



Digital Identity Toolkit

Section 4: Case studies

May 2023



What is this Toolkit?

Digital identity is a relatively new but rapidly evolving sector that can and will affect many aspects of our everyday lives.

Digital identities verify and authenticate someone's identity. They can then be used to access a wide range of services and opportunities, from health and education services, voting and travelling, through to online shopping and dating. Governments and the private sector are developing and implementing digital identity solutions, and they're likely to become increasingly common in the future.

While there is already a lot of information on this topic, much of it is in lengthy, technical reports and hasn't been collated into a simple format that non-technical people can understand. We hope this Toolkit can help close that gap.

This Toolkit has been designed to help you find everything you need to know about digital identity. Before producing it, we spoke with individuals and non-profits around the world to get a sense of what they'd like to know about digital identities.

The audience for this Toolkit is members of the public, non-profits, entrepreneurs, developers, journalists and academics who want to learn more about digital identity and how digital identities might be relevant to them in their lives or work.

We hope you find this Toolkit helpful and welcome your feedback about how it could be improved.

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Summary

This section describes what a digital identity is, the different types of digital identity and why digital identity matters. It aims to bring everything we've shared so far to life by giving real world examples of how governments, charities, NGOs and the private sector use digital identities in different ways around the world.

Accessing government services

Governments across the world are developing or deploying digital ID solutions which help citizens access public and, in some instances, private services. India's Aadhaar model helps to facilitate inclusion and deliver government services to citizens, while e-Estonia is renowned as the most highly-developed national ID card system in the world, covering over 90% of the population. It allows citizens to access any public e-service, reduces bureaucracy and speeds up the process of many daily tasks. It can be used for banking, signing documents, obtaining digital medical prescriptions or for business operations.

Public and private sector national identity use

India has the world's largest national digital identity system, known as Aadhaar. It has over 1.2 billion users and relies on biometric data for validation. Citizens use it to access government services, and financial providers can use it to undertake due diligence. It can be used to open a bank account, file tax returns, receive a pension or receive other government subsidies.

In Canada, SecureKey relies on authentication by financial institutions to enable citizens to access dozens of government services.

Digital identities are also used to improve government administration. In Japan, a cloud-based system enables national and local public agencies to seamlessly track and share information. In Singapore, the Moments of Life initiative bundles government services and information. It uses data to anticipate citizens' specific needs as they reach key life moments, such as marriage or the birth of a child.



Addressing social challenges

Digital identity can address a whole range of social challenges. For example many countries are now registering births digitally. This is a critical type of digital identification as birth registration is often the gateway to accessing services, such as health and education, throughout life. iCivil in Burkina Faso is an example of this.

In India, Aadhaar is used in the education system to access student scholarships, online courses and to track attendance. In Pakistan, computerised national identity cards are used for cash transfers, voting rights and opening bank accounts.

Digital identification is also improving health outcomes globally. Botswana uses digital national identification numbers to track adherence and adverse reactions to antiretroviral therapy in patients with HIV across the country's decentralised health facilities. Thailand has a digitised national population register and digital personal identification numbers for the successful implementation of a universal coverage scheme, guaranteeing subsidised healthcare to all citizens. It is also used to track vaccinations, produce vital statistics that guide public health policy and to monitor health system performance.

Digital identification is used in the agricultural sector too. Nigeria and Estonia have digitised agricultural subsidies, and in Malaysia land registration is digitised and uses fingerprint readers to reduce fraud. Farmers also have unique digital profiles which can be used to track market attendance and receive extension services. Uruguay has implemented a digital livestock traceability system.

Uganda has created a web-based refugee information management system to issue ID cards to refugees so they can access special entitlements, including discounted education and healthcare. Jordan, Lebanon and Egypt use a digital refugee assistance information system to monitor and coordinate humanitarian aid. This is an inter-agency tool for tracking assistance, referrals and assessment information.

Private sector case studies

The private sector is also building solutions that aim to give customers safe and efficient access to public and financial services. Examples include NemID in Denmark, BankID in Norway and Sweden, and TUPAS in Finland. In the Caribbean, Juvo's Flow Lend solution enables Cable & Wireless prepaid mobile customers to establish a financial (functional) identity, which gives customers access to airtime credit.

In the retail sector, Komplett, one of Europe's biggest e-trade companies, uses the Signicat digital identity platform for rapid online payments, whilst in China, customers can pay for their online shopping at certain establishments by scanning their fingerprints, or through facial recognition.

The United Arab Emirates has released a digital smart wallet app to replace paper-based travel identity documents such as passports, and the government is creating a 'biometric border' which will use facial recognition scanners to verify a traveller's identity.

Financial institutions and regulators also use digital IDs to undertake due diligence. For example, Global Legal Entity Identifier Foundation is working to create a standardised global view of legal entities, and in Spain a consortium of banks uses a blockchain platform to create digital identities designed to counter money laundering and boost KYC (know your customer) efforts.



Introduction

Section 3 of this Toolkit helped define digital identity, shared some of the different types of digital identity, and explained why digital identity matters. This section provides examples about how governments, charities, NGOs and the private sector use digital identities around the world.

Before looking at specific case studies, this excerpt adapted from an Africa Policy Review article gives a good overview of digital identity uses:

Africa has been at the forefront of innovative uses of ID. Since the mid-1990s, South Africa has used fingerprint-based biometric ATMs, smartcards and bank accounts to deliver pensions and social grants, including to locations with limited connectivity. The system of social grants now covers some 16.5 million people. In the Democratic Republic of Congo, iris technology facilitated disarmament, demobilisation and reintegration. Ex-combatants were enrolled in a cash transfer programme to help them adjust to civilian life. Following iris scans, users received

an ID card and a PIN which they could use to collect 13 monthly cash payments from over 8,000 airtime sales agents. In rural areas, where distribution through vendors proved difficult, mobile teams delivered cash using exclusively iris scans for identification.

Digital identity systems also facilitate the delivery of emergency relief. The Dowa Emergency Cash Transfer (DECT) programme in Malawi covered 11,000 rural families by using fingerprints for initial registration and verifying payments at mobile ATMs in conjunction with smartcards. The programme improved recipients' nutritional and health status, but highlighted the cost of creating a special system for each programme in the absence of a proper national ID system. Digital identity systems underpin emergency relief in several other countries, including programmes for refugees in northern Kenya, for example.

A strong identity can also support financial inclusion. In Kenya, bank, mobile and micro-finance account holders are identified by their national ID numbers, allowing negative and (more recently) positive credit histories to be shared across the system. Non-financial entities, such as utility companies, may also participate on a reciprocal basis. The result has been a sharp fall in the number of non-performing loans and an increase in the number of credit accounts and information-based financial products.

