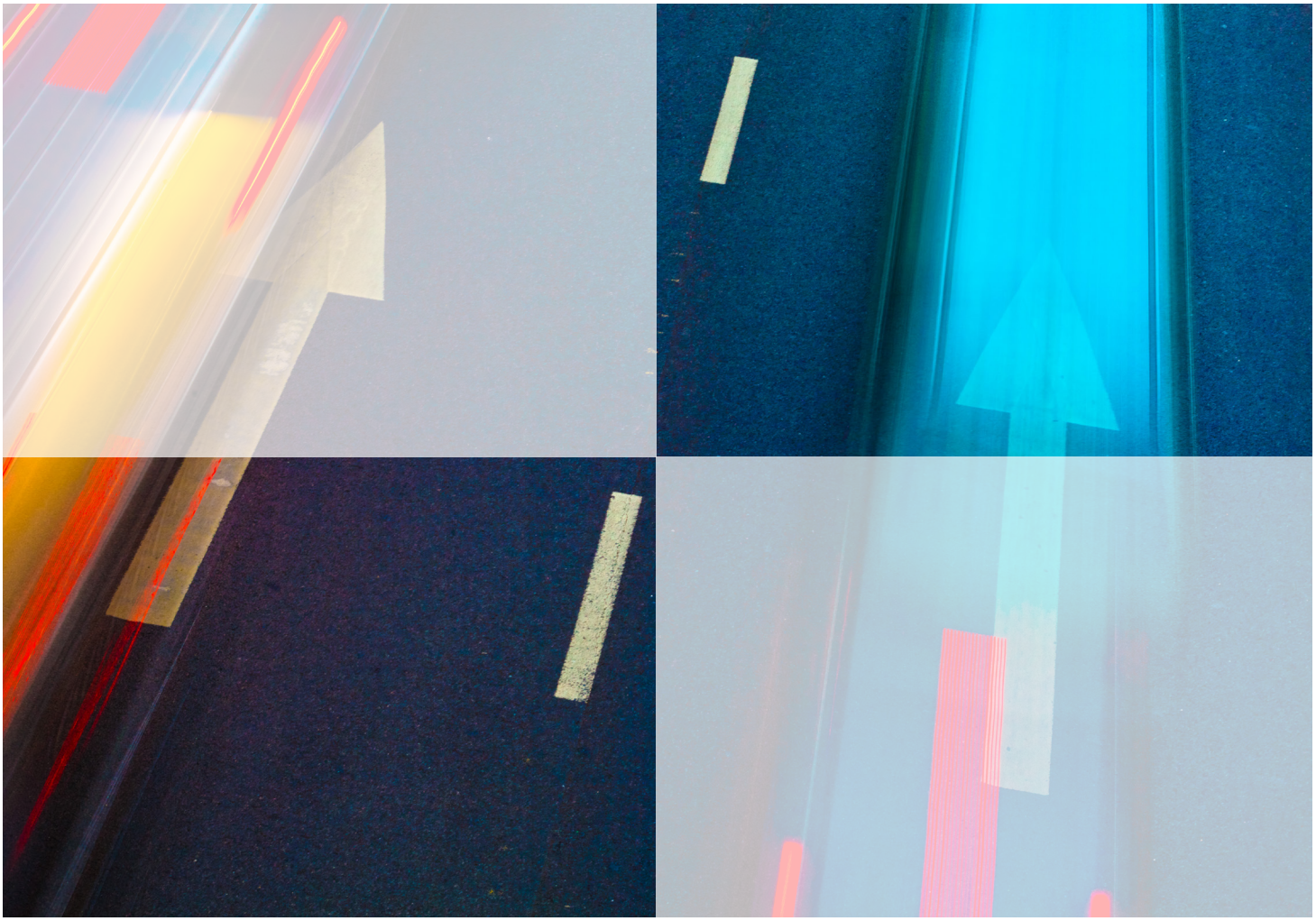
COMMITTED TO IMPROVING THE STATE OF THE WORLD

Industry Agenda

# Connected World
## Hyperconnected Travel and Transportation in Action

In collaboration with The Boston Consulting Group

May 2014



REF 280414

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# Preface: Transforming Travel, Transportation and Supply Chains

In 2013, the first of 14 "smart-gates" went into operation at Dubai International Airport's Terminal 3. Passengers who enrolled and qualified were able to simply – and swiftly – walk through automated, secure checkpoints using biometric recognition to identify individuals. Without breaking stride, they cleared customs in 20 seconds.

From Dubai to Rio de Janeiro, from the United States (US) to Hong Kong, cities and countries are introducing technology and processes – some of which are familiar and others that appear futuristic – to increase efficiency of travel, trade and transport. Megacities are deploying traffic monitoring systems to unsnarl congestion. Companies and customs agencies are widening the use of standardized and digitized trade documents to reduce trade barriers. Moreover, companies are introducing applications that plan, book and update the best, customized real-time travel options across multiple transportation modes.

These moves come at a time when traffic, transportation, travel and trade are accelerating, but also hindered by vexing problems that threaten the fluid, seamless movement of an increasing number of people and goods.

**500,000 fewer travel-sector jobs in the US** – cost of US visa requirements for Chinese, Indians and Brazilians

As of 2011, for the first time in history, more than half of the world's population was living in urban areas.[1] By 2050, an additional 2.6 billion people will add to those already in the world's cities.[2] In the meantime, these urban residents are becoming increasingly prosperous and progressively more influential as consumers. One result of this gain in wealth is a growing demand for automobiles, whose number worldwide could swell by 60%, increasing from 1 billion today to 1.6 billion by 2025.[3] That presents a challenge for many cities already plagued by traffic congestion. Without coordinated efforts by companies and governments, this growth in the number of vehicles risks putting these cities in a state of near permanent gridlock. Traffic congestion already erodes an estimated $200 billion in gross domestic product (GDP) in the European Union (EU) and the US,[4] and reduces commerce worldwide by more than $1.4 trillion.[5] For drivers, traffic interruptions reduce productivity; for companies, they translate into delayed shipments and lost revenue.

**600 million** – increase in the number of cars by 2025

**$1.4 trillion** – cost of traffic jams worldwide

Over the last 20 years, international travel has played an increasingly pivotal role in the economic development of many countries, as newly prosperous citizens become more mobile. Growth in real incomes, greater amounts of leisure time and improved and highly accessible transportation systems are some of the important drivers behind the surge in global travel. Overall, travel contributed an estimated $6.9 trillion to global GDP in 2013; that amount could increase by 50% through 2023 to $10.4 trillion.[6] Increased travel also creates challenges, with a steep price to pay for travellers waiting for baggage, security checks and border entry. The inconvenience faced by citizens of the People's Republic of China (China), India and Brazil in obtaining a US visa has contributed to losses in the US share of the international travel market amounting to almost half a million travel-sector jobs.[7] Increased demand created by hundreds of millions of new passengers is clearly overburdening systems – from checking-in for flights to clearing security lines and processing visas.

**$10.4 trillion** – potential contribution of travel to global GDP

International trade has increased steadily because of advances in technology and transportation, the rise of globalization, multinational corporations and outsourcing, and has grown for the past 160 years at a rate faster than global GDP.[8] That growth is expected to persist: world merchandise trade is forecast to grow 8% per year through 2030, outpacing even the most optimistic GDP estimates.[9] As trade volume continues to accelerate, so does the need for speed and seamless flow of material, increasing pressure on customs operations among other facilitators of global trade. The lack of coordinated and efficient international supply chains and logistics networks have an enormous cost, restraining global GDP by an estimated 5% and slowing total trade volume by a staggering 15%.[10]

In 2012, The World Economic Forum, in collaboration with The Boston Consulting Group, launched the "Connected World: Transforming Travel, Transportation and Supply Chains" project to identify new solutions for traffic, transportation, travel and trade that use hyperconnectivity – the increasing interconnectedness of people, places and machines. This hyperconnectivity exists not only in communication between people – as the number of smartphone users is forecast to rise by 120% to 3 billion in 2017[11]– but also in the connectivity of machines; it is estimated that 90% of all new cars will be able to communicate with infrastructure systems by 2025.[12]

**3 billion** – smartphone users in 2017

The project gathered more than 50 senior executives across several related industries (transportation, travel, tourism and logistics, and information and communication technology [ICT]), as well as officials from the public sector and leading academics. The work aimed to identify and exploit opportunities to significantly improve traffic, transportation, travel and trade, not only by using new technology but also by bringing together multiple stakeholders to forge collaborative solutions. During its first year, the project created a long list of possible solutions; four of those stood out for their potential to offer the most profound societal benefits and business opportunities:

**Automated check-in, security, border control and smart visas (ACIS)** will ease difficulties in international travel while ensuring high levels of security and traveller privacy. This solution focuses on countries improving visa application and processing at the national level, or on creating a common visa application process for regional trading blocs. In addition, the solution enhances check-in and security procedures at airports and other travel hubs through extensive process automation and technological improvements, including biometric identification and new scanning technologies.

**Condition-based megacity traffic management (COMET)** uses real-time data collection and analytics to steer or redirect traffic, provide smart parking capabilities for inner cities and manage public transportation capacity. It also uses dynamic tolling as well as access restrictions to handle congestion or manage emergencies. Individuals can thus circulate, and transport goods efficiently and securely, through the megacities of the future.

**Integrated proactive intermodal travel assistant (IPITA)** creates an integrated tool for selecting, booking and navigating different modes of travel customized to individual needs, using real-time information and advanced technology. Easy to steer, it uses smart devices or other interfaces such as data glasses or contact lenses as displays. Any changes or disruptions, such as congestion or weather problems, are directly detected, and alternative modes of travel or rerouting are suggested in real time. All of this is provided by one interface that can also purchase a ticket for all the transportation required.

**Transparency and traceability for logistics optimization (TATLO)** streamlines cumbersome logistics and customs processes, addressing the flow of information among companies and between companies and governments. By creating a "single window" for customs operations and providing information exchange for companies, TATLO allows trade to flow more smoothly and efficiently, ensuring goods move more swiftly, less expensively and more reliably.

In its second year, the "Connected World" project analysed each of the four solutions in detail. The focus was to identify important stakeholders, present the existing, partial implementations of each solution and develop potential operating models based on discussions with leading industry partners and other organizations. In addition, the project highlighted the main challenges and potential roadmaps for putting each solution into action. This report presents the results of that work and summarizes the recommendations for creating the multistakeholder governance models and other prerequisites needed to operate these solutions at scale.

The recommendations include:

- **Alignment among stakeholders:** All the relevant parties must have a good understanding of the benefits to them.
- **Well-crafted, multilevel governance models:** Each solution will have a model that balances the need for representation with effective decision-making.
- **Standards for data collection and transmission:** Collectively agreed-upon standards on data formatting will ensure that information from various sources is comparable.
- **Data security:** Storing and handling data in a secure manner will address concerns about loss of personal or business privacy.
- **Viable business and financing models:** Each solution includes an operating model that shares the benefits among all parties in a way that encourages them to collaborate, engage and create a roadmap for achieving that model.
- **Step-by-step approach:** All solutions would be implemented incrementally, with each stage reinforcing the model and delivering sufficient economic benefit to motivate further investment.

Over the next 12 months, the "Connected World" project will focus on building policy dialogue to bring together the key stakeholders and accelerate implementation – which could prove to be a major driver of innovation and make traffic, transportation, travel and trade more efficient, comfortable and sustainable by 2025.

# 1. Smoother Travel through Electronic Visas (e-Visas) and Smart Airports

*ACIS: Automated check-in, security, border control and smart visas*

### Key Points

- Travel and tourism, a frequently underestimated segment of international trade, has grown dramatically over the past 30 years and has provided enormous GDP growth and job creation, especially for nations relying heavily on the sector for economic growth.
- Archaic visa applications and processing, as well as inefficient queues at security checks and points of entry (notably airports), cost governments tens of billions of dollars each year in lost revenue.
- Smart visas and smart airports can dramatically enhance the experience and increase frequency of travel, thereby elevating the sector's contribution to national or regional economic growth.
- The main obstacles to implementing such advanced systems are not technological, but are related to security concerns.
- Implementing ACIS will require governments to collaborate through individual bilateral agreements or regional trading blocs, and to adopt common approaches to visa applications and border crossings.

### 1.1 Tourism in 2025

*Imagine travelling from Beijing, China to Sydney, Australia in 2025. Before your trip, you applied for and received an e-visa without visiting an embassy. At the Beijing airport, airline check-ins used to mean long waits at the ticket counter; now, a simple fingerprint scan issues your ticket. Next, you speed through an automated checkpoint, where a biometric scan identifies you, recognizes your behavioural profile and travelling patterns, and clears you and your luggage to proceed past security. At the departure gate, electronic boarding replaces long lines, delays and jockeying for position. Upon arrival at Sydney Airport, immigration is seamless as your biometric data is compared with the information on your e-visa. After positive identification, you hop on the train to Sydney Harbour.*

### 1.2 Improved Customer Experience for International Travellers

The benefits of having such a system are clear: for the Group of Twenty (G20) countries, it was estimated in 2011 that improving visa processes could generate an estimated $40 billion-200 billion in additional tourism receipts by 2015, resulting in as many as 5 million new jobs.[13] For airport security, the impact of a more efficient baggage screening system could potentially reduce the personnel costs of the US Transportation Security Administration by almost $500 million over the next 5 years.[14]

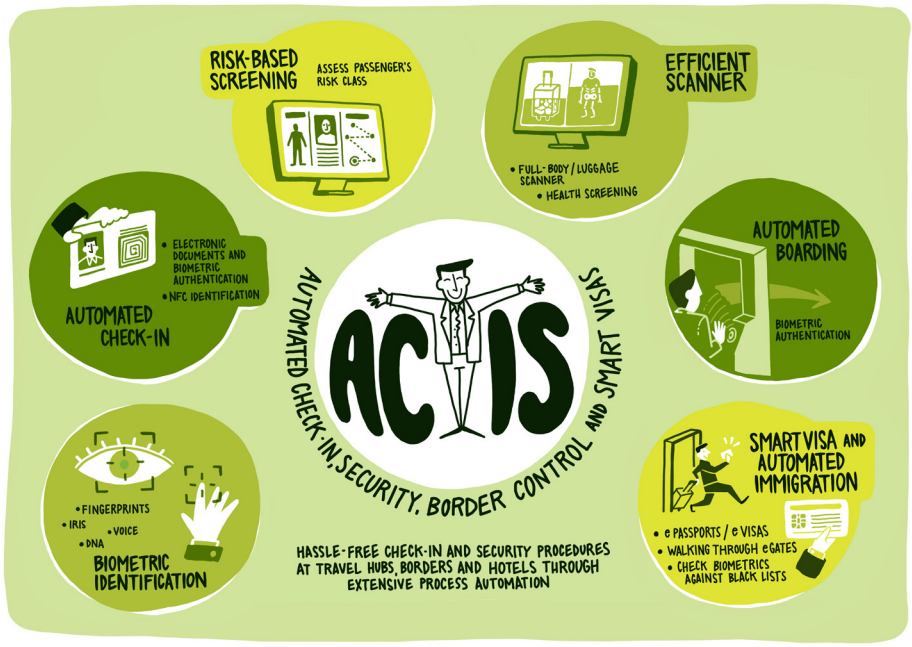
A sharp increase in international travel and heightened security requirements are straining systems designed to handle a substantially lower volume of travellers. To improve the process, ACIS focuses on two main areas. First, it creates a framework for single countries or regional blocs to ease visa acquisition and processing for international travellers, with use of online platforms and advanced people screening technology. Second, ACIS enables hassle-free movement of people. The system's important overall features are shown in Figure 1, an illustration developed for the "Connected World" project.

