Center for Global Development
The Eighth Annual Richard H. Sabot Lecture

"Technology to Leapfrog Development: The Aadhaar Experience"

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NANDAN NILEKANI: Thank you, Nancy. It's really great to be here at the Center for Global Development and giving the Eighth Dick Sabot Lecture. I think, as all would assert, that Sabot was a kindred soul. So, I'm really delighted to be speaking at a lecture in his memory.

I will speak about the Aadhaar Project, which I took up about four years ago. The goal of this project was to give every resident of India a unique number. You may wonder why anybody would do this.

[Laughter.]

The reasons are many, but I will give you two broad ones. Firstly, in Western countries, identity is defined when a child gets registered at birth and gets a birth certificate. That's called the basic, or breeder, document. Once you have this birth certificate, it establishes citizenship. It also becomes the basis for getting subsequent documents, like the passport, and so on and so forth. So, generally, in Western countries, most of the babies who are born are registered.

In many developing countries though, including in India, a large number of children are not registered at birth. In many states in India, for example, about 50 percent of the births are not registered. Therefore, you actually have a situation where you have a large number of people—probably millions and millions—whose existence has not been acknowledged by the state. They don't have a birth certificate and, therefore, they don't have any other consequential documents that they need.

Historically, this was not such a big deal because, if you lived and died in the same village, “everybody knew your name" (as they would say on Cheers). Therefore, you didn't really have to have a document. But, as people had greater aspirations, migrated from villages, moved to cities, and went from North India to South India, it became increasingly apparent that not having any form of an identity or document became a really serious handicap. These people can’t get access to anything because they can't prove who they are.

The Aadhaar Project is an attempt to give everyone and every resident that document, or that identity, which then allows them to participate in the economy, in society, in getting jobs, in traveling around, and so on. So this is very, very important. When you look at it from that perspective, it's really a huge project of social inclusion. It's about giving people a chance to be part of the formal society, or the formal economy. That's the point of view of the people.

Secondly, why is it important from the point of view of the government? As India builds a welfare society, which it has been doing for the last decade or so, it has been rolling out all kinds of entitlement programs. These programs offer guaranteed employment, or healthcare, or education, or food and pensions, or scholarships, and so forth. Ultimately, all these entitlements—and even subsidies—go to individuals. But, if the individual is not clearly identified and if the government doesn't have an accurate record of individuals, these entitlements or subsidies can often go to the wrong people. Therefore, you can have inefficiency or invasion in your entitlement programs, which can run into the billions of dollars. Over the last decade, India's spending on social programs has gone up. So, the government needs to make these expenditures much more efficient, much more effective, and much more equitable. And, as these expenditures go up, the government needs to identify individuals very well.

In some sense, the same thing happened in the 1930s in the United States when Roosevelt passed the Social Security Act as part of the New Deal. The New Deal required a way to identify every American citizen because he or she would pay into the social security system when he or she was working and would draw from it later. That is how the whole concept of a social security number began in the U.S. Such numbers have, therefore, been very much a part of the welfare state, such as those used in Sweden from 1947 and in Britain from 1953. So, as the welfare state got played out in Europe and America in the twentieth century, you had the concept of granting a number to everyone. Now, India didn't have that approach. But, as the welfare state is being rolled out in India, having some kind of an ID has become very, very important.

So, fundamentally, the purpose of this project is twofold: 1) to give millions of people an ID, which they can then use to get access to various services; and 2) to improve the quality of government spending on various public programs.

These are the goals. But, how do you do it? How do you give a billion people an ID? One could say that you can just have them come in, you give them an ID, and they go out. But, then, how do you make sure that a person has only one ID? Let's say you have 100 million people who don't have an ID and they all come in for an ID. You have no idea whether the person is going to get only one ID. Are they going to come in with 10 different names, or go to 10 different locations? So, if you don't get that fundamental ID thing right in the beginning, then you are liable to have huge consequences based on these inaccuracies. Getting the root ID right is very, very important. And, we came to the conclusion that the only way we could do that was by using biometrics.