Strong digital identities can save governments millions by cutting leakage and corruption. As part of its civil service reform, Nigeria eliminated over 43,000 'ghost' workers from the public payroll following an audit using biometric identification in 2011; this is reported to have saved the country over \$60 million. One of the best-known examples of using an advanced ID system to underpin subsidy reform comes from India, which eliminated around 40 million

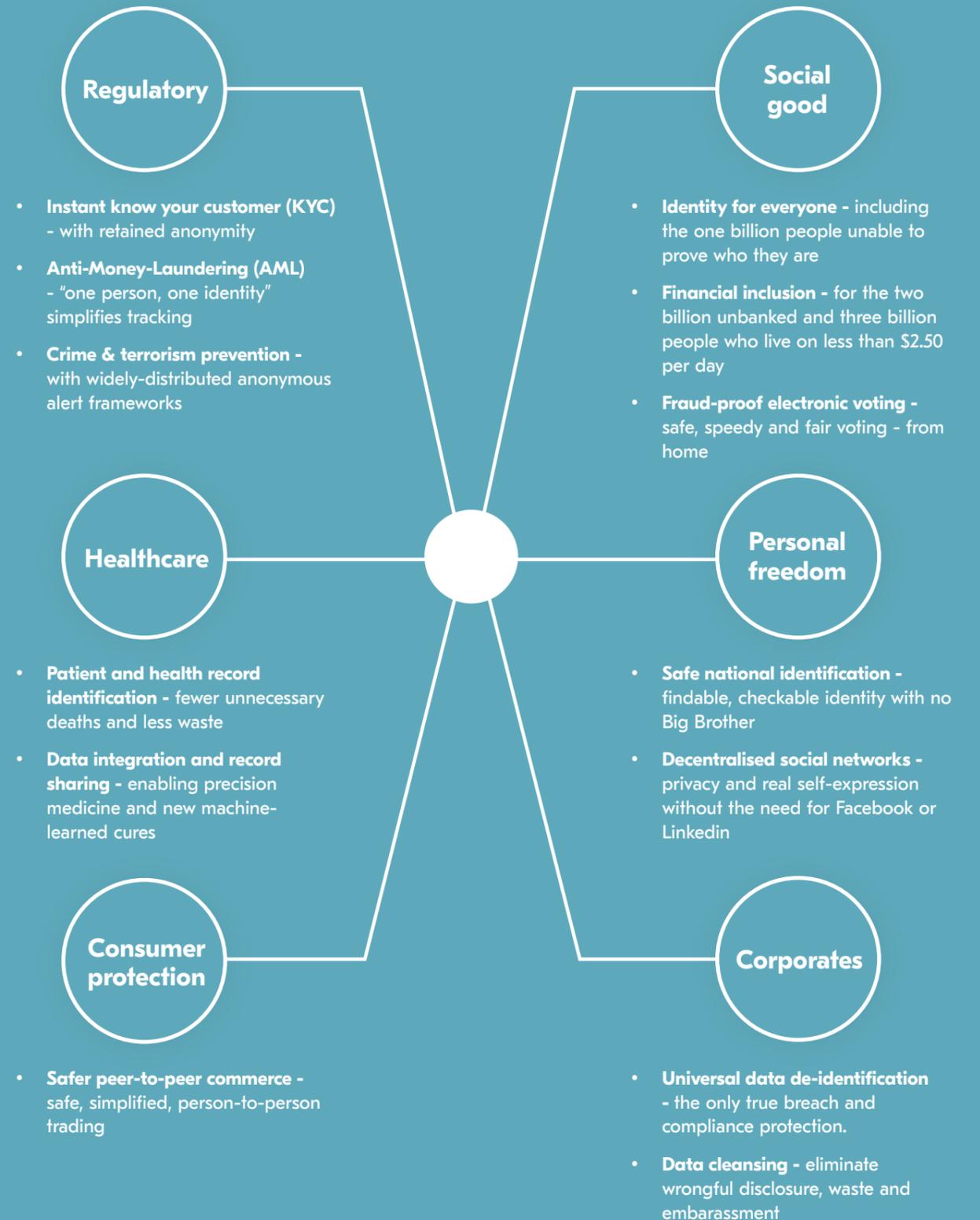
'ghost' beneficiaries when it replaced its market subsidy on liquified petroleum gas (LPG) cylinders with direct bank transfers.

Robust ID credentials can also facilitate free movement of people across Africa's numerous borders without compromising security. The 15 ECOWAS member states are taking the lead. The community plans to launch a biometric ID card to serve as a travel document in the region. Kenya, Uganda and Rwanda have also concluded an agreement to accept national ID credentials for travel among the three countries.

For lovers of lists, here are some examples of how you can use a digital identity:

- Allow brands of your choice to have access to your personal data so they can market to you.
- Give charities permission to claim tax relief on your donations.
- Allow your children to enter a children-only chat room which maintains a strict age restriction policy, verified by a digital ID.
- Request a student ID card to get discounts on products and services.
- Prove that you're the person entitled to access chargeable services from third-party providers.
- Log in to your university network and student web portals.
- Log in to commercial cloud services offered by providers.
- Digitally sign a credit agreement or direct debit.
- Anonymously respond to a customer survey.
- Prove your identity when making a formal offer to purchase property.
- Digitally sign a tax declaration.
- Register a business.
- Undertake a know your customer (KYC) due diligence check for financial services.

The different ways digital identity can be used in different sectors:



Adapted from Private Sector Digital Identities in Emerging Markets by Caribou Digital Publishing and Omidyar Network. <https://www.cariboudigital.net/wp-content/uploads/2019/01/Caribou-Digital-Omidyar-Network-Private-Sector-Digital-Identity-In-Emerging-Markets.pdf>

Mechanism	Case	Description	Key Factors
1a. Reducing fraud and leakage: Ghosts, duplicates	India	The unique Aadhaar number has been seeded into databases and used to authenticate beneficiaries for dozens of social programmes, resulting in savings, potentially in the billions of dollars, from removing fakes and duplicates.	<ul style="list-style-type: none"> • unique ID • digital authentication • interoperability/integration
	Pakistan	The NADRA database was used to eliminate duplicates and ineligible beneficiaries for emergency relief (Watan Card and IDPs), saving an estimated US\$378 million.	<ul style="list-style-type: none"> • unique ID • interoperability/integration
	Uganda	Verifying the identities of civil servants against the national ID database reportedly saved the government US\$6.9 million in less than a year by removing some 4,664 ghost workers from the public payroll.	<ul style="list-style-type: none"> • unique ID • interoperability/integration
1b. Reducing fraud and leakage: Ineligible	Argentina	Using its SINTyS system to link databases at the federal, provincial, and local levels, the government identified inclusion errors in its pension and social programme databases, saving at least US\$300 million since implementation, or nearly eight times the cost of its World Bank financing.	<ul style="list-style-type: none"> • unique ID • interoperability/integration
	Thailand	The national ID number was used in a cash transfer programme for the poor to cross-check the eligibility of beneficiaries against tax, occupational, and other databases, saving between US\$29.7–59.4 million.	<ul style="list-style-type: none"> • unique ID • interoperability/integration
	Pakistan	The NADRA database was used to eliminate ineligible beneficiaries for the initial targeting of the BISP cash transfer programme and the government's Zakat programme, saving an estimated US\$52.9 million.	<ul style="list-style-type: none"> • unique ID
1c. Reducing fraud and leakage: Impersonation	India	Biometric authentication using a functional smart card in the State of Andhra Pradesh reduced leakage in NREGA benefits by approximately 12.7 percentage points, and in pension benefits (SSP) by approximately 2.8 percentage points.	<ul style="list-style-type: none"> • digitisation • digital authentication
2a. Reducing administrative costs: Transactions	Slovenia	An interoperability platform to verify identity information for safety nets across 50+ databases has saved the Ministry of Social Affairs approximately US\$14.5 million per year.	<ul style="list-style-type: none"> • digitisation • interoperability/integration
	United States	Projections estimate that a secure, digital identity credential would save the IRS between US\$91–318 million per year by reducing authentication costs and facilitating online services.	<ul style="list-style-type: none"> • digitisation • digital authentication