**$40 billion-200 billion** – potential increase in tourism receipts in G20 countries

Integrated smart visa and automated immigration processes can exploit biometric identification, pre-interviews and e-visas to create national (or international) databases that ease the visa application procedure for international business and leisure travel. The ACIS solution accomplishes this through risk-based screening that allows border control authorities to assess risk profiles based on several factors, such as travel patterns. By adopting smart infrastructure at the point of departure, systems can evaluate physiological characteristics to speed up recognition at security checks and accelerate passenger movement through the selected travel hubs. Efficient full-body and luggage scanners can further reduce queues at security. In addition, while automated check-in using electronic documentation and identification is already widely used in air travel, it could be expanded to automated boarding and thus conclude this integrated process. A video illustrating the ACIS solution can be viewed at http://youtu.be/hRyv0aLgsxw.

**Figure 1:** Key Features of ACIS

Source: World Economic Forum/The Boston Consulting Group analysis; *illustrated by The Value Web*



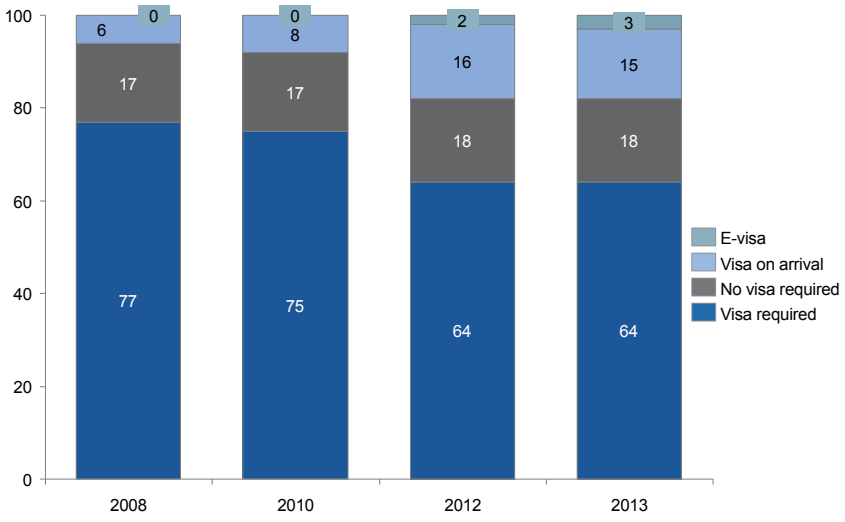

## 1.3 Technology in Place, but Implementations Still Limited

Various governments have already put some of the ACIS components into place to reduce processing and waiting time for visa approvals, utilizing online application or visa on arrival (Figure 2).

Some governments have also streamlined the process of border passage using preapproved traveller programmes. However, none of the current implementations (Figure 3) covers all the ACIS criteria.

**Figure 2:** Share of World Population Affected by Visa Policies (%)[15]

Source: World Tourism Organization (UNWTO), 2013. Tourism Visa Openness Report: Visa facilitation as means to stimulate tourism growth



## **Figure 3:** Current Smart Airport Implementations

Source: World Economic Forum/The Boston Consulting Group analysis

| | IATA | Dubai International Airport | Swiss Federal Railways | US Global Entry |
|---|---|---|---|---|
| Biometric ID | ◕ | ◔ | ○ | ◔ |
| Risk-based screening | ◔ | ◔ | ○ | ◔ |
| Automated check-in | ◑ | ◔ | ◔ | ○ |
| Efficient scanners | ◕ | ○ | ○ | ○ |
| Automated boarding | ○ | ○ | ○ | ○ |
| Automated immigration | ◔ | ◑ | ○ | ◔ |
| | Air passenger screening based on risk assessments/ analysis of passengers' data; not fully automated | More highly automated airport security and immigration through the use of biometric data | Facilitation of air travel through pre-check-in at Swiss railway stations; no immigration, not automated | Bilateral agreement on facilitating security and immigration through intensive pre-checks; not automated |

◑ Degree of fulfilment of ACIS criteria

### ACIS Criteria

**Biometric identification**
Use of biometric data (e.g. fingerprints, iris scans) for identification

**Risk-based screening**
Vary screening based on assessed risk class (e.g. profile, travel patterns)

**Automated check-in**
Use of electronic documents or near field communication (NFC) for check-in

**Efficient scanners**
Full-body and luggage scanners identifying dangerous and forbidden materials

**Automated boarding**
Biometric identification against ID and boarding pass

**Automated immigration**
Use of e-visas and e-passports for immigration
Source: World Economic Forum/The Boston Consulting Group analysis

## **Figure 4:** US Global Entry Programme

Source: US Customs and Border Protection, 2014. "Global Entry". http://www.cbp.gov/travel/trusted-traveler-programs/global-entry; World Economic Forum/The Boston Consulting Group analysis

Terminals for expedited clearance after identification with Global Entry card


Global Entry card for identification as preapproved, low-risk traveller

Handling almost 30 million international air travellers per year,[16] US Customs and Border Protection (CBP) recently introduced "Global Entry", its trusted-traveller programme, to expedite clearance for preapproved, frequent and low-risk travellers upon arrival in the US (Figure 4).[17] The service mainly targets US citizens and extends through bilateral agreements to some countries such as Germany, South Korea and Mexico. To gain admission to the programme, travellers undergo a background check and complete an interview. Once accepted, they can proceed through an expedited immigration process using automated kiosks that rely on biometric facial recognition, and computers that scan and verify visa information.

The US programme followed on the actions of the International Air Transport Association (IATA), which introduced its "Checkpoint of the Future" concept in 2011, aiming to increase operational efficiency by classifying passengers into different risk categories based on previously collected biometric data and passenger behavioural information. Those classified as requiring additional screening would pass through iris scans, contraband detectors and thermal lie detection (Figure 5). Most travellers would be considered low risk and would pass through with minimal stops. The concept focuses on check-in and security checks, but does not cover boarding or immigration. In 2013, IATA announced an updated version of the concept called "Smart Security", with pilot tests scheduled for Amsterdam Schiphol and London Heathrow airports starting in 2014.[18]

In 2013, Dubai International Airport began to deploy one of the most technologically advanced systems for security and immigration, installing smart counters and e-gates using biometric identification based on iris-, fingerprint- and facial-recognition (Figure 6). The time required for immigration has dropped to less than 20 seconds for passengers who have preregistered their biometrics and are considered as low risk.[19]

**Figure 5:** IATA "Checkpoint of the Future" Concept

Source: International Air Transport Association (IATA), 2012. Checkpoint of the Future: Executive Summary; IATA, 2014. "Smart Security"; World Economic Forum/The Boston Consulting Group analysis


Three different scanning tunnels are equipped with an array of eye scanners, X-ray machines, and metal and liquid detectors.

The scanning process depends on passenger's risk class: "enhanced", "normal" and "known traveller".

**Efficient scanners; full-body scan, dependent on risk class**

**Risk-based screening through lie detection**

Thermal lie detection shows variations in facial temperature in response to questioning.

**Figure 6:** Dubai International Airport – Biometric Immigration

Source: Dubai International Airport, 2014. http://dnrd.ae/en/Services/Pages/Smartgate.aspx; World Economic Forum/The Boston Consulting Group analysis

Automated immigration via e-gate card with machine-readable documents

Biometric ID for immigration with fingerprint

## 1.4 Bringing Together Citizens, Authorities and the Private Sector

The success in broadening the use of systems such as those in the US, Dubai and Europe, and in enabling ACIS to reach its full potential, hinges on the alignment of interests among three crucial stakeholders: the private sector, public authorities, and citizens and travellers (Figure 7).

*Citizens and travellers* are the main users and beneficiaries of the system, as they enjoy reduced travel time and cost, and also benefit from smoother visa application and processing. However, the benefits must be balanced with the need for data protection and privacy, as well as for maintaining border security. Public opinion can also exert significant influence on authorities when the solution is being implemented.

*Public authorities* include multiple actors with partly divergent needs. Immigration, border protection and customs focus with maximum efficiency on preventing crime, terrorism and smuggling. Transport and tourism authorities, on the other hand, have goals covering the efficient operation of infrastructure and increasing a country's attractiveness as a travel destination. These authorities provide both the regulatory framework for ACIS and the oversight of many critical services of the system, including visa processing and border control.

*Private enterprises* supply many key services of ACIS, which include those provided directly to end users (e.g. airline check-in procedures) as well as services potentially funded by the public sector, such as security clearances at airports. For these parties, successful implementation can increase passenger volumes and reduce costs by increasing efficiencies. Also, private companies that may be responsible for handling visa applications can benefit from the introduction of smart visas through cost savings in visa processing and a potential increase in volume.

## 1.5 Smart Visa and Smart Airport Linked by Centralized Database

In order for ACIS to operate smoothly, governments should recognize that online visa application using the latest technologies is a fast, efficient and secure way to identify and screen travellers for customs, border control and travel[20] purposes. Research has shown a direct correlation between easing of travel restrictions for tourism and business purposes, and an increase in travel and trade (including foreign direct investment).[21] The magnitude can be profound, as the elimination of visa requirements can increase travel volumes by up to 25%.[22]
Furthermore, to provide an even more seamless travel experience and increase security controls, countries can develop smart infrastructure at travel hubs (as described later). While the two parts of ACIS – faster visa processing

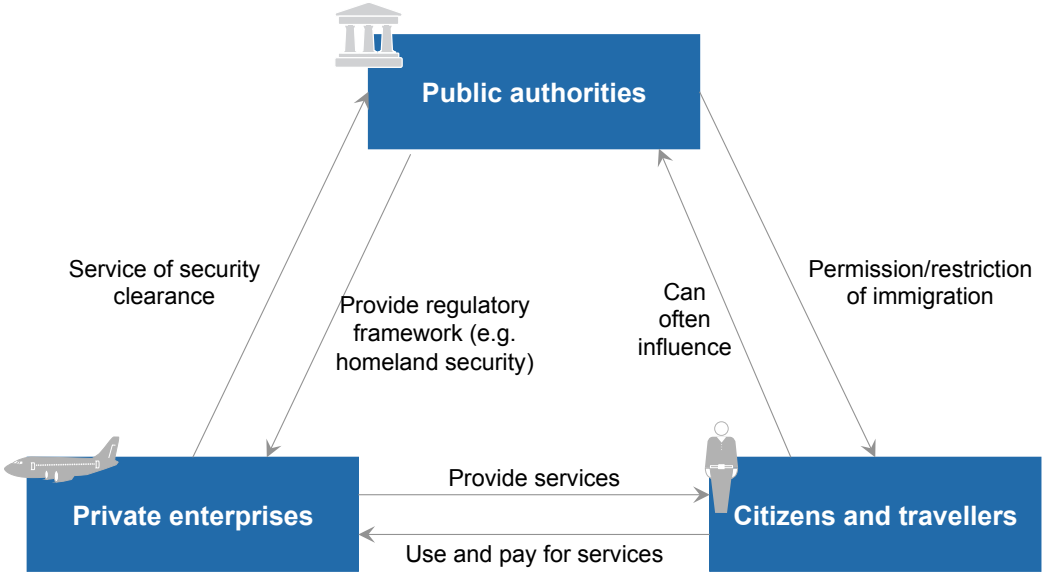
**Up to 25% increase in travel volumes** – impact of removing past visa restrictions

and acquisition, and streamlined procedures at travel centres – work best when implemented in concert, they can also be discrete systems.

In a proposed operating model for the smart visa (Figure 8), the visa processing would begin with the applicant, or traveller, submitting an online application and biometric information, and paying the fee to a processor (either a public or private operator). This processor would check the applicant's information against a national database funded by national authorities and linked to an international database operator, i.e. a supranational organization co-founded by numerous national authorities, similar to Interpol. The international operator would check the information

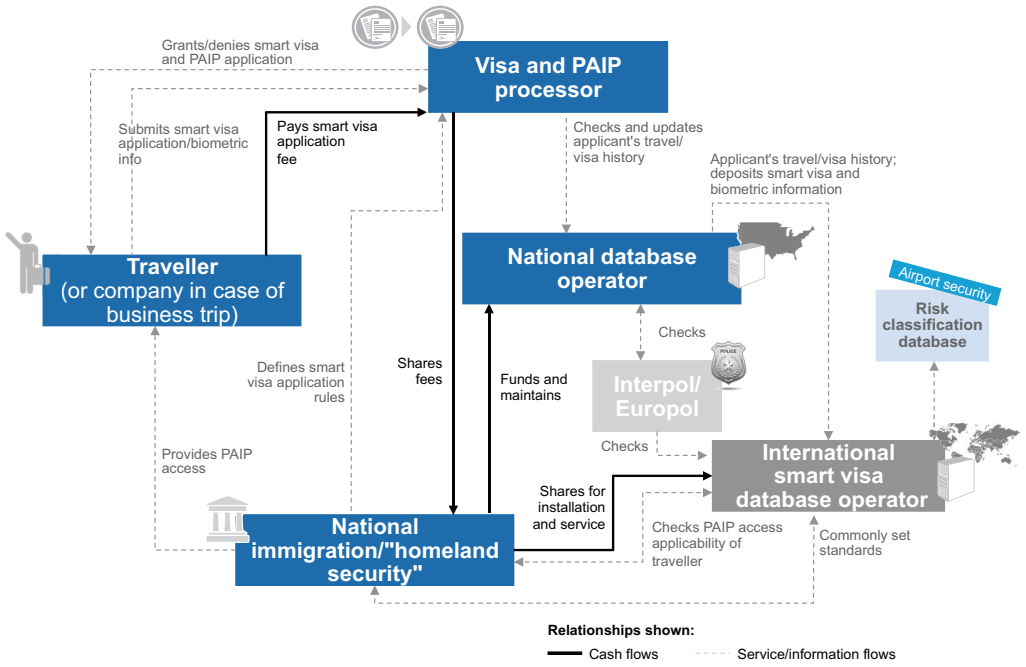
**Figure 7:** ACIS Stakeholders

Source: World Economic Forum/The Boston Consulting Group analysis



## Figure 8: Operating Model for Smart Visa

Note: PAIP = Preapproved immigration programme
Source: World Economic Forum/The Boston Consulting Group analysis




against criteria for the preapproved immigration programme (PAIP) and pass the assessment on to the national immigration or homeland security authority.