Now, biometrics has a big history in the world. Biometrics was first used in India in the 1870s when the British used it for land titling, and they also used people's fingerprints to record the registration of documents. Historically, and up until a few years ago, the use of biometrics was essentially in forensics. It was about using biometrics for crime investigation and crime protection. You had all these Perry Mason novels where you took the fingerprint off the glass and identified the killer and all that. So, fundamentally, biometrics was used for forensic purposes, but, after 9/11, biometrics has increasingly been used for the purpose of surveillance, or security, or for immigration control.

Today, when non-Americans arrive at JFK Airport, they give their fingerprints. We all give up biometric information. In that case, it is for the purpose of identifying potential people coming in, to improve security, and so forth. After forensics, that is the second phase of using biometrics.

What we are doing—and why it's important to understand the difference—is that we are using biometric technology for development purposes. We are using it to make it easier for people to access services. And, the reason we are using biometrics is to give us a reasonably fool-proof way of making sure that, when we are giving a billion people an ID, that everybody gets only one ID. How do we make sure that everyone gets only one ID? It's a complex problem, but, if we take sufficient biometric data of an individual, then that person's biometrics will be unique across a billion people. Now, we have to find that out. We haven't done it yet, so we'll discover it as we go along. However, if you take the 10 fingerprints and the iris of both the eyes, there's enough data variation in that information to enable us to identify uniqueness over a billion people.

Using two kinds of biometrics—the fingerprints and the iris—is called multimodal. If you use two different attributes, then the likelihood of getting uniqueness improves a lot. Our belief now is that, across a population of a billion people, we will have accuracy of 99.99 percent. In other words, across a billion people, we really have a very high level of uniqueness. We may have a few duplicates, but they will be something we can manage. Biometrics becomes essential to conclusively make sure that everybody gets a unique number.

This is where my title—“Technology Can Leapfrog Development"—comes into play because whatever we're doing today could not have been done five years ago. It has been made possible because computing power and software have become more powerful and because one can set up databases for a billion people, which has been shown to us by the Internet companies that have a billion users. So, we have leveraged recent developments in technology for our purposes.

When somebody enrolls into a system, they provide very basic information. They provide their name, their address, their date of birth, their sex, and their biometrics. This information is captured and sent to sort of a massive database. We then compare the biometrics of an individual against all the people who are in the database to make sure the person is not a

duplicate. In other words, we check to make sure that the person doesn't have a number from some prior transaction.

So, you can imagine what this means at scale. Let's say we have a database of 300 million people and, that day, a million people enroll into our system. Then, each of those million people has to be compared against all 300 million in the database to see whether that person is a new person, or whether that person has already enrolled in the system. This presents a very massive de-duplication challenge, and we have to do that every day because another million people are going to line up on the next day. Therefore, you need a way to really process that information. This system is really built using the same technology that is used by the Internet companies. The Internet companies build these massive databases—such as the Facebooks and the YouTubes of the world—where they can have a billion users, or a billion views, or whatever. So, we are using that same architecture, as it were. We have taken that model, built it, and used it for a development purpose. Today, it's been about 2 ½ years since people started enrolling. We have already enrolled 380 million people into our system, or 380 million people out of 1.2 billion. And, we have issued numbers for about 320 million of those people.

Additionally, we process about a million people a day. In other words, a million people line up every day at our various enrollment stations, they enroll into our system, we process them, and we issue them the numbers. Our goal is to reach about 400 million people this year, which we will accomplish very soon. We hope to enroll about 600 million people by 2014, which is about half the population of India. So, at 400 million people, two out of every three Indians will be in the system. At 600 million people, one out of every two Indians will be in the system.

Obviously, this project requires a large infrastructure and we have about 25,000-30,000 enrollment stations. About 40 to 50 people line up each day at each station and enroll. The data is collected, each person's data is run against the entire stack that we have, and we eliminate duplicates. So, the biometrics has a very important purpose, which is to ensure uniqueness and to make sure that everybody gets a unique number.