Mechanism	Case	Description	Key Factors
2b. Reducing administrative costs: Redundancy	Estonia	The eID and X-Road systems-which provide digital authentication and signatures, and facilitate data exchange-save an estimated 2 percent of GDP per year by reducing identity related transaction costs and facilitating online services.	<ul style="list-style-type: none"> • digitisation • unique ID • interoperability/integration • digital authentication
	South Africa	Integration between the national ID and voter registration contributed to some of the falling costs of elections (from US\$250 million in 1994 to US\$32 million in 2009)	<ul style="list-style-type: none"> • unique ID • interoperability/integration
3. Increasing tax collection	Malawi	Integration between the national ID and voter registration eliminated the need for a separate voter ID card, saving approximately US\$44 million ahead of the 2019 elections.	<ul style="list-style-type: none"> • unique ID • interoperability/integration
	Argentina	Integration between tax databases and other registers (e.g. property and vehicles) via the SINTyS system improved tax audits, generating approximately US\$44 million in additional revenue from a reduction in tax fraud.	<ul style="list-style-type: none"> • unique ID • interoperability/integration
	Pakistan	NADRA's cross-checks of taxpayers against a variety of databases identified some 3.6 million potential taxpayers who were not filing taxes; had this information been used to increase payments by these individuals, it could have saved an estimated US\$1 billion within a few months.	<ul style="list-style-type: none"> • unique ID • interoperability/integration
4. Increasing tax collection	India	The Government will require Aadhaar numbers when filing taxes in order to weed out duplicate or fake tax ID numbers (PANs), commonly used for money laundering and tax evasion.	<ul style="list-style-type: none"> • unique ID • interoperability/integration
	Peru	RENIEC has earned approximately US\$45 million in revenue annually by charging fees for verification and other services, while ensuring that services remain free for the poor.	<ul style="list-style-type: none"> • unique ID • interoperability/integration • digital authentication
	Pakistan	NADRA charges both public and private sector users to verify identities against its database; for example, it earns approximately US\$9.3 million per year from verifying the identity of BISP beneficiaries.	<ul style="list-style-type: none"> • unique ID • interoperability/integration • digital authentication

* Note: All savings figures should be taken as approximations; see full descriptions in text for data sources, limitations, and caveats

Adapted from Public Sector Savings and Revenue from Identification Systems by the World Bank - <https://documents1.worldbank.org/curated/en/745871522848339938/Public-Sector-Savings-and-Revenue-from-Identification-Systems-Opportunities-and-Constraints.pdf>

How people are using digital identities around the world

The following case studies demonstrate how people can use digital identities to: migrate, reduce the burden of proof, reduce fraud, improve commercial interactions and support inclusion:



Ella

Ella employs her digital identity in different ways. At bars, she uses it to prove she's old enough to enter, without having to show a driving licence that would reveal her name, address, and date of birth. She uses her digital identity to enter her office building, instead of a staff pass, and to order her prescription medication online. But she can also use her digital identity to sign up to loyalty and rewards programmes, subscribe to magazines and dating sites, create social media profiles, and share her favorite music. It is Ella's decision about where to use her digital identity, what data to make available, and to whom.



Michael

Michael is relocating abroad to start a new job. He needs an address in the new country in order to open a local bank account. But to rent an apartment, he needs a local bank account. With a globally recognized digital identity, he can prove who he is and provide his credit history and verified personal information from his previous posting.



Rahul

Rahul was a victim of a data breach at a credit rating agency. Fraudsters stole all the data he used to prove who he was. That data was used by others to create new accounts, borrow money, and in doing so undermine his credit rating. Now he has a digital identity and the data required to assess his credit worthiness for a loan is no longer stored in one place. Instead, with his permission, different elements are presented on an as-needed basis.



Anya

As a mother with limited income, Anya is entitled to financial assistance from the state. Previously, she was unable to access this because she didn't have an official identity recognized by state institutions. Since signing up for a digital identity, however, Anya can claim the benefits directly. The funds are applied to a prepaid debit card secured by her fingerprint. She uses this digital identity to open her own bank account and register with a doctor.

Adapted from 'Digital Identity, Restoring Trust in a Digital World' by Mastercard. <https://www.mastercard.us/content/dam/mccom/en-us/issues/digital-identity/digital-identity-restoring-trust-in-a-digital-world-final-share-corrected.pdf>

Government case studies

Estonia: e-Estonia

Estonia has by far the most highly-developed national ID card system in the world. The mandatory national card provides digital access to all of Estonia's secure e-services. The digital identity system of Estonia, called e-Estonia, introduced in 2002, currently has a coverage close to 94% of a total population of 1.3 million.

All citizens carry an electronic ID card with embedded files which make use of strong 2048-bit public key encryption. The system is built on a secure, efficient and transparent system that saves money and time and can be used both online and in person. In 2007, a mobile-ID solution (dependent on a SIM card) was introduced, which allows citizens to use mobile phones as a form of digital identity without using their electronic identity card.

Estonia now has one of the most digitally advanced governments in the world as its citizens reap significant benefits, ranging from ease of access to governmental single sign-on websites to rapid credit approvals and near one-click tax filing.

The system was designed from the ground up to deliver efficiencies for the government and to allay the understandable concerns of its citizens. The e-Estonia solution combines both photo and biometric aspects, with a built-in chip containing two certificates, one for verifying identity and the other for a digital signature, each protected by a four-digit personal identification number (PIN).

e-Estonia can be used to access any public e-service, reducing bureaucracy and speeding up the process of routine tasks. It can be used for banking, signing documents, obtaining digital medical prescriptions or for business operations.

Watch this video to find out more about how e-Estonia works:

Estonia's national identity card



India: Aadhaar

India's Aadhaar is a unique model of state-based identity as it creates a digital identity that is separated from legal status or citizenship. This greatly simplifies enrolment and has contributed to its wide adoption. It now has over 1.2 billion users.

The Unique Identification Authority of India (UIDAI) is responsible for Aadhaar enrolment and authentication. Aadhaar provides users with a digital ID, authenticated online, that lasts a lifetime. It is essentially a 12-digit number that is randomly generated after the user's biometric data (fingerprint and iris) is verified. It began life in 2010, and any individual who resides in India can voluntarily enrol to obtain an Aadhaar number.

While Aadhaar is a state-based programme, its architects envision that its unique identity database can support private sector involvement. It is hoped that it will contribute towards the concept of 'the India Stack', which is a "unified, integrated layer of digital tools and services leveraging Aadhaar on which the private sector can build customer-facing solutions".

Private sector use of Aadhaar remains limited but is growing. Financial providers are starting to use it for KYC (Know Your Customer) due diligence services. Research from Microsave suggests it has saved over 100 billion rupees (approximately \$1.5bn) from e-KYC, which relies on using the customer's 12-digit Aadhaar number to verify identity. Microsoft is trying to integrate its Skype service with Aadhaar in an effort to provide verified digital communications between individuals and the government (for example, users could self-verify using biometrics and connect to the Aadhaar database to have an official video chat with a government agent).

Some examples of how Aadhaar is being used include:

- Verifying filed income tax returns online.
- Applying for a passport online and receiving it in just 10 days.
- Rapidly opening a bank account.
- Timely pension payments.
- Receiving a digital life certificate (this speeds up receiving a pension and avoids physical trips to the bank).
- Being accepted by the Securities and Exchange Board of India for stock investments.
- Receiving government-related subsidies, such as LPG subsidies, straight to a bank account without registering for each subsidy separately.
- Easier voting.

'The Indian government aims to issue unique identification numbers to all residents of India, and will use these to facilitate inclusion, deliver services and benefits and subsidies to citizens. The scheme has already resulted in huge savings.'