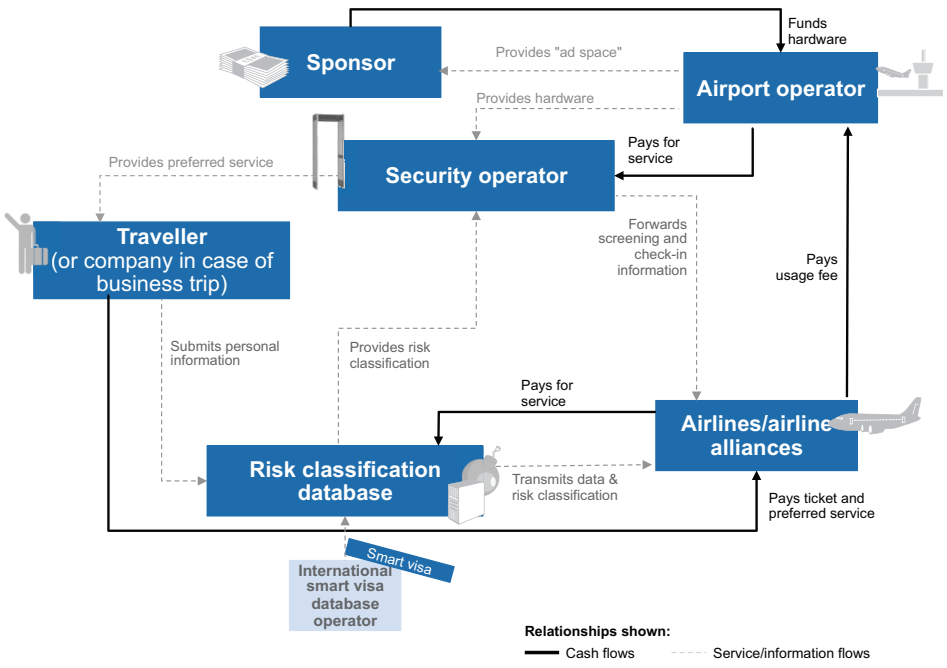
In a potential operating model for a smart airport scenario (Figure 9), a traveller would submit personal information to a risk classification database and pay a fee for preferred service. The database operator would pass the data into a government-operated risk classification database and then to airline and security operators. The information would also be linked to an international visa database that provides additional information about the traveller and facilitates risk-based screening for eligible travellers. Based on the database operator's assessment, the security operator would approve preferred service or forward the assessment to airlines and security personnel to take into account during check-in, security clearance and boarding.

### 1.6 Building Support through Gradual Roll-out

A high-level roadmap for implementing both the smart visa and smart airport solutions is shown in Figure 10.

## Figure 9: Potential Operating Model for Smart Airport

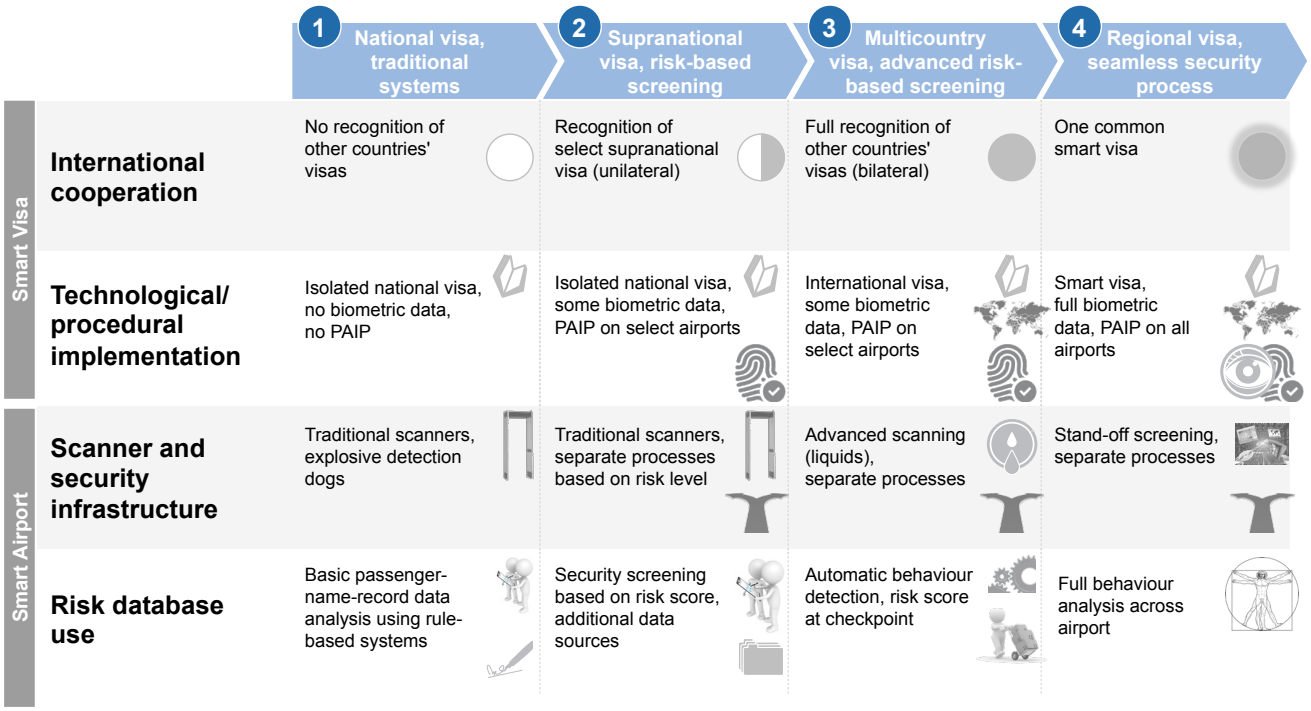
Source: World Economic Forum/The Boston Consulting Group analysis



Both systems would start with government recognition of the benefits of online visa acquisition, nationwide implementation of databases and visa systems, and the deployment of screening and profiling technology. Individual countries would then recognize visas of other countries through bilateral negotiations and an electronic application of visas (such as visa waiver programmes, or other programmes that would eliminate the need for travellers to apply for visas in person). This could lead to a supranational database created for the visa application. At travel hubs, the ACIS system would require the deployment of smart infrastructure. Finally, regional trading blocs such as the EU, Pacific Alliance, Association of Southeast Asian Nations or Southern Africa Development Community would establish unified visa systems with standard criteria and processes. Establishing a common visa policy for regional nationals is the first step. Regional blocs can then extend common visa regimes to international travellers, which would further increase trade and foreign investment.

**Figure 10:** Implementation Roadmap for Smart Visa and Smart Airport

Source: World Economic Forum/The Boston Consulting Group analysis



## 1.7 Sidebar: Smart Visa Systems in Place

Several examples of advanced visa acquisition programmes exist throughout the world. In Europe, 23 of the 28 EU member countries and four others cooperate in the Schengen visa and the Visa Information System (VIS), the world's largest smart visa operation that issued about 13 million short stay visas in 2011.[23] Necessity spurred this effort: because no internal border controls exist in the Schengen Area, a strong need arose for unified criteria and processes for handling visa applications. This works as follows:

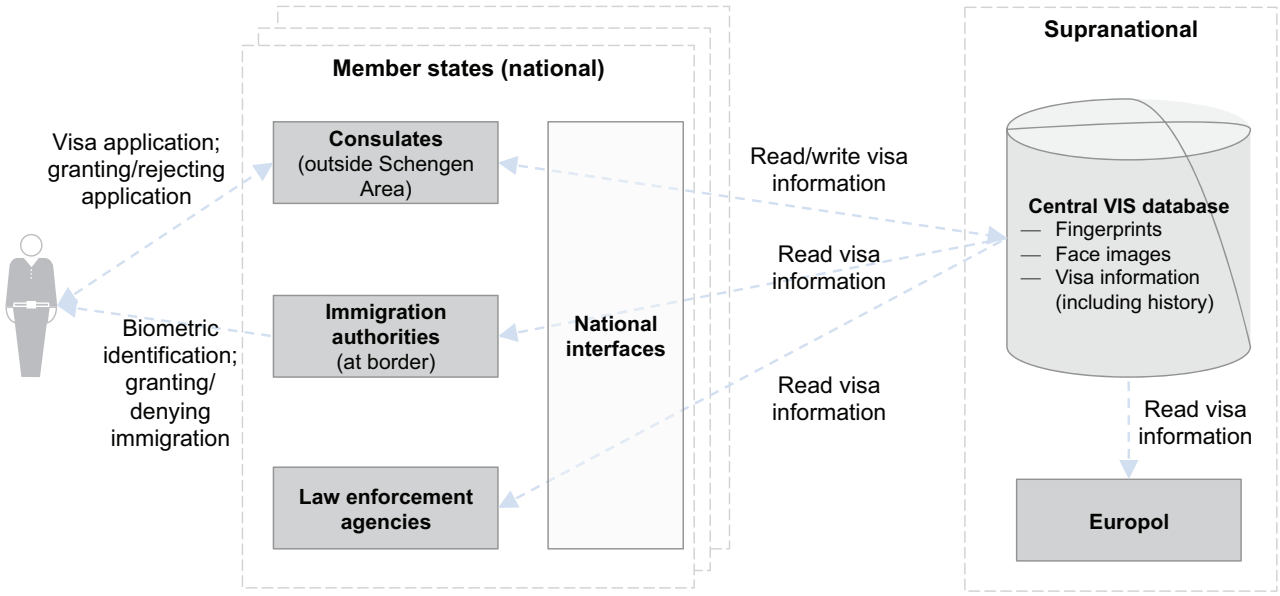
– Consulates of member countries handle visa applications manually. This requires physical presence for first-time visa applicants, who are also required to provide biometric information. Some member countries outsource the application process to private service providers.
– Once the information is gathered, applicants' data, including visa status and biometric information, are forwarded to the central VIS database. When travellers enter the Schengen Area, their visas are read electronically and compared to the database while they are identified with biometric data.

An overview of the system is shown in Figure 11.

While the Schengen system is very efficient and secure, it requires significant investment in establishing the database and communications infrastructure. It also requires sharing confidential data across borders and setting up one central database, both of which could heighten privacy concerns. The EU has attempted to solve these problems through an agreement on data protection and unified legislation on visa applications.

**Figure 11:** Schengen Visa System

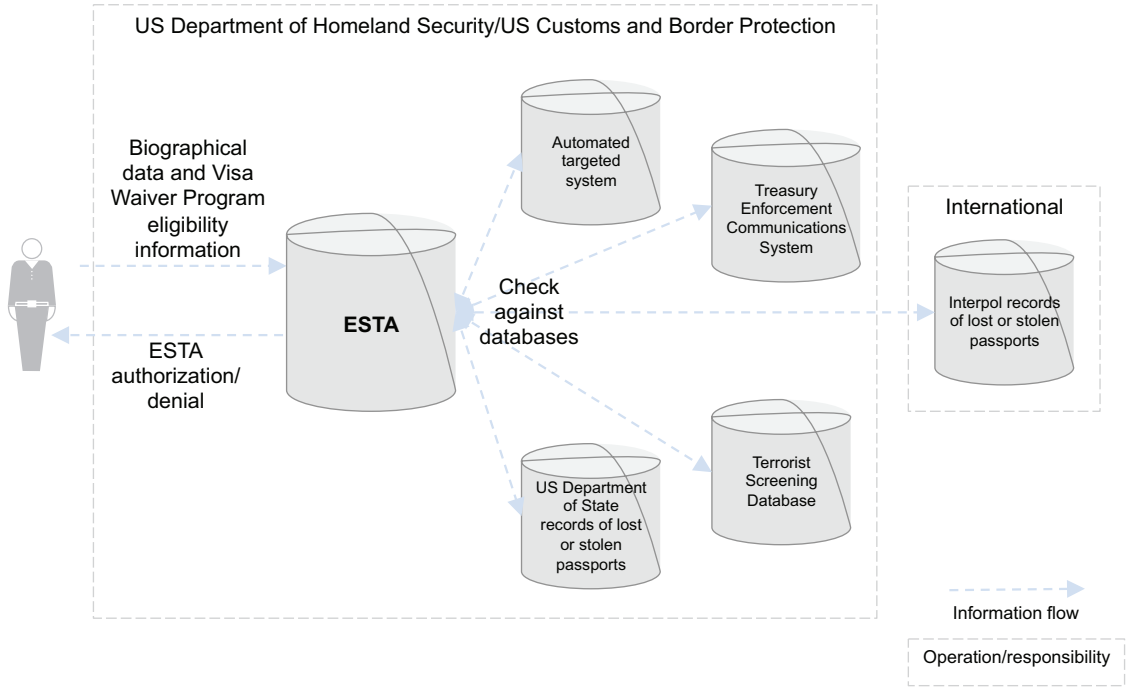
Source: European Commission. "Visa Information System Fact Sheet". http://ec.europa.eu/dgs/home-affairs/e-library/docs/vis_factsheet/visa_information_system_factsheet_disclaimer_ec_lr_en.pdf; World Economic Forum/The Boston Consulting Group analysis



The US developed two programmes to balance the large number of international travellers and the requisite level of security: the Visa Waiver Program (VWP) and the Electronic System for Travel Authorization (ESTA). The VWP covers 37 countries whose citizens do not require a visa for the US for stays of 90 days or less. However, those citizens are required to get travel authorization through ESTA before arrival in the US. A traveller from any of the 37 countries needs to complete an online ESTA questionnaire that aggregates biographical data. After that, CBP, part of the US Department of Homeland Security, decides on the authorization. At the port of entry, the CBP officer can see the ESTA status from a computerized database and make the final entry decision based on risk assessment. The ESTA information is stored in a centralized database where other agencies, such as the Terrorist Screening Center, can access the data. An overview of the system is shown in Figure 12. The ESTA programme is fast, effective and inexpensive for travellers (currently $14 per application).[24] However, it is limited to the US, which does not share the information on travellers collected for its database with other countries.

**Figure 12:** Overview of ESTA System

Source: PricewaterhouseCoopers, 2011. Policy study on an EU Electronic System for Travel Authorisation (EU ESTA): Final Report; World Economic Forum/The Boston Consulting Group analysis




ENREGISTREMENT
CHECK-IN
ENREGISTREMENT

# 2. Optimized Traffic Management for Tomorrow's Megacities

*COMET: Condition-based megacity traffic management*

### Key Points

- Traffic management has become a major challenge for megacities – and is likely to be more problematic in the future as people in the rising middle class in urban centres purchase and drive cars.
- COMET is a multistakeholder system that uses big data and analytics to solve megacity traffic problems through tools such as access restriction and smart parking. Current systems cover only some of these features.
- Based on analysis, COMET can result in up to $10 billion worth of benefits for a megacity with an initial investment of $1 billiion-4 billion. The main benefits come from improved productivity, reduced number of accidents and decreases in fuel consumption and carbon dioxide (CO2) emissions.
- Public-private collaboration and data security are two critical parts of setting up an effective, accepted system.

## 2.1 Traffic in 2025

*Consider that, one afternoon several years from now, you are driving and entering Mexico City. Suddenly, at 15.19, a regional traffic management system issues a warning: traffic may increase over the next hour by 200%, and $CO_2$ levels could exceed dangerous thresholds within 45 minutes. The system immediately offers you options: you can continue on the same route, but will have to pay an increased toll, or you can take an alternative route. By 16.00, the situation is not easing, and $CO_2$ levels have now breached the dangerous threshold. The system takes further action, restricting all access to the city. Now, drivers have to park outside its limits in designated park-and-ride facilities, where e-bus shuttles will whisk them into the city. The condition-based megacity traffic management centre has reduced $CO_2$ emissions and mitigated the jam by proactively detecting the situation, providing alternatives and then taking concrete steps. By 16.20, emissions have fallen well below the threshold, and traffic clears.*

## 2.2 Data and Analytics to Create Intelligent Traffic Management

To address the needs of growing megacities and the accelerating increase in traffic, a holistic system must provide timely, accurate snapshots of traffic patterns and allow for dynamic, real-time responses. To provide real-time traffic analytics, COMET uses real-time traffic monitoring from infrastructure and vehicle sensors, as well as weather forecasts. From there, a system operator using this analysis to anticipate traffic flows can respond in various ways – dynamically adjusting speed limits, traffic lights or toll charges; restricting or limiting access to certain areas; or providing variable-priced or free parking. The illustration in Figure 13 was developed for the "Connected World" project to summarize the system's features. Based on a cost-benefit analysis by the World Economic Forum and The Boston Consulting Group, implementing a comprehensive intelligent transportation system that covers all relevant functionalities for a megacity of 10 million people would result in net present value benefits of just under $2 billion to over $10 billion, depending on the technology and scope (see Sidebar). A video illustrating the solution and a user journey can be viewed at http://youtu.be/Meh359rr014.