Now, the next important question is "What is the use of this system apart from giving everyone a unique number?" Again, this is where the biometrics comes in because, if we're going to design an ID system in the twenty-first century, we must make it a digital ID system. This is, again, an example of leapfrogging because, when ID systems were done in the U.S. and Europe in the last century, they were not done as digital IDs. At that time, they didn't really have all these technologies and, therefore, you would get a piece of paper or you would get a card.

In this new world, you can really put all the data on the cloud or on a computer. Then, rather than giving everybody a physical ID like a piece of paper or a card—which we do give—it is really valuable that the ID is online. It is out there in the ether, and, once the ID is on the cloud, then you can actually verify a person's ID on the network, on the Internet, or on whatever technology that you have. Therefore, the big difference of this project from any other project is that it is not about giving a card or a piece of paper. Rather, it is about giving a number that

operates online, which can then be used to verify your identity anywhere you are. This process is called "online authentication."

Now, authentication is something that we are very familiar with. When you use your e-mail, for example, you use your user name and password. The e-mail service provider checks your password and says, essentially, “I know who you are because this is the password I gave you."

Similarly, when you go to an ATM and swipe your ATM card and withdraw some money, that system is saying, "I know who you are because the ATM card issued is according to what you have”.

Biometrics verifies who you are. Once you give a person a number using this system, and when they go to get a particular service, they can use either their finger or their iris to authenticate the person they claim to be. The two fundamental goals of this system, then, are: 1) to give everyone a unique number; and 2) to use this number for verification online, and anywhere that they happen to be.

Here again, the other big difference with other ID systems is that most ID systems run by governments tend to conflate the ID with the application. So, for example, some people use ID systems to give someone a voter ID card for voting. Somebody else uses it for security purposes. Somebody else uses it for social security. In our case, the important difference is that the ID has been separated from the application; the application is a layer on top of the ID. This method, essentially, creates an open platform for applications. Once everybody has an ID, the ID can be used for a social program as one goal. It can be used for citizenship as another goal. And, it can be used for health records as a third goal. Creating this deliberate layering in a way that separates the ID from the application is a very, very important part of what we have done. It is also what makes it possible to develop more and more applications that the ID can be used for. Over time, we have seen more and more people enroll. As I said, we have already enrolled 380 million people. As more and more applications come up, more people will be allowed to get services.

As people start seeing the benefit of getting the services from the ID, more and more people will go and get this ID. And, as more and more people get this ID, more will build new applications that use this ID. We are trying to create a virtual cycle between people who get IDs and applications so that IDs drive applications and applications drive IDs. Creating this cycle will enable us to get India’s 1.2 billion people on board with this system.

Now, how does all of this aid development? I think that's an important question. First of all, it’s important to realize that many of the people who get this ID don't have an ID, right? So, for example, there is a migrant who has come from the village. He has come to the city and he doesn't have an ID. When you don't have an ID, you can't apply to the public soup kitchen system and get an entitlement of rice. You can't open a bank account. You can't get a mobile connection. You probably can't get a job because employers want to know who you are. So, fundamentally, a lot of things get blocked out.

An ID, on the other hand, is like an internal passport and is the gateway to getting services. By working with the various regulators, we have worked to make this ID sufficient for getting a particular service. For example, we have worked with the banking system to make this ID sufficient to open a bank account. We have worked with mobile regulators to make this ID sufficient to get a mobile connection. All of these services require you to verify your identity. In banking terminology, it's called "know your customer." This principle has become more stringent after 9/11 because people want to make sure that money-laundering is not taking place and all that. And, therefore, ID has become important.