Tomorrow Makers

Canada: SecureKey

In Canada, a scheme managed by SecureKey enables customers from multiple financial institutions to use their existing credentials to access dozens of Canadian government services online.

SecureKey is an authentication network which conveniently connects people to critical online services using banking credentials they already have and trust. This has helped encourage wide adoption. SecureKey is configured to be 'triple-blind', ensuring that no party receives sensitive or personal information from other parties.

SecureKey is based on a single identity broker system and a set of identity providers (five of the country's major banks). It provides a method of identification and authentication to access public services, based on a 'bring your own credentials' model, where users can use identity credentials that already exist and that they already use.

In 2014, two years after the launch of the initiative, the number of digital identities had reached one million.



Adapted from the Digital Identity Roadmap Guide by ITU - https://www.itu.int/en/ITU-D/ICT-Applications/Documents/Guides/ITU_eID4D_DIGITAL%20IDENTITY_ROAD_MAP_GUIDE_FINAL_Until-05-10-2018.pdf

Government administration

Japan

All government information systems in Japan use a cloud-based public certification service to verify identities and allow seamless access between systems (with the exception of some with special requirements). Public agencies at the national and local levels can track and share information, avoiding problems such as inaccurate payments or duplication of administrative processes, and helping smooth operations by breaking down vertical divisions within agencies. These efforts have also reduced operational costs and helped improve the security and disaster resilience of governmental and citizen data.

Singapore

The Smart Nation and Digital Government Office is currently developing its Moments of Life initiative, an intergovernmental framework that bundles government services and information. It uses data to anticipate citizens' specific needs as they reach key life moments, such as marriage or the birth of a child.

- Since its release at the end of June 2018, the Moments of Life app has been well received by citizens.
- In its first three months, the app was downloaded more than 10,000 times.
- Over 500 parents have used the new online birth registration feature to register the birth of their child.
- The app now includes a feature that allows parents to search for institutions that accept the use of the child development account funds.

Adapted from Digital identities, Advancing Digital Societies in Asia Pacific - <https://data.gsmaintelligence.com/api-web/v2/research-file-download?id=30933435&file=Digital%20identities%20advancing%20digital%20societies%20in%20Asia%20Pacific.pdf> and from the Smart Nation website - <https://www.smartnation.gov.sg/initiatives/strategic-national-projects>

Addressing social challenges

Birth registration

Burkina Faso: iCivil

In Burkina Faso over 2 million children under the age of 18 remain unregistered. iCivil has been developed to simplify and digitise the birth registration process to enable more children to be registered at more locations around the country. iCivil has produced a hospital bracelet, manufactured with a unique bubble tag and QR code, which is attached to newborn babies by a health professional. Courtesy of the iCivil mobile app, the QR code and unique bubble tag can be scanned, bringing up a digital registration form where the birth details can be entered and updated. The registration details are then forwarded to the national birth registry for verification and, once verified and registration is complete, the birth certificate can be collected by presenting the iCivil bracelet.



Adapted from *Mobile for Development: Digital Identity Case Studies from Africa and Latin America* by GSMA - <https://www.gsma.com/mobilefor-development/blog-2/digital-identity-case-studies-from-africa-and-latin-america>

Education

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‘India’s Aadhaar is now being used to address several issues in the education sector. It can be used to access student scholarships and track attendance. It is mandatory to use Aadhaar to access online education courses and has helped to reveal 80,000 ‘ghost’ teachers at higher education institutes (teachers who are registered faculty members but don’t actually teach).’

Times of India

Adapted from *Aadhaar Helped Identify 80,000 ‘Ghost’ Teachers in Higher Education* in *The Times of India* - <https://timesofindia.indiatimes.com/india/aadhaar-helped-identify-80000-ghost-teachers-in-higher-education-institutions/articleshow/62383881.cms>

Health

Botswana: Improving HIV treatment with national ID numbers

Among other health-related uses, Botswana's national ID number has been integrated into the country's flagship antiretroviral therapy (ART) programme. This programme, called Masa was launched in 2001/2002 to tackle the country's HIV/AIDS epidemic by providing comprehensive and free treatment to all citizens in need. When Masa began, patient records were stored in the form of handwritten paper-based files. This made it difficult for providers to track patients' adherence and adverse reactions to ART over time and across the country's decentralised health facilities. To improve outcomes and reduce the administrative burden of the programme, Masa was transitioned to a computer-based patient management system, and the user's assigned Omang number has been gradually adopted as a unique patient identifier throughout Botswana's ART facilities and related testing and treatment programmes.



‘Integration with the national ID system (Botswana) has improved administration and treatment, and has also facilitated data collection necessary to strengthen the programme and assess its impact.’

The Role of Digital Identification in Healthcare

Adapted from *The Role of Digital Identification in Healthcare: The Emerging Use Cases by Identification for Development*, World Bank - <https://documents1.worldbank.org/curated/en/595741519657604541/The-Role-of-Digital-Identification-for-Healthcare-The-Emerging-Use-Cases.pdf>

Thailand: National ID as a delivery system for universal health coverage

Thailand's foundational identification system has been used to increase access to healthcare and enhance the efficiency of health systems in several ways. Its most significant contribution was the instrumental role that the national population register and PID – a lifetime unique identifier – played in enabling the government to successfully implement its universal coverage scheme (UCS) in 2001, guaranteeing subsidised healthcare to all citizens. Called ‘one of the most ambitious healthcare reforms ever undertaken in a developing country’, the UCS reduced the uninsured population from 29% to 5% in less than two years. The foundational identification system also plays several other roles, from tracking vaccinations and producing vital statistics that guide public health policy to monitoring health system performance. As Thailand's health system moves from paper-based to electronic health records, the Ministry of Public Health and the National Health Security Office are exploring how the PID could be used to facilitate access to those records anywhere across Thailand while maintaining privacy, data protection and ethical standards.

Healthcare and food assistance

Everest has built a decentralised platform made up of three components: EverID, a digital biometric identity system to store and confirm user identity data; EverWallet, a multi-currency digital wallet with built-in document storage; and EverChain, a blockchain-based transaction system. The platform is available to all people from birth until death. It does not require a mobile device to join, is encrypted to protect users' privacy and is interoperable with other systems.