**$2 billion-10 billion** – potential benefits of traffic management system in a megacity

**COMET Features**

Real-time monitoring
Using infrastructure and vehicle sensors to collect data on traffic and other issues

Real-time analytics
Combining and analysing data from multiple sources (e.g. predicting traffic volumes)

Intelligent steering
Using signalling and speed limits to manage traffic in real time

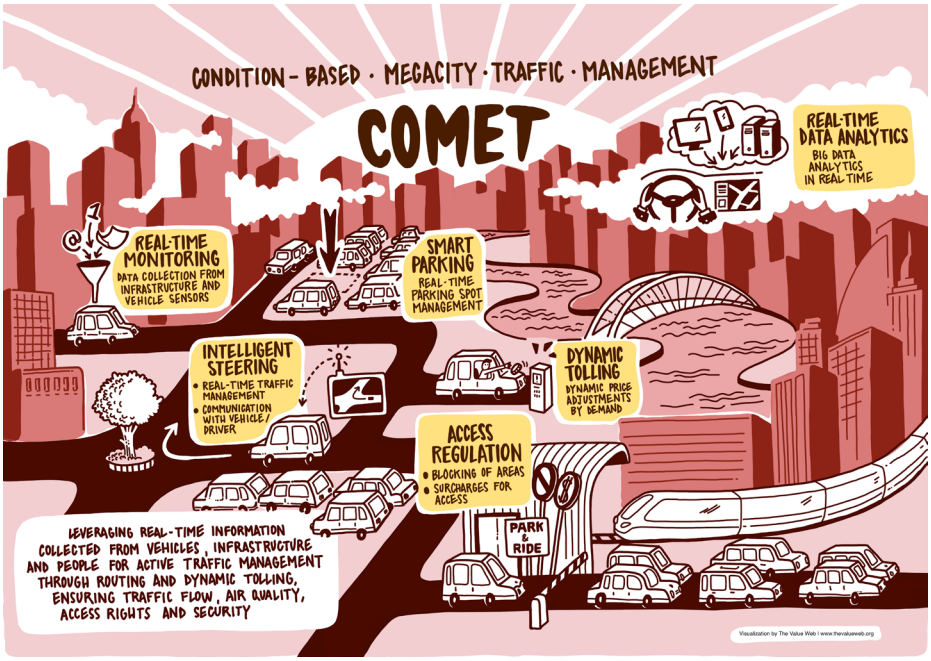
Dynamic tolling
Adjusting tolling rates dynamically (e.g. based on traffic volumes)

Access restrictions
Blocking or restricting access to areas (e.g. because of emission limits being exceeded)

Smart parking
Using real-time parking space management (e.g. signalling free parking or adjusting pricing)
Source: World Economic Forum/The Boston Consulting Group analysis

**Figure 13:** Key Features of COMET

Source: World Economic Forum/The Boston Consulting Group analysis; *illustrated by The Value Web*




## 2.3 No System as Yet Covering All the Features

Several examples exist around the world of citywide traffic systems (some implementations are shown in Figure 14). While each has real-time monitoring and other characteristics of COMET, no system as yet has all six features in place.

Launched by the Hong Kong Government in 2001, the Route 8 project (Figure 15), which began operations in 2010,[25] looked to reduce congestion and improve traffic flow within the densely built metropolis. The focus was to track usage on a major highway and road tunnels carrying a large share of the city's traffic. The system works by monitoring infrastructure and vehicle data in real-time, using this information to adjust speed limits and toll prices during peak and off-peak hours, as well as to restrict access during congestion. The system also includes advanced communications capabilities with information sent wirelessly to electronic road signs, display boards and mobile phones.

## **Figure 14:** Existing Traffic Management System Implementations

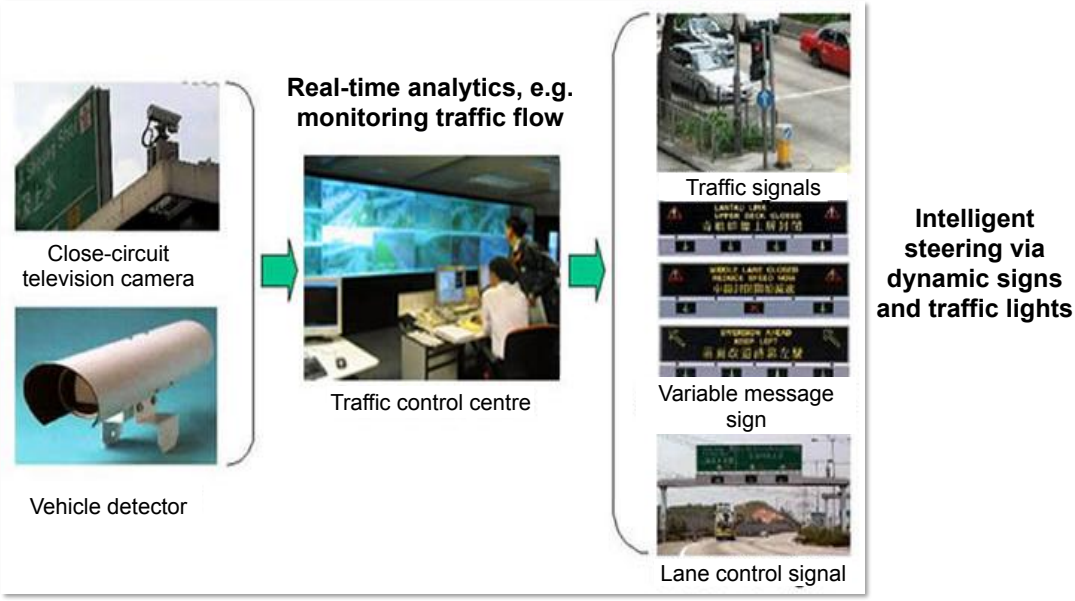
Source: World Economic Forum/The Boston Consulting Group analysis

| | Hong Kong | Zhenjiang | Rio de Janeiro | Singapore |
|---|---|---|---|---|
| Real-time monitoring | ◑ | ◑ | ◑ | ◔ |
| Real-time analytics | ◑ | ◑ | ◑ | ○ |
| Intelligent steering | ◑ | ◑ | ◑ | ◔ |
| Dynamic tolling | ◔ | ○ | ○ | ◔ |
| Access restrictions | ◑ | ○ | ◔ | ◔ |
| Smart parking | ○ | ○ | ○ | ○ |
| | System focusing on traffic steering to reduce congestion; no smart parking component | System with advanced analytics capabilities to steer traffic, but no tolling and parking capabilities | Comparably strong analytics, but largely human-powered; no dynamic tolling or smart parking | Dynamic tolling system to smooth traffic flows, but no advanced analytics capabilities |

◑ Degree of fulfilment of COMET features

## **Figure 15:** Hong Kong's Route 8 Project

Source: ITS International, March-April 2012. "Hong Kong's integrated traffic management system"; World Economic Forum/The Boston Consulting Group analysis




With a different set of goals – namely, to foster economic development and tourism[26] – the city of Zhenjiang, China, a municipality of 3 million people,[27] launched its traffic management system in 2010. It aggregates data collected from infrastructure and vehicle sensors throughout the city. Armed with this data, the system actively manages traffic patterns and responds proactively to traffic jams by dispatching buses on more than 80 routes. Focusing on communication to vehicles, this system does not include restricted access or smart parking capabilities.

In Brazil, Rio de Janeiro's Operations Centre is the first of its kind. The primary goal of the city's authorities was to create an intelligent operations centre, providing the city with insight into various aspects of city management and to react more quickly to emergencies. Launched in 2010 and employing more than 400 people, the Operations Centre monitors the city and integrates data from more than 30 city agencies and other sources.[28] That information helps the Centre prevent traffic jams using restricted access and intelligent steering, and also provides support for emergency services and law enforcement agencies.

**Figure 16:** Rio de Janeiro's Operations Centre

Source: IBM, 2012. "City of Zhenjiang, China and IBM Collaborate to Build a Smarter City". http://www-03.ibm.com/press/us/en/pressrelease/36883.wss; World Economic Forum/The Boston Consulting Group analysis

**Intelligent steering through real-time traffic management**


**Real-time analytics via integration of a variety of data**

Integrating all major functions of a city in one

## **20% annual growth** – in smart transport investment until 2025

These examples demonstrate the ability to implement even an ambitious traffic management system for a large city. However, none of systems includes all the features of COMET with data collection and analytics, or connects the different features with each other. Thus, significant potential for improvement exists.

Important technologies in the smart transport market are also advancing rapidly. While tolling began with manual collection stations, a later evolution introduced microwave technology to enable automated collection. To overcome this technology's drawbacks, automated cameras capable of scanning the number plates of cars entering urban areas were installed in cities such as Stockholm and London. More recent tolling technology, based on the global positioning system (GPS), is not yet accurate enough to use in cities, but could markedly reduce the cost of dynamic tolling. Driven by a raft of similar developments in other key technologies, the market for smart transport is forecast to grow 20% annually until 2025.[29]

### 2.4 Many Parties with an Interest in Traffic Management

The inclusion and alignment of several distinct stakeholders are prerequisites for COMET's successful adoption, as shown by a high-level overview (Figure 17).

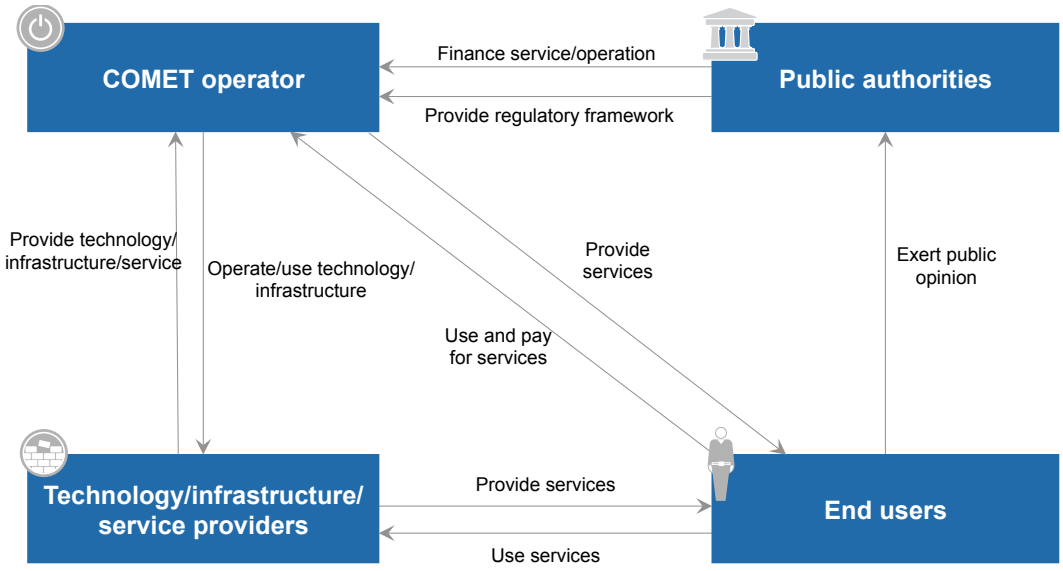
*End users*, or vehicle drivers and users of other transport methods, will be the ultimate beneficiaries of the service. Users can play a crucial role in pressuring authorities to set up such a system, and then can serve a watchdog function to ensure the system is running well. Drivers, of course, will benefit from reduced travel times, better parking availability, and the reduction in accidents and reduced emissions, with the latter two leading to health and safety improvements.

*Public authorities* are another important stakeholder group, charged with setting up the regulatory framework for creating and operating the traffic management system. This requires cooperation among authorities on multiple levels, as the system incorporates aspects of road management and communications, as well as police, treasury and environmental divisions. The authorities need to create a stable legal and financial framework to manage the system properly. The critical decision for them is assigning the operational responsibility for the system by either outsourcing the work to a private operator, or by managing it within the public sector through a road and transport authority. The key benefits for the authorities are improved liveability in the city owing to reduced pollution and congestion levels, accelerated economic growth through investment in infrastructure, and higher productivity.

Finally, involvement from a range of *technology, infrastructure and service providers* is required to set up a system like COMET. The system would include installation and operation of sensors and onboard units for collecting data from cars and infrastructure, and storing and analysing the tremendous amounts of data generated. It would also include installation and operation of smart parking meters and dynamic steering equipment, such as electronic signals. The main benefits for these stakeholders are new business opportunities and the potential to test and develop more advanced technologies.

## Figure 17: COMET Stakeholders

Source: World Economic Forum/The Boston Consulting Group analysis



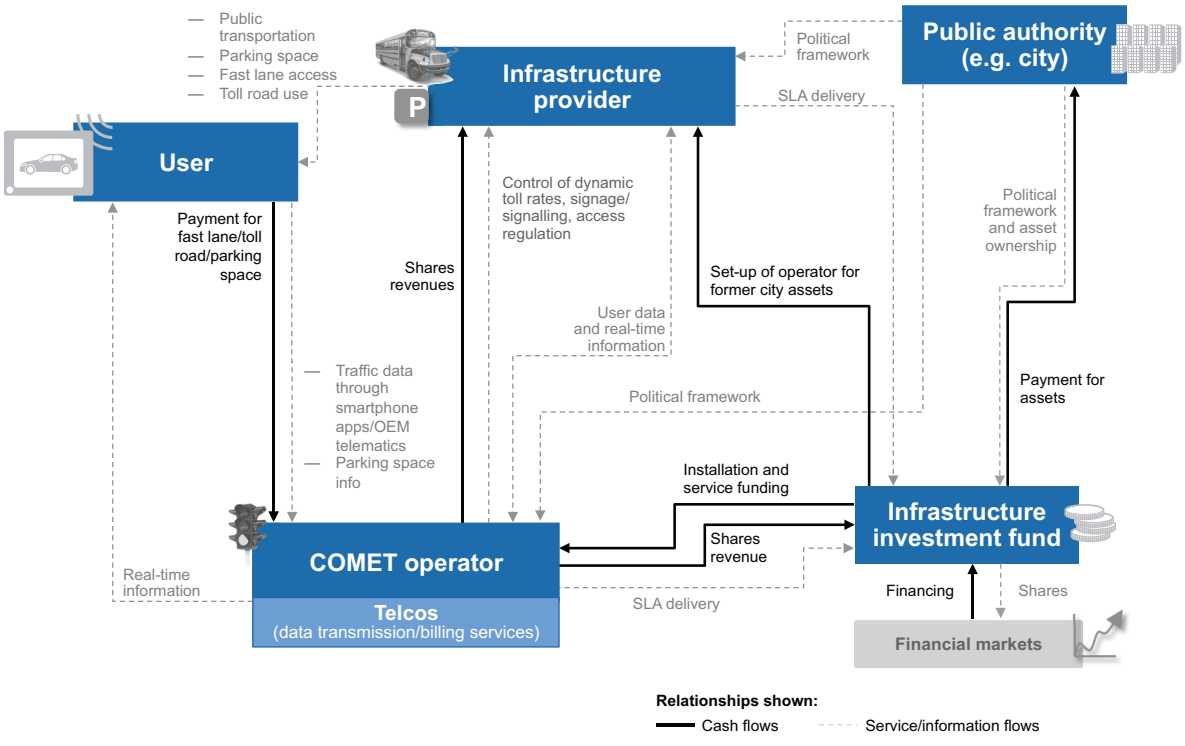

## 2.5 Separating the Roles of Investor and Operator in Establishing the System

While a number of potential operating models exist for a COMET system, one prominent alternative was identified in discussions with industry, public sector and academic experts. This model (Figure 18) addresses the responsibility for setting up the operating framework, funding the installation, providing the infrastructure, and managing the system's operations as well as the data and payment flows of the running system.