In our system, and once you have the ID, you can use it to open a bank account, get a mobile connection, get an insurance policy, or something else. It enables you to go immediately and get any of these services. And, because it's an electronic system, the ID verification can be done online and services can be provided instantly. The network effect also comes into play. Let's say that we have 300 million people who have this ID, and let's say that somebody launches a product for a new kind of an annuity product. With the help of our system, all 300 million people can instantly get access to the product. So, it really creates this huge network effect where you can quickly get people to ramp up and get services. Therefore, one of the fundamental values of this project is as a gateway to services. This is one of the reasons why the ID is very popular in India because people see it as way to get new things or new services.

Many people ask what we do if the guy gives a wrong name and all that. Fundamentally though, remember that we only give one ID. It's very important to understand that each person only gets one ID in the system. So, the ID you get and the name you give is your name in this system for the rest of your life.

Now, you can think of this as the twenty-first century Ellis Island.

[Laughter.]

What happened at Ellis Island? There is an Ellis Island in America and in Nova Scotia, Canada So, you got all these migrants who came and one part of the family lands at the Statue of Liberty in New York and one branch went to Nova Scotia. They would meet an immigration guy who would ask, "What's your name?" They would give some long-winded name from wherever they came from. And the guy said, "No. From here on in, this is going to be your name." So, you have one branch of the family with a different name in Canada and in America because, at the point of entry, their name got changed. From that day on, they had a new name in the New World.

Similarly, what's happening in India is that all the people are coming from a sort of nonexistent world into the organized world. Therefore, whatever the name they come with into this system becomes their name for the rest of their lives. So, think of this as a modern version of Ellis Island.

One of our goals is to give people these IDs, but the other very important application is to give direct benefits or direct cash to people. The next thing we're doing with this ID platform, then, is to enable people to get access to benefits. When you look at Indian entitlement programs and subsidies, they are more than $60 billion a year. Our program enables you to directly send money to somebody's bank account by just using his or her ID.Suppose a government program has a thousand beneficiaries and each of those beneficiaries has to receive 500 rupees. In the old model, you had a very complicated number of layers to deal with. In the new model that we have proposed, you can just send 500 rupees to that person's ID number. The money automatically gets credited into the appropriate bank account and at the other end—using that person's authentication and biometrics—you can make sure that only that person withdraws the money from his or her bank account. By creating this bank account first, actually on top of the ID, you suddenly create a very sophisticated, paperless, end-to-end electronic crediting system, which allows you to credit money electronically into the account.

I've offered an example of how this system is used for a particular benefit, i.e. to credit money. But, it also helps in reforming subsidies. One of the ways that subsidies work in India is that the subsidy is priced into a product. So, for example, a particular thing like a can of gas—which is called LPG, or liquefied petroleum gas—may cost 900 rupees. You, however, may get it for 400 rupees, which means that the manufacturer subsidizes the rest of the price. Let's say that everybody sells the cylinder at 900 rupees. With our system, the difference between the market price and subsidized price is given as cash into your bank account, which allows the subsidized product to be unbundled from the money. These are all examples of how this particular transaction can be done, and it's a very, very important thing.

Now, I will quickly show you some slides on some basic numbers from the Aadhaar Project. We take the fingerprint, photograph, and the iris to create this database, which, today, has about 380 million people. We'll have about a billion people in this database in the next few years. As I have explained, we generate a unique number for everyone. Since we use a 12-digit number, it allows us to create up to 100 billion different numbers. So, when somebody dies, they take the number with them. We don't reuse numbers.

Then we use this for online authentication, which is a verification of the person's ID, wherever they are. This system is also portable because, if I get the ID and I live somewhere in Bihar and I come to Bombay, my ID travels with me. It's very important because the ID assumes the mobility of a person and the ID travels with them online, which is on the cloud. As I said previously, we have issued 320 million ID numbers so far, 380 million residents have enrolled, and the target is about 600 million by 2014.

This is how we are using the Internet architecture. We use "big data analytics" to generate a daily status of exactly what is happening. You can go to our website, which will tell you, as of this morning, how many numbers were generated. So, this is all being done in real-time. It's a massive database, which allows you to generate data and analyze it for whatever purpose you need. For example, you can click down by state, by district, by ward, and do all kinds of other analysis.