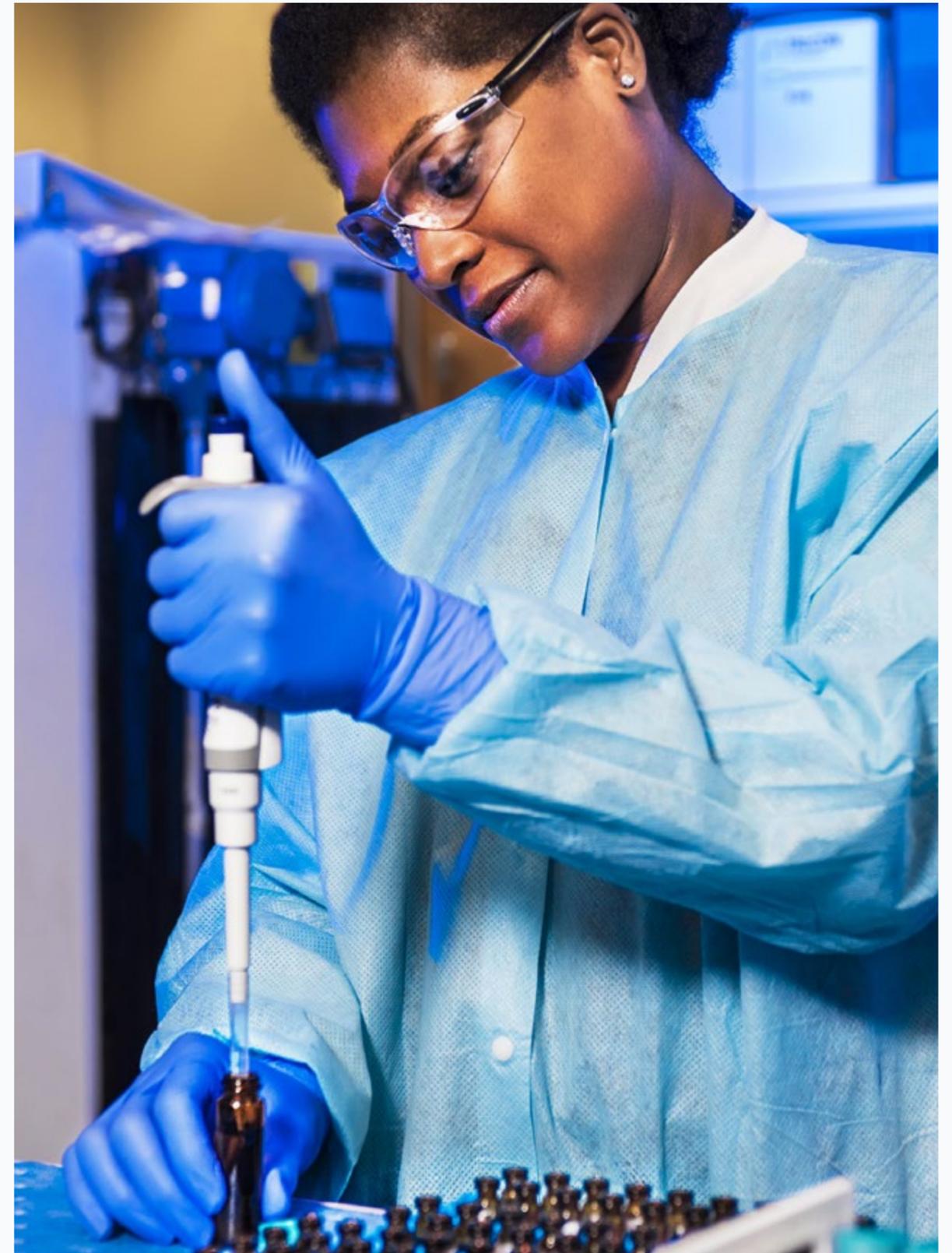
Institutions, corporations and government organisations can effectively, cheaply and quickly validate user identity, at scale. Value can then be transferred securely to the correct recipient with reduced transaction costs, lower losses from leakage, and innovations in service and value transfer.

It has many potential applications, one of which is for identity verification for healthcare and food assistance.

Access to healthcare and the distribution of food assistance are both examples of a need for an infallible verification method that has to be concluded quickly and without the need to own a mobile device (or laptop) to receive the benefit.

Everest users are validated against the EverID blockchain, which can include the retrieval of records and status to ensure accuracy. Once the user has been verified, they will be able to receive the service or assistance.

Institutions, government organisations and commercial enterprises are often risk-averse. Reducing risk through verification allows for unprecedented economic growth opportunities in emerging markets.



Adapted from Everest Digital ID Whitepaper - <https://www.readkong.com/page/whitepaper-july-2018-bob-reid-bob-everest-org-brad-8533794>

Agriculture

Nigeria: Lessons from GES Subsidy Pilot

In 2014, the government of Nigeria supported a pilot project to digitise agricultural subsidies under the national Growth Enhancement Scheme (GES). The intention was to tackle corruption and prevent fraud that kept eligible farmers from receiving their intended subsidies under the scheme.

At the time, Nigeria did not have a robust, high-coverage foundational ID system to identify recipients. Although many farmers had a voter ID, a voter identification number was not held by all potential beneficiaries and was not unique, as duplicate numbers had been issued during the registration process. Therefore, the pilot system accepted 10 different forms of ID for enrollment. Despite that, about 14 percent of farmers did not have a qualifying identity document.

For these farmers, the pilot created a system of sponsorship where one person could vouch for the identities of up to four other people. The pilot successfully registered 500,000 farmers, and 85 percent redeemed their vouchers. Despite this success, there was significant extra time and cost devoted to work-arounds due to the lack of a foundational ID system that could assure the unique identity of each farmer.

In addition to the challenges associated with the lack of a foundational ID system, there was also limited mobile connectivity and electricity in rural areas targeted by the subsidy programme, requiring the pilot to develop a specialized off-line, solar-powered point-of-sale device for registering and authenticating farmers.

The programme also relied on facial recognition, which did not work as effectively as expected at the time: the color tones of farmers' skin were not different enough to be recognized by the available software in some cases, and in other cases the software was confused by the patterns in the background (often, farmers' photos were taken against a cinder block, which was highly textured).

The accuracy and capabilities of facial recognition software has improved since 2014; however, it is important to recognise that not all biometrics work in all contexts, and that unique challenges can be faced when creating identities for farmers in rural areas. Challenges associated with mobile connectivity, electricity access, and lack of a universal foundational ID are unfortunately still present in many rural areas, especially in developing countries, and will have to be taken into account when considering any application of digital IDs for agriculture.

Estonia: e-Estonia tackles agricultural subsidies

Estonia is unique in terms of its adoption of digital governance. The government has brought almost all of its public services online and has enabled online identity verification and authentication via an interoperability platform called the X-Road, which connects various functional registries and the country's foundational, digital ID system.

Ninety-four percent of Estonians have an e-ID and as a result, can access various public and private services and transactions, and even vote remotely from anywhere in the world. In addition, through the e-Residency programme, anyone with a government-issued ID from around the world can apply to become an Estonian e-resident, which allows them to start a company, conduct financial transactions, and file taxes remotely online, even if they have never visited the country.

For Estonia's farmers, this means that their agricultural subsidies are integrated with both the e-ID and X-Road. This allows farmers applying for agricultural subsidies to apply online using data that they have already provided to the government, as the government committed to never asking an individual to supply information multiple times that had already been recorded in an X-Road connected database.

As a result, farmers now spend 45 minutes on subsidy applications, down from 300 minutes using the previous paper-based system. This also reduced delays in paying out subsidies in Estonia. In addition, farmers can also register land and cattle remotely online and access detailed geographic and soil-related information through X-Road.



Adapted from *The Role of Digital Identification in Agriculture: Emerging Applications by Identification for Development* by the World Bank Group - <https://openknowledge.worldbank.org/server/api/core/bitstreams/6f0a35f9-4d04-5b14-a590-4b888b3e91cb/content>

Lands and assets registration

Malaysia: ID to address title fraud

Malaysia has a robust foundational ID system. The original, paper-based system (which was started in 1949) was eventually replaced with a digital ID system called the MyKad. The MyKad system leverages a smart card, which includes a picture and a chip that contains the holder's fingerprint biometrics.

The country also performs well for land administration globally. It ranks 42 out of 190 jurisdictions in the ease of registering property in the World Bank's annual Doing Business rankings, a significant improvement from 2010, when the country was only ranked 86th. The stark improvement was brought on through concerted effort on multiple fronts, including an overhaul of the business processes involved in land registration.

As part of this overhaul, the government of Malaysia introduced the obligatory use of MyKad for land registration and installed fingerprint readers as a means of reducing fraud and forgery. The fingerprint readers allow anyone who wants to register a piece of land to authenticate their identity using their MyKad smart card. In this case, the land registration system uses the foundational ID system to assure that the individual is who they claim to be, reducing land disputes and loss of land rights that have resulted from fraud in the past.