Setting up the COMET system would start with the public authority (e.g. city or municipality) establishing the political framework and guidelines for all parties. To provide stability and independence of the system, the city would sell selected assets – roads, bridges or tunnels – to a specific infrastructure investment fund created for this purpose. The fund would then be responsible for managing transferred assets efficiently and funding other needed infrastructure upgrades. It would finance itself by selling stock and debt to the capital markets, with the city potentially owning a minority or majority share.

## Figure 18: Potential COMET Operating Model

Note: OEM = original equipment manufacturer; SLA = service level agreement
Source: World Economic Forum/The Boston Consulting Group analysis



Under this operating model, the infrastructure fund would pay a separate COMET operator to manage the system. The fund would set the terms of service with all infrastructure providers – road and parking space operators, and public transport systems. The COMET operator would receive and analyse traffic data in real-time from users, infrastructure operators and other external sources, and use this data to control traffic flow by adjusting toll prices, restricting access and sending real-time information and route alternatives to drivers. In addition, the operator would provide data to infrastructure providers responsible for maintaining and providing public transportation systems and parking spaces. Under this model, drivers would pay the COMET operator for some services (e.g. parking spaces, access to certain lanes, use of toll roads). The operator would share this revenue with the infrastructure providers based on usage. The COMET operator might also enter into a revenue sharing agreement with the investment fund.

## 2.6 Gradual Build-up to Create Acceptance

The first step in a roadmap for deploying a COMET system (Figure 19) is collecting data, either from cars or smartphones within cars, to capture detailed information on traffic patterns and help drivers to better plan their trips. Next, in the "active steering" step, real-time analytics and signalling would enable the system to evolve into a more mature structure that could restrict access during peak travel periods and offer alternative routes. More technologically advanced features in the third step, such as smart parking, could be added to the service portfolio. Finally, the fully enabled operating model would be ready to implement. This final phase brings important players together: the infrastructure fund with a mandate for financing; the COMET operator with the responsibility for managing the full system; and public authorities with the task of providing supervisory and regulatory oversight.

The COMET system faces several key policy challenges; the most important of these are governing the collaboration between private and public parties, and securing required political acceptance. Best practices gleaned from successful public-private partnerships in cities show it is critical to define both operational and financial metrics at the outset. Moreover, transparency on costs and benefits of the system is crucial to gaining public support.

Local preferences need to be considered when selecting the features to implement. These can include dynamic tolling or access restrictions, which may raise significant opposition and be politically difficult to carry out in locations with a limited history of traffic management systems. In those places, it is better to start with features that provide immediate benefits to the users, such as smart parking and analytics. Additionally, it is critical for a COMET system to be particularly sensitive to managing data, which typically heightens concerns about privacy and data security. Public authorities need to define and articulate clear standards on how they will collect, store and use data.

**Figure 19:** Roadmap for COMET Implementation

Source: World Economic Forum/The Boston Consulting Group analysis

| | | 1 Open access to public data | 2 Active steering | 3 Complete service portfolio | 4 Fully enabled COMET |
|---|---|---|---|---|---|
| **Functionality scope** | | Transparency for users | Active traffic steering | Active traffic steering | Traffic steering and unified payment provision |
| **Asset scope** | | Integration of public transport (PT) | Signage installed; key toll roads operational | Parking included | Toll roads, signage, public transport, parking |
| **Data collection infrastructure** | | Floating car data | Floating car data | Additional sensors where needed | Floating car data and sensors |
| **Responsibilities of fund/public authorities (PA)** | | PA provide PT data; fund enables analyses | PA enable active steering; fund investment in toll roads and signalling | Fund investment in sensors and parking; approval by PA | Full engagement of fund; PA in supervisory role |
| **Benefits for...** | ***users*** | Transparency over traffic situation | Active recommendations, including link to public transport | Smart parking features | Simple payments through one unified system |
| | ***city*** | Efficient toll roads, smoother traffic | Lower congestion due to active steering and ability to leverage traffic data | Added transparency over parking usage and better utilization of parking spaces | Full transparency over transport system |
| | ***companies*** | Business opportunities through car data | Opportunity to operate toll roads and signage infrastructure | Opportunity to monetize smart parking (e.g. dynamic pricing) | Additional revenue and efficiency through unified payments |

## 2.7 Sidebar: COMET Cost-Benefit Analysis

To evaluate a COMET system's impact, the World Economic Forum and The Boston Consulting Group undertook a cost-benefit analysis of an active traffic management system in a fictitious, modelled US megacity. COMET produced societal benefits ranging from $1.9 billion to 10.1 billion in net present value over 10 years in this city, with a population of 10 million and a congestion level comparable to that of major, vehicle-clogged American cities. The analysis used real data for all costs and benefits, and verified input data and results with industry and academic experts.

Furthermore, the analysis simulated the impact of two discrete technological implementations: one replicated a situation using existing technology, while the other used advanced technology that was currently under development. Any future, real-world implementation would likely combine elements of both.

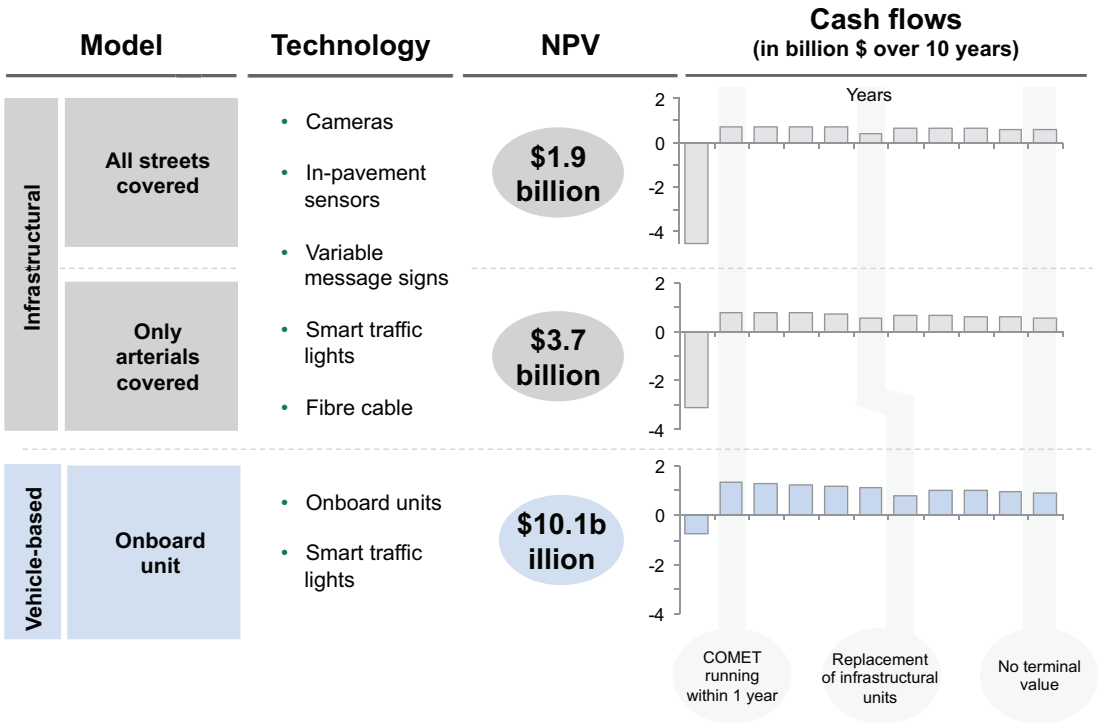
Using a smart parking system was an important driver of benefits. Almost 30% of urban traffic comes from drivers looking for parking space, and they spend up to 15 minutes doing so.[30] Implementing a system that lets motorists automatically see available, nearby parking spaces can cut that time significantly.

An overview of the cash flow analysis (Figure 20) shows that most benefits stemmed from reducing the hours lost to congestion; the system would cut the time wasted in traffic jams by 40 million hours overall, and prevent 4,000 traffic accidents per year. It would also reduce annual fuel consumption by 20 million gallons, and $CO_2$ emissions by 200,000 tons. The analysis did not account for indirect benefits such as noise reduction, or for an increase in housing prices due to faster traffic flows.

As shown here, COMET can provide significant benefits for society. Despite the required investments and obvious challenges related to implementing such a system, private and public stakeholders can work together to create an operating model that ensures those benefits are shared in a sustainable way.

**Figure 20:** Net Present Value (NPV) Analysis and Key COMET Parameters

Source: World Economic Forum/The Boston Consulting Group analysis



# 3. Seamless Travel Planning

*IPITA: Integrated proactive intermodal travel assistant*

**Key Points**

- Travel planning is becoming increasingly complex because of the many options and decisions confronting the traveller, and the lack of transparency regarding the alternatives.
- IPITA's objectives are to improve the travel decisions and experience for both business and leisure travellers.
- It provides a seamless, efficient and cost-effective travel solution by combining a wide range of information from multiple sources and transportation alternatives.
- Implementation would require standardizing and sharing data among stakeholders from different sectors.
- The project scope could make for many profitable business models and would rely on the collaboration of multiple stakeholders.

## 3.1 Travel in 2025

*Picture yourself waking up in Frankfurt in the year 2025. It is a workday, and you need to be at a meeting that afternoon in Brussels. After you have showered and packed your luggage, a synchronized, coordinated system alerts you that your flight has been delayed by 3 hours, which means you would be very late for your meeting in Brussels unless you choose an alternative mode of transportation. Instantly, the system provides you with viable alternatives – another flight, or the high-speed train. The system prices the options (you select the train, the less-expensive choice), books your ticket, assigns an aisle seat for you and dispatches a taxi to take you to the train station.*

## 3.2 Planning, Booking and Updating Travel with One Tool

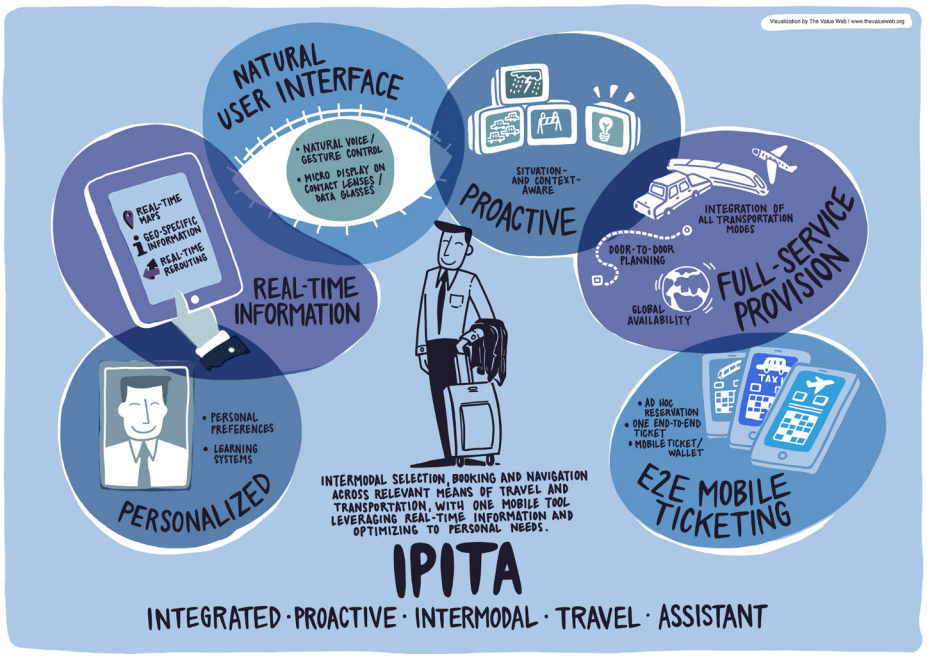
Business travellers spend much time and money determining the best travel plans and schedules. Delays can be costly to individuals, adding up to massive amounts when aggregated. In the US, for example, an estimated $3 billion-9 billion is squandered annually because of delays and cancellations at 12 major airports. Assuming that none of the current capacity constraints are addressed, those costs are estimated to rise to anywhere from $9 billion to $20 billion in 2020.[31] Extrapolating that estimate on a global level would yield direct and indirect costs in the tens of billions of dollars per year.

IPITA, a mobile tool that integrates planning, booking and ticketing across all means of travel and transportation, can reduce delays and make travel involving multiple stops and different modes of transportation easier, faster and more cost-efficient. Key features of IPITA, as shown in the illustration of Figure 21 developed for the "Connected World" project, include personalization based on the user's needs and preferences, such as desired modes of transport. The system also learns from user behaviour, and provides guidance in planning based on preferences and situations using input from real-time weather and traffic updates. The tool would have global reach and tap into traditional modes of transportation, such as bus, plane and train service, and emerging modes such as urban bike-rental programmes and car-sharing services. IPITA would also book and ticket travel, be accessible through a natural user interface on data glasses or contact-lens displays, and recognize commands by voice or gesture. An example of a user journey illustrating some of IPITA's functions during a business trip can be viewed at http://youtu.be/4KGNjAS7VkQ.

**$9 billion-20 billion –** forecast cost of delays at major US airports in 2020

**Figure 21:** Key Features of IPITA

Source: World Economic Forum/The Boston Consulting Group analysis; *illustrated by The Value Web*

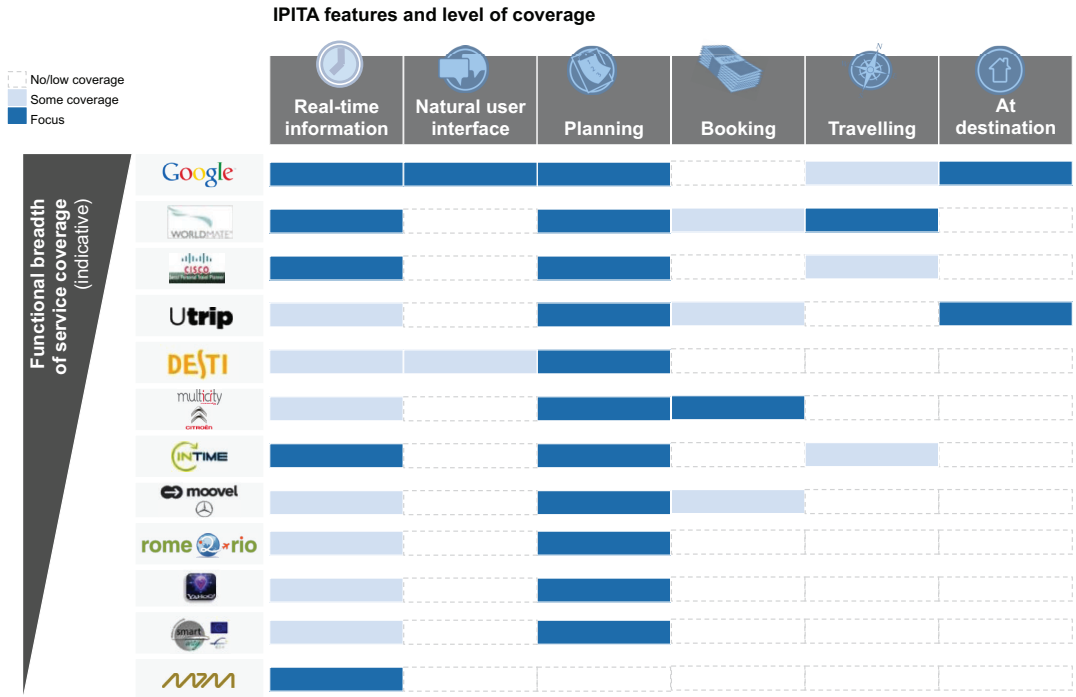



## 4.3 Multiple Travel Planning Solutions – though None with All of IPITA's Features

Numerous travel planning platforms exist, with most offering at least some level of real-time information and planning ability. However, none combines all the IPITA features (Figure 22).