This is a little technical, but I think the important point is to realize how we did this. Our organization has less than 300 people, but our ecosystem has 100,000 people that don't work for us. The latter work for our partners and include enrolling agencies, operators, etc… You know, we have 50,000 operators out there who are trained on this technology, but, to manage this we manage using data The important thing to remember is that, if you want to do large-scale projects in government, you have to have highly granular data that you build. After that, you can farm out the work. So, in our case, enrollment is done by one set of guys and the letters are delivered by the post office. Everything is outsourced in this whole process. But, these 300 million people are managing this whole thing with data. Because they are using a very high level of granular data, they know exactly, at any given point, how things are going. Therefore, this process offers an example of how you can apply this technology to a large project.

So, we have enrolling agencies, certification, device testing, and an authentication agency. Everything is built as an ecosystem, which has allowed us to scale up very rapidly. This is one of the reasons we're able to process so many people per day.

Here's a typical enrollment site. This is an enrollment center in Andhra Pradesh, and you can see a long line of women standing to get a number. This is a very, very popular thing. We have millions of people all over the place lining up, and we are always faced with the challenge of opening more and more locations because there is so much demand for our services. And I think this offers an important lesson. Namely, the reason why this service is so popular is because people see its value. They see this as a gateway to city services—not as some kind of an attempt to pin them down, but as a way to get benefits.

Here's an example of an enrollment center in Andhra Pradesh. And, here's an enrollment center in Jharkhand, which is a Middle Indian state. Again, you can see the long line of people waiting to enroll.

This is an enrollment center in Puducherry or Pondicherry. Again, you can see the numbers of people waiting patiently to enroll into the system.

Similarly, this is on the authentication site. This slide shows somebody withdrawing their money in a village in Jharkhand. This example goes back to the direct benefit transfer I talked about, i.e. the money goes electronically to the bank account and there's a small device there called the "micro ATM." This person puts their finger on the device, the person's ID is authenticated, and they get their money. So, it's like an ATM for the common man. Here's another slide of a payment transaction in Jharkhand.

Here, the same concept of online verification of identity is used for distributing rice in Andhra Pradesh. This person goes to the public distribution shop, scans their finger, authenticates their identity, takes their rice, and goes home. So, basically, using the same identity verification platform, we are able to distribute rice, or food, or money, or whatever is required.

This is an old-age pensioner in Tripura. This is a live application All of these are live applications. We are doing thousands of transactions every day and, here, this lady is able to authenticate her identity and get her pension. Now, to get a pension in the old days, this woman would have had to go a bank branch that was many kilometers away. She would have had to go to a government employee, or to a postman. Now, somebody with this small handheld device can come to the village and do the distribution and, therefore, distribution becomes very simple. And it's very, very convenient for people to get access to money this way. That is, generally, the whole value, i.e. that you are making it convenient for people to get access to public services.

The other big advantage is how this system empowers the person at the point of service delivery. Historically, what happens in government services—certainly in India and maybe elsewhere—is that, to get a government service, you went to only one location, or you could only go to one place. Therefore, when you have only one place from which you can get a government service, then the bargaining power is with the supplier because they call the shots and because there is nowhere else you can go. That supplier can come some other time and ask for some rent, or whatever.

However, when the ID verification is online, it suddenly creates a multiple outlet network where I, as the customer or the beneficiary, can go to anyone to get my money or to anyone to get my rice. The moment you create a choice architecture where I can go to anybody to get my service then, automatically, the bargaining powers and convenience shifts to the user. This is actually the most important benefit socially for the person because, now, they are empowered to go to anyone to withdraw their money. We are doing this right now in Andhra Pradesh where there are several thousand of these machines, and a person gets the money to the bank account. They can go to any one of these machines and withdraw money. That’s a very important social benefit of this technology, i.e. that by creating an ID on the cloud and by creating verification anywhere, you suddenly empower that person to go anywhere to withdraw whatever services they need.