Uruguay: A global exporter through livestock traceability

Uruguay has become a leading exporter of meat since implementing a livestock traceability system. The setup of the system was initially motivated by an outbreak of foot-and-mouth disease in 2000 and 2001, which led to the overhaul of the paper-based system that had been in place for the previous 30 years.

The government financed the traceability system, creating a sense of pride in what was recognised by farmers as a publicly owned asset—a factor that supported uptake and broad participation. Participation in the system was initially voluntary but became compulsory after a successful pilot.

The cattle are associated with each individual farmer, based on their national ID. When a farmer needs to identify new calves, they can request tags online or by phone, and the tags are delivered within 24 hours, along with a printed form including the farmer's name, ID number, the name of the business, and the numbers of the tags being sent. The farmer only has to add the gender, breed, and age of the animals, plus the date on which the ear tags were attached, and return the paperwork by mail, where the form is scanned, and the information transferred to the electronic system.

Malaysia: National ID for farmer profiles and extension services

In Malaysia, due to the ubiquity of the MyKad ID card and its open technical design, each government agency can build its own applications on top of the national ID system. This allows the government agency to benefit from the fact that there is already a foundational ID system available to verify the unique identity of the individual, while building a functional ID specific to agency needs on top of this foundation.

In the agricultural sector, the Federal Agricultural Marketing Authority (FAMA) introduced two identity-related applications derived from MyKad: one specifically for farmers and one for fishermen. These applications are used to record data and information on participation in farmers' markets throughout the country. The applications use MyKad as a platform for storing data and information on the participants, including personal details and business licences. It is connected to Famaxchange, an agricultural marketing information portal developed by FAMA to improve the efficiency and effectiveness of information dissemination to the target groups.

Digital ID solutions for refugees

Uganda

Uganda hosts over 1 million refugees, primarily from South Sudan and the DRC. Uganda is a party to the 1951 Refugee Convention and is widely-recognised as one of the most generous host states for refugees in the world. The government provides freedom of movement, access to services and allocates plots of land for shelter and agricultural production.

In terms of refugee status determination and registration, the UN Refugee Agency (UNHCR) and the government's Office of the Prime Minister (OPM) used UNHCR's proGres software until 2014, when the OPM introduced its own system, the refugee information management system (RIMS). RIMS is a web-based platform that includes registration, biometric capture, case management and card production. Although RIMS captures two fingerprints, it does not operate a biometric deduplication or authentication and is not linked or interoperable with the national ID system, maintained by the

National Identification and Registration Agency (NIRA), which covers all nationals and foreign residents.

Since assuming responsibility for refugee registration, the government is in the process of registering the 1 million refugees in the country with RIMS. The refugee ID card and certificates issued are widely-recognised and allow access to all the services that a non-national is entitled to. In 2017, when the government made it mandatory for all SIM cards to be linked to a national ID number, the refugee ID number was accepted. Likewise, the refugee ID card is accepted for opening a bank account and enables refugees to access a range of special entitlements for refugees, including discounted education and healthcare.

While there have been some challenges with the implementation of RIMS, Uganda's progressive policy and practices with regard to providing ID to refugees and asylum seekers ensures that these IDs are widely recognised.

Jordan, Lebanon and Egypt

These countries extensively use the refugee assistance information system (RAIS) to monitor and coordinate humanitarian aid. This system is an inter-agency tool for tracking assistance, referrals and assessment information. It enables the UNHCR and partners to share assistance records, cross-check beneficiaries lists and host different types of data. RAIS is synchronised with proGres, from which refugee data from all UNHCR field offices is updated daily. Today, the UNHCR and the World Food Programme (WFP) provide direct assistance to beneficiaries and manage other NGOs that use the system.

The largest implementation is in Lebanon, where more than 1 million refugees now use either the WFP's smartcard to buy goods at participating retailers and/or UNHCR-backed ATM cards to withdraw money instead of receiving physical goods. However, there is currently no clear legal and regulatory framework for e-money transactions.

In Egypt, the WFP has adopted the Carrefour supermarket store card as a delivery mechanism. In Jordan, refugees can withdraw their cash entitlement from the UNHCR in branches of the Cairo Amman Bank by placing their eye against an IrisGuard scanner, with no card required. The success of this programme has encouraged the WFP to pilot the use of iris recognition technology so refugees can purchase food in participating supermarkets.



Adapted from G20 Digital Onboarding by The World Bank Group and Global Partnership for Financial Inclusion - <http://documents.worldbank.org/curated/en/362991536649062411/pdf/129861WP10-9-2018-17-26-21-GDigitalIdentityOnboardingReportlowres.pdf>

Private sector case studies

The private sector is also building solutions to help users access services. A few examples of private sector initiatives follow in this section.

Denmark: NemID

NemID is an electronic ID, digital signature and secure email solution that provides individuals access to public and private services. The government tendered the system to the private sector. Users use a common NemID login and password, as well as unique one-time passwords to authenticate themselves to online services. User attributes are stored in a central registry.



Finland: TUPAS

TUPAS is a digital identity provider (IDP) that has created a distributed ID system to connect IDPs to online service providers (RP) to help users access a range of private and public services, including financial services.

TUPAS is an identity system in which over 10 banks act as IDPs. Individuals can log into a wide range of services with credentials from their bank. The users' full names and national ID numbers are transferred from the IDP to the RP.

Case study

A set of banks act as IDPs in the TUPAS system, providing individuals with access to over 180 public and private services.

- The Federation of Finnish Financial Services drove the creation of a bank identity system called TUPAS, designed to improve user access to online services.
- The RPs pay for the service (initiation fees, monthly fees and fees for set transaction volumes). Users may also be charged on a monthly basis, depending on their relationship with their bank.
- While a group of telecoms in Finland offer a competing service, as of February 2016, 95% of all online service logins were processed through TUPAS. Only 2% of online service logins were processed through the competing system. This may be due to the government's strong adoption of TUPAS, citizen loyalty towards government and banks, or the fact that it was the first successful service in the region. TUPAS has established a new revenue stream for banks as well as a strong competitive position.
- With most banks, the user must approve and certify that the data being transferred from the bank to the RP is accurate, eliminating any liability risk for the IDP.

Adapted from A Blueprint for Digital Identity The Role of Financial Institutions in Building Digital Identity for World Economic Forum in collaboration with Deloitte - http://www3.weforum.org/docs/WEF_A_Blueprint_for_Digital_Identity.pdf

Sweden: BankID

Sweden has established an eID system that provides citizens and businesses access to over 300 public and private services. Digital identities are issued by a set of private entities, including large banks and a major telecommunications provider. The public sector buys identity validation services from the private sector. Private sector service providers can join the BankID system by signing contracts with eID providers for authentication. The solution has been very successful - over 9 million citizens currently use the service.



Adapted from A Blueprint for Digital Identity The Role of Financial Institutions in Building Digital Identity for World Economic Forum in collaboration with Deloitte - http://www3.weforum.org/docs/WEF_A_Blueprint_for_Digital_Identity.pdf

Retail

Safe and efficient online shopping

One of Europe's biggest e-trade companies is experiencing great success using the Signicat platform in their online shop. Using these solutions, Komplettn has made it simpler and more convenient for their customers to shop safely online. Komplettn can complete credit assessments and collect payment online in a matter of seconds.