**Figure 22:** Existing IPITA Implementations

Note: Selected companies only; some companies/services with limited geographical scope
Source: World Economic Forum/The Boston Consulting Group analysis



**IPITA Features**

Real-time information
Updated based on, for example, changes in schedule

Natural user interface
Controlled through voice or gesture, with output provided by voice or microdisplay

Planning
Aggregated data from multiple providers for planned trips and stays

Booking
Booking and paying tickets directly through the service

Travelling
Updates provided while travelling, e.g. real-time updates on schedule

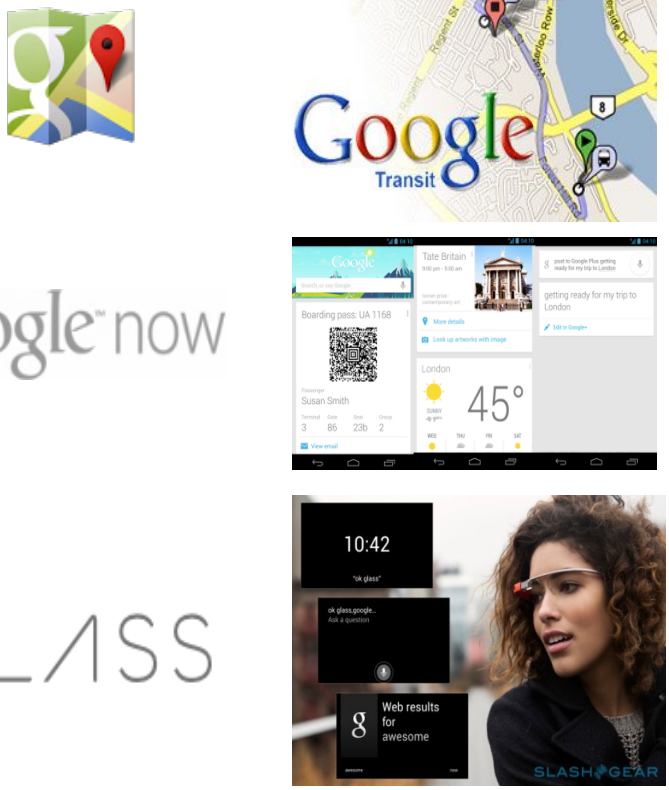
At destination
Tips and location-specific information at the destination

Source: World Economic Forum/The Boston Consulting Group analysis

Google offers one of the most advanced product suites in terms of IPITA's overall objectives, having introduced new features incrementally over time. Google Transit, a public-transport planner, is integrated with Google Maps, covering many major cities and providing real-time updates on traffic and disturbances. Google Glass, the wearable head-mounted display, supplies travel information using Google Transit and Google Maps and is voice-activated, making the system into an intelligent personal assistant providing customized travel information (Figure 23). The current product suite does not offer ticketing or mobile payment options.

**Figure 23:** Google Product Offering

Source: Google; World Economic Forum/The Boston Consulting Group analysis



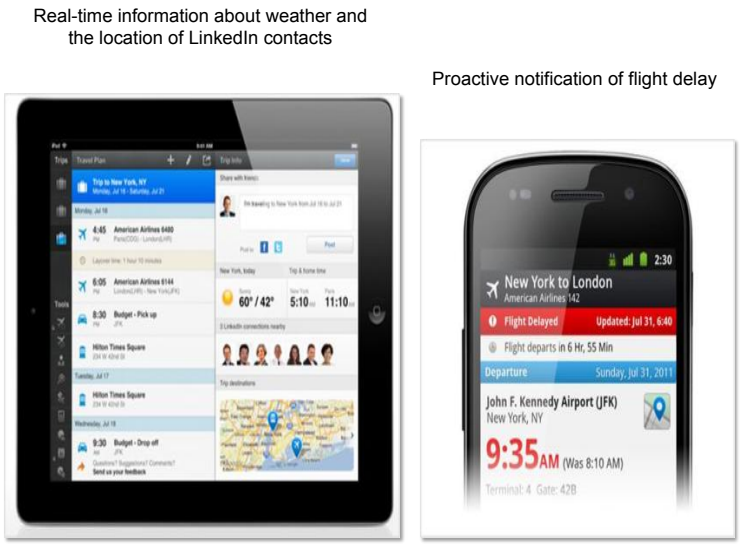

Full service provided by integration of different transportation modes into Google Maps

Real-time information about geo-specific context

Natural user interface by integrating Google Glass

## **Figure 24:** WorldMate Mobile App

Source: WorldMate; World Economic Forum/The Boston Consulting Group analysis




WorldMate, founded in 2000 and owned by Carlson Wagonlit Travel, is a mobile travel app targeted at business travellers. Besides combining travel planning and real-time information on flights, hotels and rental cars, it also integrates with the user's calendar and email to provide a comprehensive view of the traveller's itinerary (Figure 24). While the operation is personalized based on preferences, and updated in real time, its booking features and natural user interface are still under development.

Rome2Rio, a free, internet-based app, provides intermodal travel planning. Started in 2011, the company offers a door-to-door planning service, updated with real-time information based on a proprietary database covering both public and private transportation options. It has partnered with the travel website Booking.com to offer hotel reservations, and the e-commerce travel company eDreams Odigeo for flight reservations. Rome2Rio has focused on the business-to-business (B2B) market – chiefly travel agencies and travel industry clients – and does not offer full booking or ticketing services.

Airline, hotel and car rental companies have recognized the need for a comprehensive system. The Open Travel Alliance (OTA), a non-profit, independent trade organization, was launched in 1999; it focuses on developing open data transmission specifications for the electronic exchange of business information within the travel industry. Currently, more than 100 member companies and institutions exchange tens of millions of messages daily. OTA operates as a back end for information exchange, with limited visibility to the end user, or traveller.

The examples presented show that while the technology largely exists, considerable room for improvement still remains through implementation of key IPITA features. Chief among these are end-to-end planning, and ticketing and aggregation of multiple data sources.

### 3.4 Bringing Together the Travel Assistance Supply Chain

Successfully implementing IPITA depends not only on integrating the technology and necessary data that are largely available, but also on bringing together a variety of stakeholders (Figure 25).

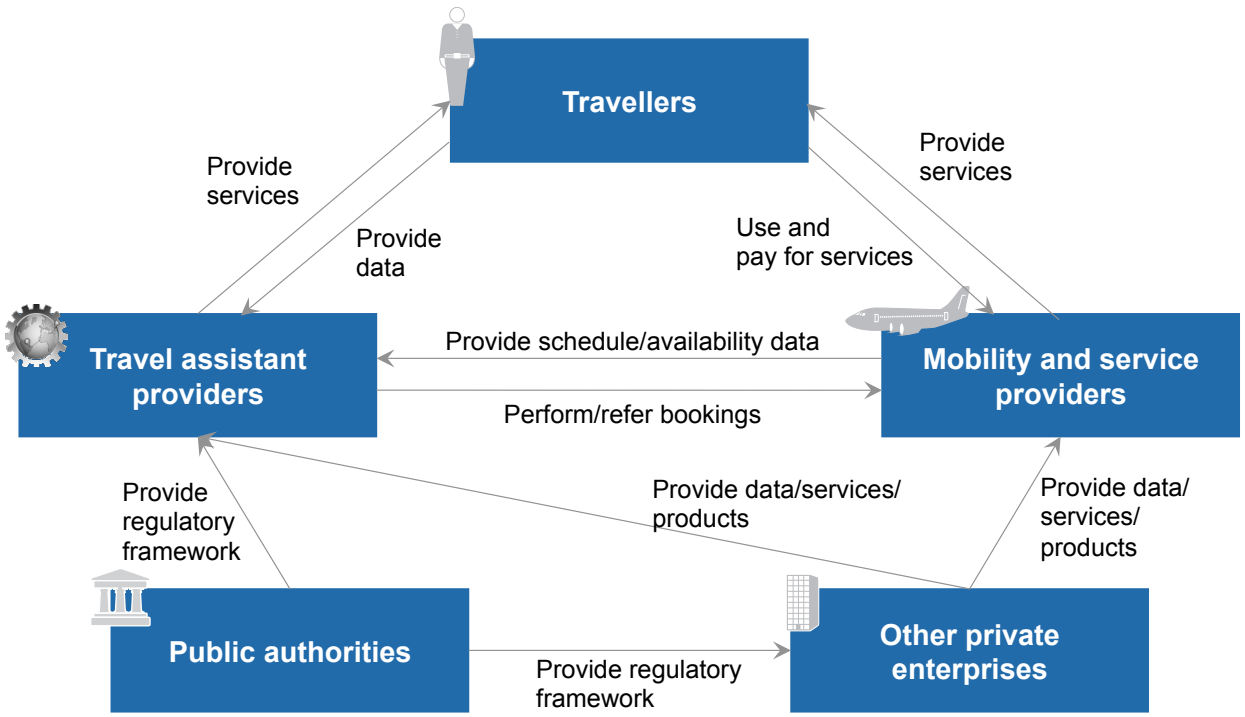
*Travellers:* Local, domestic or international, they would be the main users and beneficiaries of IPITA in terms of increased convenience and travel flexibility. The system would analyse user-provided data, such as travel patterns and preferences, and use it to optimize services and predict traffic conditions, delays and the capacity of different means of transportation. Depending on the business model, travellers could subscribe to the service on a premium basis, or use a free model and be targeted with advertising relevant to their needs and context. The IPITA operator would cover operating expenses through commissions and advertising revenues. In addition, the operator would have to address travellers' sensitivity to privacy issues in sharing personal travel data and preferences.

*Public authorities*: Another key stakeholder group, they would have the dual role of establishing the regulatory framework for sharing and protecting data, and offering services crucial to the system's effectiveness (e.g. public transport data, weather and traffic forecasts). Public authorities would derive benefits from increased mobility, more efficient use of infrastructure and better planning for peak hours.

*Transportation and service providers*: Not only would they provide requisite services to users, but also data about these services to the IPITA operator. This broad stakeholder group includes airlines, public transportation agencies, rental car firms, hotels and service providers such as global distribution and reservation systems. The group would benefit from reaching a wider client pool and getting access to meaningful data. Other private enterprises also would have a significant role to play in IPITA, including hardware and software providers for data storage and payment processors for managing the transactions.

**Figure 25:** IPITA Stakeholders

Source: WorldMate; World Economic Forum/The Boston Consulting Group analysis



### 3.5 Aggregated Data Provider with Competing Front Ends

A collaboration of industry executives and other travel experts developed a possible operating model (Figure 26) that differentiates between the operator's back-end data aggregation and front-end customer service roles.

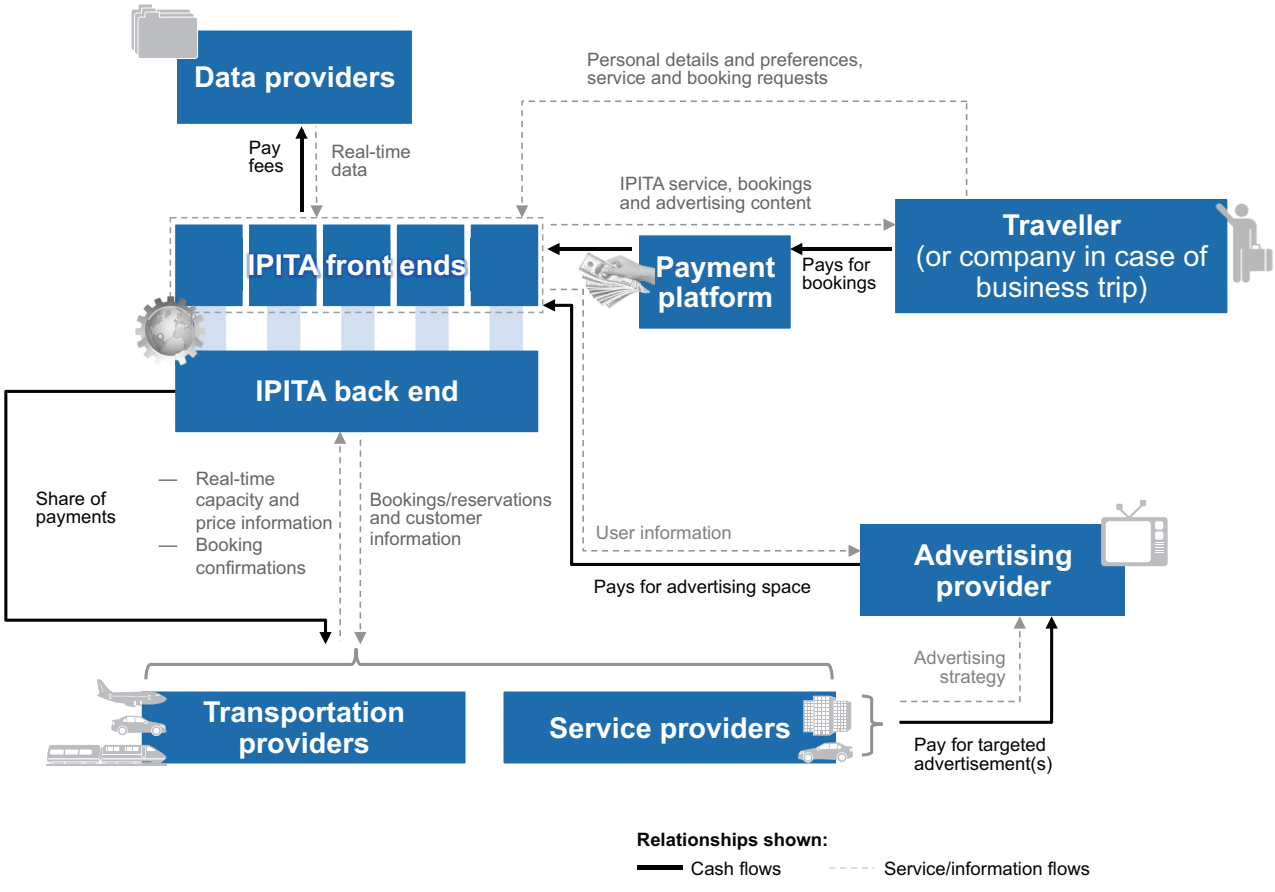
One part of IPITA would focus on data storage and processing, effectively managing all information provided by transportation affiliates (e.g. capacity, schedules, pricing) and data providers (those contributing real-time updates on weather and traffic conditions). Such back-end operators might be large technology companies or a consortium of smaller firms specialized in, for example, current global distribution systems. The other part of IPITA would collect and store customer data and handle travel bookings. In a sense, these front-end operators, of which there could be dozens or even hundreds, would compete with today's travel assistance providers, but they would have greater access to information about conditions and alternatives, and would be able to offer intermodal ticketing options. This dual operating model would reduce the risk of monopolistic competition and help address the need for user data protection.