Here’s an example of the "know your customer" principle that I talked about. We can use it to get a mobile connection, or buy a train ticket, and so on. We expect that, over the next few years, that this will be used as the basic ID, or basic "know your customer" for getting all kinds of services, like bank accounts, mobile connections, etc… This is how you are really using technology, to suddenly reach out to a large number of people using this electronic thing. Here’s how the whole thing works related to benefit transfers. On one side, you have a list of beneficiaries. By using the other number , you remove duplicates, which is a very big challenge in many of these programs. You send that information electronically. It goes into the bank account, and you can go to one of these micro ATMs and withdraw the money. This entire transaction is traceable at an individual level. So, you will have complete because you know exactly how much money was sent, from which government program to which individual, and how much they withdrew on which day. This represents a quantum leap in transparency, and that is very, very important for these programs.

Here's an example of the micro ATM I talked about. It is nothing but a small device with a mobile connection and a fingerprint reader, and it will cost just $300 or so. These prices will keep coming down as things become more and these can operate anywhere there is a mobile network. Therefore, it works anywhere in the country.

I'll just show you an example. Basically, this person can go to any outlet anywhere in the country and withdraw money from any bank. Think of it as a massive ATM network for the common man. Essentially, by using identity verification, debit/credit, and standard banking technology, people can get access. So, this is an example of a sophisticated application, but it is being used for very, very basic issues

A lot of people ask about privacy and security and all that. Fundamentally, this is just an ID system. This just gives you an ID and verifies your ID. So, the ID database does not collect all kinds of data about you. It really collects only very basic information, such as your name, your address, your date of birth, your sex, and your biometrics. And, it provides verification services so that, when you go to get a particular service, you can say yes or no. The data for your health records is with the healthcare provider. The data for your banking account is with the banking provider. So, everybody keeps their own parts of the data; there is no "Big Brother" here. It's not about massive data collection. It's just a simple ID system and, therefore, it's designed to be optimal in its privacy dimension. Similarly, from a security perspective, we've done a lot of work to make it secure.

Let me just briefly end by talking about the technology and why technology can leapfrog development. Firstly, as I mentioned when I began, something like this could not have been done five years ago. So, what has happened in the last five years? You have seen the arrival of these large Internet databases, which have a billion people in them. So, if you can have a billion people with a Facebook account, you can have a billion people for an ID system. Scale has been made possible.

Secondly, communication has become far more ubiquitous. India is a country that has something like 700-800 million mobile users, mobile connectivity is in every nook and corner of the country, and mobile connectivity already provides for data connectivity. So, in some sense, we are piggybacking on mobile connectivity because our online verification services are possible only because the connectivity is there. Because we have ubiquitous connectivity, we can use it everywhere to provide online verification.

Thirdly, biometric technology has reached a point of maturity where we can think about creating a database of a billion people, de-duplicating them, and making sure that everybody gets a unique number.

Fourthly, the arrival of small devices, smartphones, and tablets allows us to provide these services on any device anywhere in a village with long battery life, and so on and so forth.

Because the technology world is moving at such a dramatic pace, it is allowing us to think of ways of solving problems that we could not solve before. We have taken the existing state-of-the-art in different fields, but have put it together for a very different purpose and are using very sophisticated technology to solve the problems of the most deprived members of society. We are, in some sense, leapfrogging because this ID system is leapfrogging in a way that was not possible before. And, I believe that this approach to using technology for development can be applied in a wide variety of areas. For example, by using this technology, you could develop a next-generation healthcare record system for developing countries, or you could use it for massive online education, or whatever.

So, I think the important thing is to realize that, today, we have reached a point where many large intractable social problems can be solved using what we have. What I have shown you is nothing but one example of that use, which I hope will demonstrate what is possible elsewhere and everywhere. Thank you very much.