After using BankID for the credit assessment, and once it is accepted, a credit agreement is automatically processed and presented to the customer, at which point the customer can sign and verify the purchase using BankID. Komplettn has online shops in ten different countries, 1.8 million active registered users and had 7.3 billion Norwegian kroner (approximately \$600m) in revenue in 2015. This kind of volume requires flexible, user-friendly solutions that work with various applications and web-solutions across national borders.

China: Alibaba and KFC

Payments using biometrics are on the rise in China. On Alibaba's Singles' Day on 11 November 2018, the world's largest shopping event attracted \$30.8 billion in total transactions. This year, 60% of customers paid either by scanning their fingerprint or by taking a selfie. Alipay users can also use the Smile to Pay app: in a few seconds it can recognise and identify a face, then verify payment through a mobile phone. It's seeing widespread adoption: it has now been rolled out to 300 KFC restaurants across China.

Travel

United Arab Emirates

The travel industry is valued at some \$2.7 trillion globally and served over 3.8 billion air travellers in 2016—a number that is expected to reach 7.2 billion by 2035. The identity of each of these individual travellers must be verified multiple times throughout their journey, including during ticket purchase, check-in, security checks, and (if crossing borders) immigration and customs. However, the paper-based passports and other identity documents that underpin these verifications are often expensive and inefficient.

Customer abandonment rates are high in online ticket purchases, often stemming from friction in identity verification and authentication processes. Research has indicated that airlines themselves accrue overhead costs and fines of about \$0.50 per passenger, and errors in passenger identity data are a prominent factor. Furthermore, the high cost of documents (e.g. a passport costs more than 10 percent of per capita income in 10 percent of countries) may be insurmountable to some would-be travellers, creating a significant barrier to free movement and shrinking the potential customer pool. Improved identification systems thus represent a massive financial opportunity in the travel sector.

As home to the third busiest airport in the world by passenger volume, the UAE is a prime example of a country that has benefitted from leveraging its digital identity platform to streamline identity verification processes in the travel industry.

In June 2017, the UAE released a digital Smart Wallet app that can replace paper-based identity documents for travel. In the current “phase one” iteration, customers can upload existing passport and visa information to the app. At the airport gate, the app produces a barcode to be scanned, eliminating the need for passengers to produce physical identity documents. The service can be used by all national ID holders aged 18 and above, and over half a million travellers have taken advantage of the service thus far.

The digital verification process is estimated to have reduced the time required for identity checks by airlines to 9–12 seconds, creating significant savings in administrative costs. In the future, the UAE has plans to expand the range of Smart Wallet services outside the travel sector to improve the ease of verification for a variety of public and private sector services.

In addition, the government has announced the development of a “biometric border” in Dubai’s airport, which will replace smart gates with facial recognition scanners that can detect and verify a traveller’s identity. Thus far, these developments

only apply to those with a UAE digital identity, but other countries and airlines around the world are investigating similar mechanisms for cost reduction and time savings during air travel.



Adapted from Private Sector Economic Impacts ID Systems: Savings Channel: Decreasing Costs and Expenditures by ID4D, World Bank Group - <http://pubdocs.worldbank.org/en/219201522848336907/PrivateSectorEconomicImpactsIDSystems-Web.pdf>



Accessing financial services

Norway: Bank ID

In 2004, Norway developed BankID in collaboration with the Norwegian government and a group of cooperative banks, and it is now used by more than 75% of citizens. The system is simple to use, requiring users to enter their personal identification number, their chosen personal password and a one-time password from their physical code token. An electronic signature using BankID is just as binding as a handwritten signature on paper.

In 2009, Norway launched the mobile BankID system to enable users to manage their bank accounts through their mobile phones without becoming a victim of identity theft. The five main operators in Norway (Tele2, TDC, NetCom, Ventelo and Telenor) are now part of the programme.

It has more than 3 million users and uses the same secure technology as BankID, but can be accessed via a mobile phone rather than a physical token.

It is easy to subscribe. The client simply asks to be admitted via smartphone and the bank validates their digital identity. The BankID organisation then provides the client with a mobile BankID SIM, which they use to activate and use the system.

Users of both these services can access a range of financial services, including executing transactions and buying capital funds. Access to internet banking and the digital signing of financial documents are services most commonly used by customers. Users can also use it to shop online.

Adapted from G20 Digital Onboarding by The World Bank Group and Global Partnership for Financial Inclusion - <http://documents.worldbank.org/curated/en/362991536649062411/pdf/129861WP10-9-2018-17-26-21-GDigitalIdentityOnboardingReportlowres.pdf> and Mobile World Capital Barcelona: Norway, at the Forefront of Digital Identity for Mobile Banking Services.

Sweden: BankID

Identity is key to use cases throughout the customer lifecycle in the financial services industry, and banks currently spend over \$1 billion annually on identity management solutions. Numerous savings and revenue generation opportunities arise in the private sector from improved government-provided identification systems.

Moreover, because robust identity verification and authentication mechanisms are required in this industry, financial services providers themselves often serve as providers of federated identities for other transactions, as with Norway's BankID and Denmark's NemID. Some have argued that financial institutions are uniquely qualified to serve as foundational identity providers as digital identity regimes around the world mature. The development of BankID in Sweden provides a valuable illustration of financial services in identity system architecture, and the multiple economic impact channels that dynamic can facilitate.

Sweden has a long history of a robust federal identity ecosystem. Swedish people have had a foundational identification system characterised by a unique ID number since 1974, allowing administrative frameworks and the broader public to adapt relatively easily to digitisation.

The Swedish government opted to pursue a market-based digital identification system rooted in the financial services sector to spur competition between identity service providers, thus facilitating innovation and driving per-transaction costs down, creating trusted identity integrations into a greater variety of e-services, and reducing initial implementation costs for the public sector.

BankID was launched in Sweden in 2003 and is managed by a consortium of 10 Swedish banks. All customers of participating banks are given an eID free of charge, which can be used to authenticate transactions across the private and public sector.

Companies looking to integrate BankID with their services establish a contract with a bank in the BankID network, facilitating an additional direct revenue stream to participating financial services institutions. Identity credentials themselves are available in "hard" form (encoded on a smart chip) or "soft" form, which is available on a user's personal computer, tablet, or phone. Currently, BankID facilitates 2 billion transactions per year and is used by more than 80 percent of Swedish citizens.

Sweden has additional plans for the programme's continued expansion. BankID has recently integrated next generation identity verification and authentication mechanisms based on behavioural biometrics to minimise reliance on passwords.

Six of the country's largest banks also cooperatively launched a common mobile payment app, Swish, in 2012, building on BankID's functionality. As of 2014, the app had expanded its services to include e-commerce payments at a cost of 1.5 and 2 kronor (\$0.19–\$0.25) per transaction for retailers.

Swish is now used by more than five million Swedish people for real-time digital payments, with a user base growing by over 150,000 per month. These advanced and improving levels of digitisation, innovation, and reliable identification infrastructure have secured Sweden's status as one of the top 10 countries in terms of "ease of doing business."