Under this model, users would not have to pay directly for IPITA services. Front-end operators – those competing with travel assistance providers – would receive their income as a share of commission from the service providers or from advertising. The transportation and service providers would generate revenue from the bookings and services, while the IPITA operator would pay fees to the data providers to compensate them for the cost of supplying the data.

The only requirement for entrants to the system would be that they operate on a standardized protocol for recording and transferring data; this would eliminate the problem of incompatible data formats.

**Figure 26:** IPITA Operating Model

Note: Only key stakeholder relationships shown
Source: World Economic Forum/The Boston Consulting Group analysis



## 3.6 Approach for Implementation: Test the Concept with Closed Platform

A suggested roadmap for implementing IPITA (Figure 27) would start with the platform's launch using limited coverage in geography and services provided. This first step could coincide with a major event, such as the Olympics or World Cup, to build the awareness that the system deserves. The platform would be limited to selected service providers to set up and test the service on a small scale, and customers would interact with IPITA using current technology on their mobile communication devices.

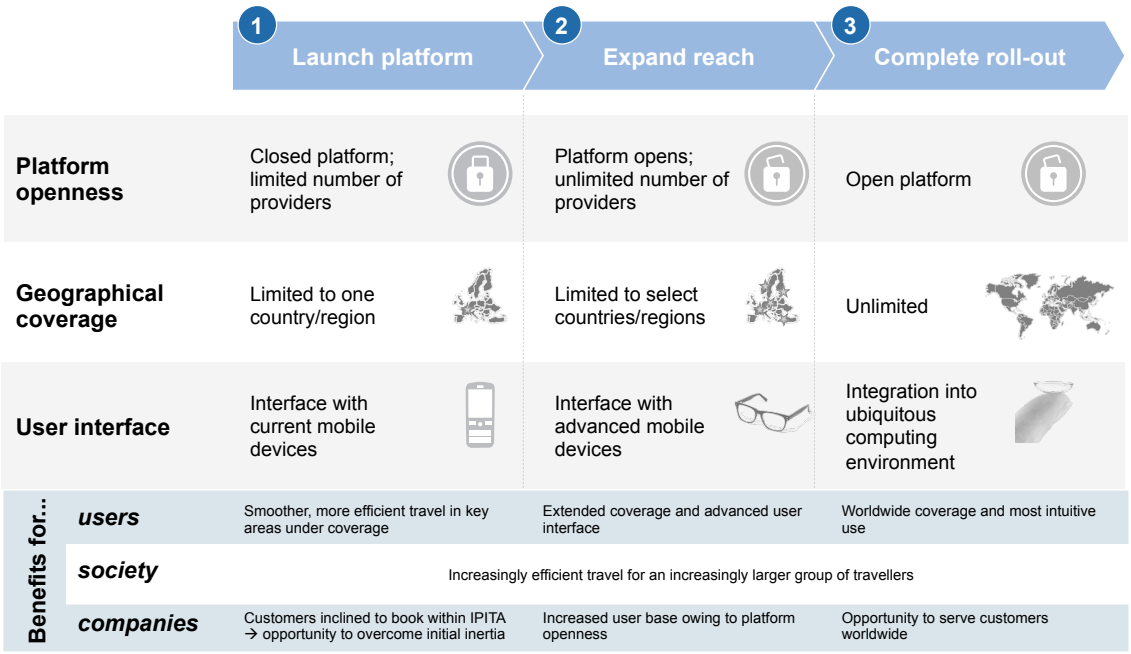
The platform would widen sequentially and include, in the second step, a wider array of service, transportation and data providers that adhere to regulations on data formats and security. The system's coverage would expand regionally at first, and then globally as user interfaces are extended and complete roll-out is achieved.

In implementing this roadmap, two major concerns involve privacy – the transfer of personal data across borders, and the mining of personal data to make proactive travel suggestions. Moreover, valid concerns exist with creating a monopoly. Separating IPITA operators into back-end and front-end providers would mitigate these risks. Another matter is the current lack of digitization and standards. Data providers would have to supply information in a compatible format, and service and travel assistance providers would need to access a common, shared system to operate efficiently.

An additional challenge is managing the balance between competition and collaboration among the service and travel providers, as they would have to share sensitive data on capacity and pricing for the service to work properly.

**Figure 27:** IPITA roadmap

Note: Only key stakeholder relationships shown
Source: World Economic Forum/The Boston Consulting Group analysis



## 3.7 Sidebar: SWIFT as a Global Governance Model

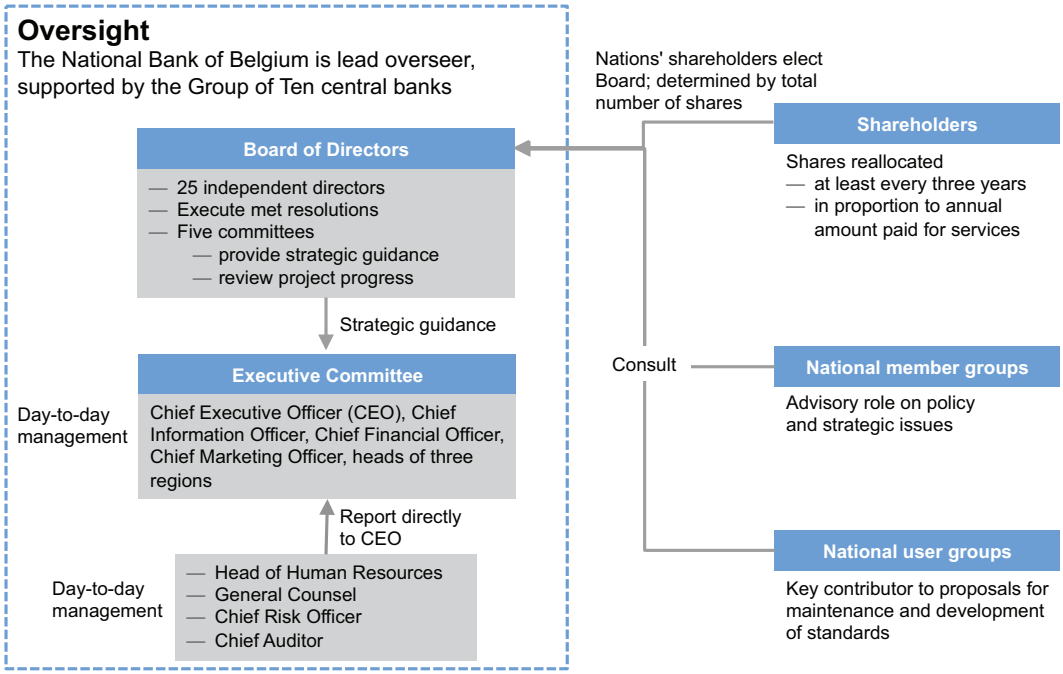
Importantly, competitors could indeed collaborate to establish global standards. A model for this was set up in 1973, when several international financial service companies banded together to form the Society for Worldwide Interbank Financial Telecommunication (SWIFT). A non-profit cooperative headquartered in Belgium and owned by its members, SWIFT currently serves more than 10,000 customers and defines standards and formats for exchanging a raft of financial information. SWIFT is a platform allowing shareholders and users to connect and exchange financial information securely and reliably. In addition, it brings the financial community together to address issues of mutual concern and interest. An overview of the operating model is shown in Figure 28.

SWIFT provides an appealing model for safely transmitting highly confidential and secure data between diverse stakeholders and competitors, according to internationally agreed standards. More than 4.6 billion messages were sent through the system in 2012. SWIFT processes authenticated and secure personal data.[32] Its decentralized authentication process (without any local authority) provides a neutral perspective. To become a SWIFT network user, companies and institutions apply for authorization; any organization that complies with the eligibility criteria is permitted to make use of SWIFT services.

Several SWIFT features can serve as a model for a global IPITA solution. The system is open to all stakeholders of relevant industries, and a neutral institution provides oversight and unbiased service. Finally, a multilayered, decentralized management system deploys an appropriate governance structure, balancing the ability to make decisions with the need to give a voice to all parties.

**Figure 28:** SWIFT Operating Model

Source: SWIFT; World Economic Forum/The Boston Consulting Group analysis



# 4. Transparent and More Efficient Trade Flows

*TATLO: Transparency and Traceability for Logistics Optimization*

### Key Points

- Fragmentation of systems and lack of common documents in international trade cause significant inefficiencies and resultant loss of revenues.
- Improving both B2B and business-to-government (B2G) information exchange through the supply chain could increase global trade volumes and GDP.
- The obstacles to implementing such exchanges are not technological, but rather are caused by lack of standardization and incentives for information sharing.
- For a broader roll-out of e-supply chains, global leaders in each supply chain step should work together on practices for sharing information and agree on joint standards.
- While initial e-customs efforts are a step in the right direction, they need to accelerate, be more ambitious and include businesses to deliver maximum benefits.

## 4.1 Trade in 2025

*As a buyer for a major American supermarket chain, you need to source several large quantities of Belgian chocolates as your company gears up for the busy end-of-year holiday season. To make sure the shipment arrives in time to fill your store displays ahead of the shopping rush, you contact your Brussels-based chocolate supplier to set the massive order in motion. The manufacturer processes your order and sends it to a European e-freight operator. Instead of being delayed at the port or customs, your order is automatically cleared for international shipping; necessary carrier fees are paid, and the goods are loaded on a vessel. Within a few weeks, the delectable chocolates have arrived at the US destination port, ready to be transferred to trucks for delivery to your supermarket's regional distribution centres. With this streamlined logistics solution, you have already shaved weeks off the delivery time compared to earlier systems, while being able to follow the progress of the order in real time – thanks to the information being available in a standardized format through the entire supply chain. In addition, you can monitor the inventory level at the stores in real time, in case you need to make an additional order during a crucial sales period.*

## 4.2 Improving Information Exchange with Clear Benefits for the Economy

International trade is growing rapidly in value and as a share of global GDP.[33] However, a lack of automation along parts of the global supply chain is slowing growth. According to the World Economic Forum's 2013 report *Enabling Trade: Valuing Growth Opportunities*, reducing barriers within the international supply chain could increase worldwide GDP by almost 5% and total trade volume by 15%.[34]

TATLO, a set of concepts and proposals for streamlining parts of the global supply chain through data digitization and standardization, could be part of the solution and lead to significant gains in trade flows and global welfare. It covers a broad set of topics, from tracing products to optimizing inventories and tracking emissions. TATLO also aims to provide integrated information flow for the entire supply chain (just as the focus of this report is on information exchange – between businesses, governments and logistics service providers). The illustration in Figure 29, developed for the "Connected World" project, summarizes TATLO's features, and a video showing some aspects of TATLO's user journey is at http://youtu.be/L_PAyvzuHII.

**5% potential increase in global GDP** – through improvement in coordination of supply chain and logistics

**Figure 29:** Key Features of TATLO

Source: World Economic Forum/The Boston Consulting Group analysis; *illustrated by The Value Web*


## 4.3 Technology Already in Place – but Standardization Lacking

The TATLO concept is not new, and many of the technologies exist for implementing it. However, a lack of standardization and sharing of norms is preventing the seamless flow of information and the use of protocols, both of which could turbocharge the process.

Businesses have been working together to share information that helps track goods under shipment. Some of the technologies already in place for B2B information exchange (Figure 30) allow shippers, recipients and logistics service providers to monitor deliveries throughout the supply chain, and enable real-time tracking of goods across distances. However, implementing these technologies alone is not sufficient, especially if the stored and tracked information is in a form that cannot be easily shared among stakeholders, and if no agreed-upon protocols or willingness to exchange the information exists.

The picture is more fragmented for B2G information exchange. Significant progress has been made in increasing the efficiency of submitting and processing trade documentation. In numerous countries, shippers and logistics providers use so-called "single-window systems" that involve a consolidated programme to handle a variety of services including customs, safety inspections and security

**Figure 30:** Tracking and Information Storage Technologies in Place

Notes: / = Limited usage; RFID = Radio frequency identification; NFC = Near field communication; QR = Quick response; GPS = Global positioning system: GSM = Global system for mobile communications; GPRS = General packet radio service
Source: World Economic Forum/The Boston Consulting Group analysis, Megatrends and supply chain trends documentation

| | Shipper (includes warehousing) | Forwarder | Ground handling/ customs | Carrier | Ground handling/ customs | Forwarder | Recipient (includes warehousing) |
|---|---|---|---|---|---|---|---|
| **RFID** | Stores basic information | Adds data on product condition | Adds data for import clearance | Adds data on product temperature | Adds data about clearance result | Adds data on current location | Adds data on warehouse location |
| **NFC** | Stores basic information | / | Adds data for import clearance | / | Adds data about clearance result | / | Reads out payment details |
| **QR Codes** | Stores broader information | Reads out transport instructions | Checks data against export requirements | Reads out handling specifics | Checks data against import requirements | Reads out destination details | Extracts product features |
| **Barcodes** | Stores basic information | Reads out sorting details | / | Reads out product location | / | Reads out destination details | Scans during checkout procedure |
| **GPS, GSM, GPRS** | Support position tracking and information transmission | | | | | | |

Selected usage example

clearance for goods. These systems align standards on data format and collection, and have clear protocols for data security. In Latin America, 13 of 33 countries were reported to have a single-window system in place, with five more countries indicating they had similar systems under development.[35] However, the progress has been limited in many places, and the systems often cannot function with each other.

### 4.4 Integrating the Supply Chain

Collaboration among multiple stakeholders (Figure 31) is necessary to improve the exchange of information and create common standards.

*Shippers* would use and pay for TATLO, deriving benefits of faster delivery times, reduced costs and increased transparency over the supply chain. This stakeholder group can exert significant influence over public authorities and logistics service providers to develop solutions for electronic information exchange across the supply chain.

*Public authorities* with a stake in TATLO include customs and transport departments, consumer and data protection, and environmental authorities. These stakeholders would have a key role in creating and enforcing the regulatory framework for international trade, including legislation and the services provided. They would balance security needs with economic growth opportunities provided by trade.

*Coordinators and funders* would have a key role in creating and operating TATLO, acting as a collective voice for shippers and service providers. They would work with industry associations or international organizations such as the International Maritime Organization, not only to provide standards and information but also to help shape the framework set by the public authorities.

*E-freight enablers and service providers* include carriers, forwarders and infrastructure operators, as well as companies providing support services such as financing, insurance, software and hardware required for trade. Together, these stakeholders supply the actual logistics and TATLO's infrastructure. With TATLO implementation, they benefit from increased business as trade volumes grow, and from the entirely new business opportunities generated, such as safe storage of trade documents or creation of single-window interfaces for customs.

### 4.5 Carriers or Logistics Providers to Coordinate Information Exchange

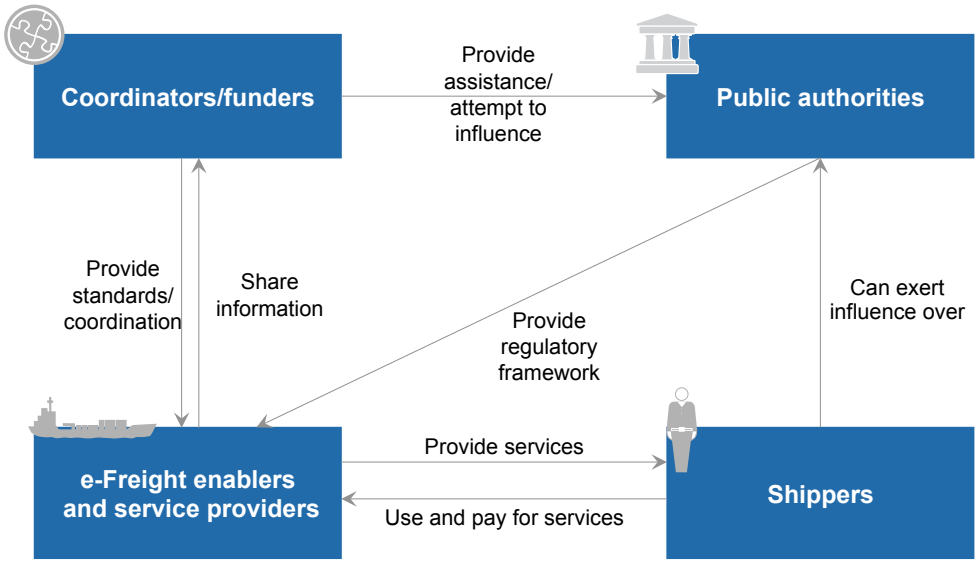
Industry executives and senior public-sector officials collaborated to create a potential, high-level operating model for TATLO that uses existing technologies. Figure 32 illustrates this model along with the key information and money flows.

Shippers either operate directly with the carriers or use freight forwarders or other third-party logistics providers (3PLs). These parties, with a pivotal role in setting up the model, provide the interfaces for different shippers or buyers to connect to their systems. This creates competitive advantage for carriers and 3PLs through the ability to provide additional services and reduce costs. Government agencies would be responsible for creating the single-window interface in their country or region, and ensuring it operates smoothly with other interfaces, including other national single-window systems.

To operate the system, a shipper would send information to the carrier or 3PL, and authorize it to use that data to communicate with government authorities. The shipper would pay the carrier or 3PL for the service, which in turn

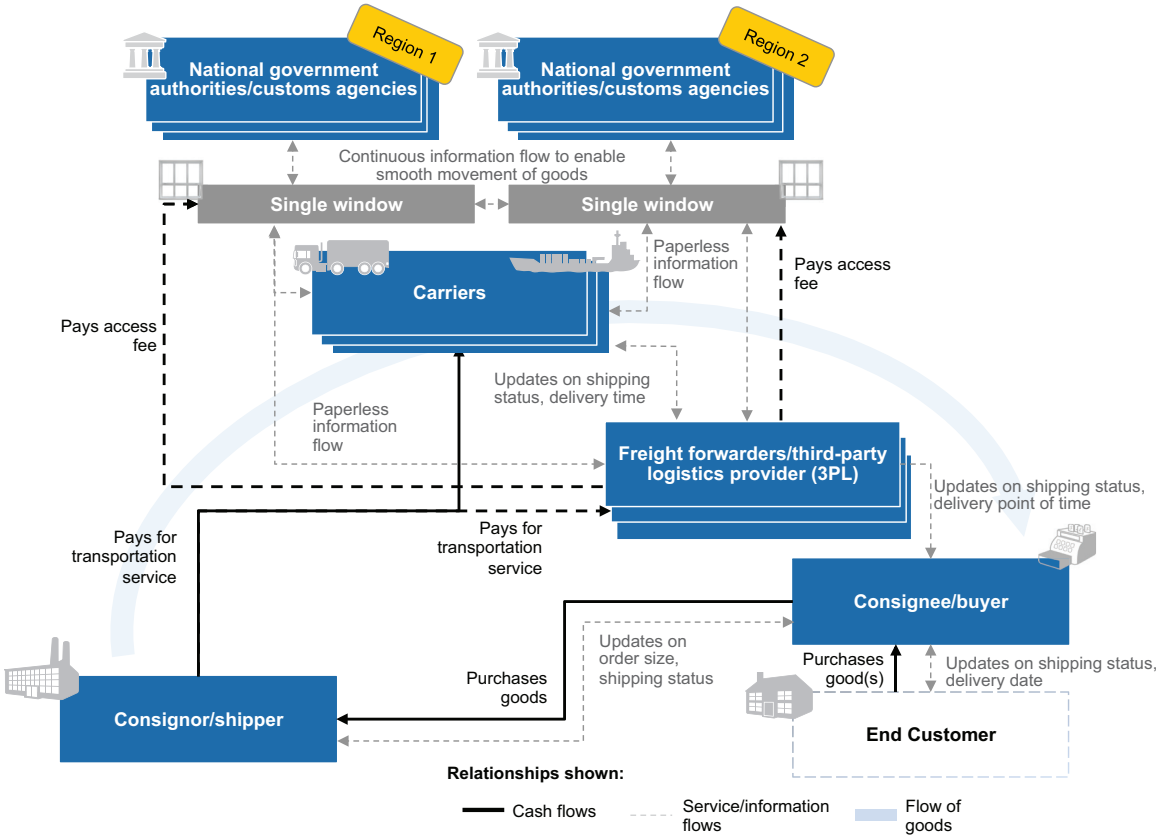
**Figure 31:** Key Stakeholders of TATLO

Source: World Economic Forum/The Boston Consulting Group analysis



## Figure 32: Potential TATLO Operating Model

Source: World Economic Forum/The Boston Consulting Group analysis



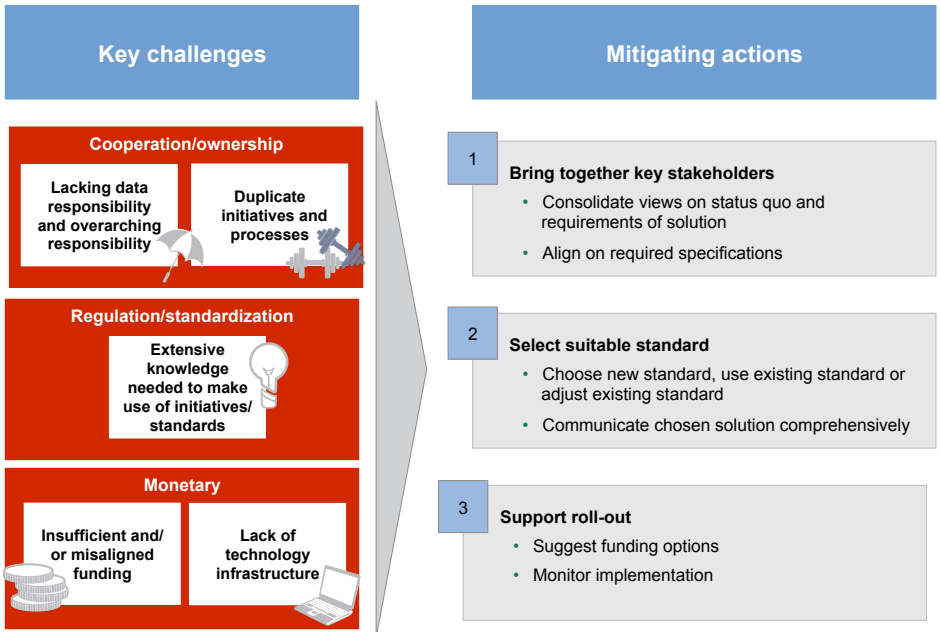

would share its revenue from the shipper with government authorities for using the single window. The carrier or 3PL – the party responsible for managing the information – would manage the flow of data and communication, and would be responsible for communicating with the buyer over any concerns. This would eliminate the need for a central data repository and reduce concerns about data security and leaks of business secrets.

### 4.6 B2B and B2G Developed in Parallel to Overcome Barriers

The plan just described is a potential model for improving the B2B and B2G information exchange. The major challenge lies not in the technical details, but in overcoming the institutional and organizational barriers or challenges, some of which are shown in Figure 33.

## Figure 33: Key Challenges to Implementing TATLO

Source: World Economic Forum/The Boston Consulting Group analysis



One of the chief challenges in setting up a complex system involving multiple stakeholders is the lack of cooperation among different private-sector parties, including carriers, freight forwarders and other 3PLs. Building a coalition of leading shippers and logistics providers is the first step, as it helps to consolidate views and define the solution in greater detail. To ensure successful results, representation from public sector agencies is necessary.

This coalition also needs to select a standard for documentation and information exchange, which includes standardizing data (such as terms used), processes, formats (e.g. XML) and documents (information contained therein), to ensure that all parties can share information using consistent terminology and shared style. A high level of standardization is also needed between the customs operations and trade regulations of participating countries; that can best be accomplished sequentially, building momentum for the system by starting, for example, to standardize trade documentation within regional trading blocs, and then moving on to bigger entities.

To overcome the lack and misalignment of funding, this coalition can connect stakeholders and coordinate their actions. It can also provide peer support to ensure all the key participants benefiting from the cost savings also participate in the necessary investments.

In addition, data protection must be carefully managed. Carriers, freight forwarders and 3PLs need strong safety measures in place to prevent leakage of confidential information. However, all necessary information needs to be shared among relevant parties with, for example, carriers or 3PLs doing so for a limited time only.

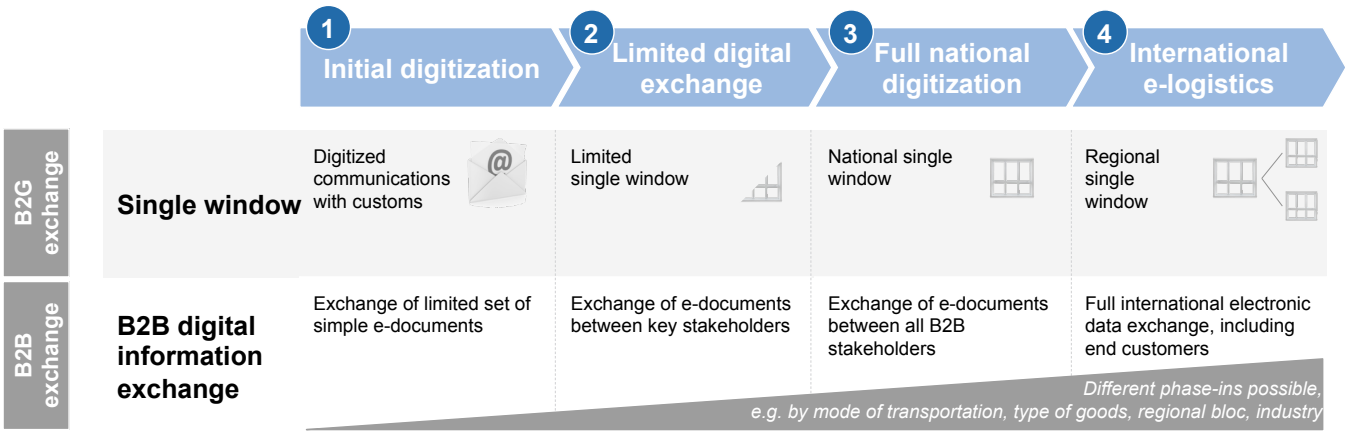
TATLO's true benefit would emerge if B2B and B2G information exchange systems were developed in parallel, leading to accelerated movement across the trade chain and reduced transaction costs. A potential process for implementation is covered in Figure 34.

Within the B2G system, the first step would involve digitizing and automating all trade information for customs purposes. Second, a single interface would be created that traders and select authorities could use to exchange information. The third step would cover a full national standard for all import, export and transit-related regulatory requirements and all government authorities. In the final step, the national window would be extended to a regional level, with exchange of information between national single-window operators.

For the B2B information exchange, the process would first create a limited set of simple e-documents shared by shippers, carriers and 3PLs. The second step would be an expansion to a more robust e-document exchange between key stakeholders such as carriers, logistics service providers and ports. The exchange would expand further in the next step to cover all stakeholders, including as well shippers and buyers, banks and freight forwarders. Finally, expansion to a full international exchange would add end customers, enabling them to access all documentation in real time.

**Figure 34:** A Suggested Roadmap for Implementing TATLO

Source: World Economic Forum/The Boston Consulting Group analysis



## 4.7 Sidebar: eCustoms and eFreight Initiatives in the EU

With its exports and imports accounting for 16% of world trade,[36] the EU has a number of trade- and customs-related initiatives in place to facilitate growth in this flow of goods and to reduce the resources required to process them.

Currently, 90% of EU customs declarations are submitted electronically. But while all EU member states have eCustoms systems in place, not all are interconnected. In 2003, the European Commission launched its EU eCustoms initiative to create a harmonized and uniform customs policy. The system will exchange data among businesses, national customs authorities and other institutions involved in border crossing and customs clearance – and aims to use the Single Electronic Access Point (a single interface for all customs affairs across the EU) by 2024.[37]

The eCustoms initiative is also linked with the eFreight initiative, which seeks to trace goods in real time and create a single electronic transport document for the entire logistics chain. The project, begun as a research programme in 2007, converted to an initiative in 2013 and represents the collaborative efforts of more than 30 logistics companies across modes, stakeholders and EU countries.

The eFreight initiative builds on previous work, including the Common Assessment and analysis of risk in global supply chains (CASSANDRA),[38] which also brought together a number of logistics and technology partners. CASSANDRA's goal was to develop a transparent data-sharing concept for international cargo, with a focus on containers. This required developing a pipeline of information for sharing across the supply chain and customs, and integrating information on goods, actors, contracts and transportation.

### Outlook

The eCustoms and eFreight initiatives are just an initial step and cover only EU countries. However, they highlight the potential of electronic information exchange to smooth trade flows. To expand the benefits on a global level, the key parties in the supply chain need to work together to define common standards for documentation and information exchange.

# 5. Summary and Way Forward: Operating in a Multistakeholder Environment

The "Connected World: Transforming Travel, Transportation and Supply Chains" project is structured around the themes of traffic, transportation, travel and trade. In the coming years, these areas will be transformed by technological change and its adherent hyperconnectivity. This report has focused on four solutions, describing how they help to improve society's welfare, identifying their key stakeholders and presenting potential operating models and roadmaps for implementing them.

These solutions differ based on the particular area of focus, but they share some common themes – namely, the role of private and public sectors as well as the involvement of multiple stakeholders. To manage this kind of collaboration successfully requires, among others, the following factors:

- **Alignment among stakeholders**: To build successful systems with multiple stakeholders, all relevant parties must have a good understanding of the benefits to them. As this report has shown, each solution can be constructed as a win-win model, but this requires careful planning.

- **Multilevel governance model**: Each solution has a number of stakeholders, all of whom have a voice to be heard. However, key decisions will need to be made effectively, most likely through an executive governing board or tiered voting rights.

- **Global standards for data collection and transmission**: All the solutions rely on aggregating data from multiple sources and sharing them with third parties, whether on a city, regional or global level. This requires collectively agreed-upon standards for formatting to make data from multiple sources comparable.

- **Data security**: The collection of private and confidential information requires that data be stored and handled in a secure way to eliminate any fear of leaks or loss of privacy.

- **Viable financing model**: Solutions need a sustainable financing model to work in the long term. While each solution must address major challenges, unlocking those roadblocks can lead to significant benefits. These benefits need to be articulated in a way that creates incentives for all parties to maintain and develop further collaboration.

- **Step-by-step approach**: All the solutions described are complex and, when being implemented, involve a degree of risk. They should be implemented incrementally, to fix any potential early and short-term issues and to test the solutions, with a simple local programme as the first step and including only key features.

The four solutions described in this report offer tremendous potential for all concerned parties. For end consumers, they promise hassle-free international travel and smooth traffic in cities. For companies, they offer an untapped, multibillion-dollar business opportunity. And for the public sector, they can increase the vitality of cities, and generate jobs and welfare by increasing trade and tourism. In the coming year, the "Connected World" project will focus on building these solutions further and bringing together key stakeholders to make traffic, transportation, travel and trade more efficient, comfortable and sustainable by 2025.

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