Adapted from *Private Sector Economic Impacts ID Systems: Savings Channel: Decreasing Costs and Expenditures* by ID4D, World Bank Group: <http://pubdocs.worldbank.org/en/219201522848336907/PrivateSectorEconomicImpactsIDSystems-Web.pdf>

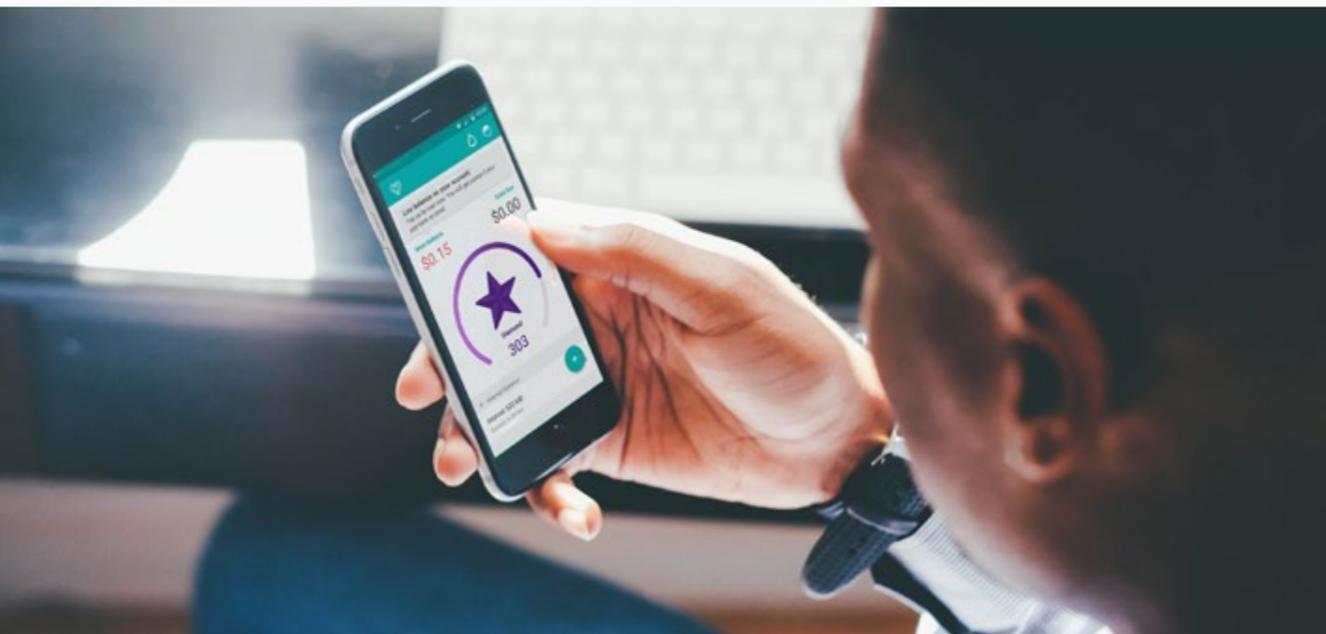
Caribbean: Juvo's Flow Lend

In the Caribbean, access to a bank account is lower than the global average because of the high prevalence of cash-based transactions, which makes proving income and credit history difficult - although most people can prove their identity. Prepaid phone ownership levels are high.

Juvo's Flow Lend solution helps Cable & Wireless prepaid mobile customers establish a financial (functional) identity.

Juvo's solution works by using a combination of data science and game mechanics to analyse mobile phone usage and predict customer behaviour. Each customer is assigned a Juvo identity score and given access to an airtime credit extension based on that score (a low score translates to a lower value airtime credit extension). Each credit extension that is repaid on time adds to the user's identity picture and contributes to improving the Juvo identity score. Over time, this enables customers to access larger value airtime credit extensions while contributing to building a financial identity for a previously anonymous prepaid subscriber.

To date, the solution has enabled over \$25 million in airtime credit extensions, increased consumption of Cable & Wireless services by 10% and increased loyalty for the Cable & Wireless brand.



Adapted from Innovative Mobile Digital Identity Solutions: Financial Inclusion and Birth Registration, by GSMA - https://www.gsma.com/mobilefor-development/wp-content/uploads/2018/07/DI-Companies-Case-Study_v5_WEB_Singles.pdf

Due diligence for regulators and financial institutions

Global: Global Legal Entity Identifier Foundation (GLEIF)

Regulators: Case study

GLEIF is an organization that supports the implementation of the Legal Entity Identifier standard – this standard might ultimately become a common thread between identifier systems in an effort to create a standardized global view of legal entities.

- GLEIF manages a network of Local Operating Units that issue Legal Entity Identifiers (LEIs) to legal entities worldwide.
- Legal entities engaging in financial transactions submit a standard set of attributes to a Local Operating Unit, which validates them against third-party records and then issues an LEI. GLEIF holds the master file of all LEIs and associated entity information.
- The system was introduced by financial regulators to improve micro and macro prudential risk assessment and management, increase market transparency and improve the accuracy of financial data.

- Beyond financial services and regulation, the goal of the LEI system is to provide reliable identity information to permit unique identification of legal entities worldwide, in financial services and beyond (e.g. supply chain applications).
- Over 430,000 LEIs have been issued since October 2015. The LEI is intended to become the link between all other identifier systems (such as know your customer systems or business register codes). This would allow regulators to have a consistent and comprehensive view of all legal entities and financial instruments globally.

Spain

A consortium of Spanish banks is moving ahead with the development of a blockchain-based digital identity platform.

Supported by eight companies (Abanca, Bankia, CaixaBank, Caixa Ontinyent, Ibercaja, Kutxabank, Liberbank and Unicaja Bank) and led by Cecabank in collaboration with Grant Thornton, the Niuron consortium was established in 2017 to build tools designed to counter money laundering and boost KYC (Know Your Customer) efforts.

Five members of the consortium are now continuing with a project to verify the identities of new clients and share the data with other consortium members.

The project is the continuation of a proof of concept stage, which demonstrated improvements in cybersecurity, the traceability of operations, increased transparency and privacy, savings in costs due to removing intermediaries and, ultimately, making the client the owner of their data.



Glossary

Term	Meaning
AML	Anti-money laundering checks are carried out by regulated businesses to perform due diligence and prevent financial crime.
API	Application Programming Interface refers to the software that allows for communication between two computer programs, such as applications, e.g. when Yofi shares your age with an app.
Back-end system	The infrastructure and system behind the 'front-end' of the digital identity solution. API would be a part of back-end system design.
Biometrics	Biometrics relate to the physical characteristics that can be used to identify individuals. Examples include fingerprint mapping, facial recognition or iris scans.
Blockchain	A way of recording information, so that it is stored across several computers connected in a network. This makes it almost impossible to exploit the system, creating a secure technology.
Cloud Infrastructure	The collection of elements needed for cloud computing. It includes hardware, software, network resources, computing power and storage.
GDPR	General Data Protection Regulation is legislation set out by the EU to protect the personal information of all data subjects within the region.

Term	Meaning
IDSP	Identity Service Providers , sometimes referred to as identity providers, allow people to remotely verify their identity.
KYC	Know-Your-Customer checks form a part of due diligence, which allow institutions to verify the identity of a customer whilst doing business with them.
MFA/V	Multi-Factor Authentication/Verification refers to a security measure in which the user must present at least two pieces of evidence to access a particular service. Alongside a username and password, the additional verification factor is usually based on one of the following things: something you know (e.g. a password), something you have (e.g. a mobile phone), or something you are (e.g. biometric data in the form of a fingerprint).
Open Source	This is a copyright licence under which the user can amend, use and distribute software. This is particularly helpful in easily creating digital identity platforms.
PII	Personal Identifiable Information is any data that can reveal someone's identity, either directly or indirectly. This must be protected at all times.
RP	A Relying Party refers to a server allowing access to secure software.
SDG	The UN has set out 17 Sustainable Development Goals . SDG 16.9 aims to provide legal identity for all, including birth registration.
SDK	A Software Development Kit is a collection of software development tools that makes it easier to develop an application, such as one for digital identity. It may also contain a software framework.

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