

2nd Edition

DigitalRajasthan Conclave

Transforming Lives through Technology

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Theme Paper

Knowledge Partner

EY
Building a better working world

EXECUTIVE SUMMARY

The internet and mobile communication are an integral part of our day-to-day lives. Most developed countries acknowledge the importance of internet and mobile governance not only in their economy and citizen welfare but also in its overall role in the development of modern states.

Besides, internet and mobile communication technologies are continually evolving with better and efficient solutions. This has led to new emerging areas of business underpinning many aspects of innovation with the convergence of technologies, processes, data, assets and people across an integrated ecosystem.

The Indian public sector is a complex system as it is centralized in terms of governance and undertakes responsibility for service delivery but is disconnected with respect to data sharing and organizational structure, which lead to austere effects. The opportunities to drive efficiencies in public service delivery, reduce costs and improve transparency have generated a growing interest of the public sector in the emerging disruptive technologies

The growing digital economy has already disrupted sectors as diverse as transportation, health and agriculture to name a few. There are newer technologies and business models being explored by the Government to improve service delivery and efficiently provide benefits to the citizens.

Rajasthan has implemented an integrated and unified e-Governance Framework[1]. It is also committed to join the digital wave by planning various initiatives involving disruptive technologies such as application of the Internet of things in water resource management for real-time visibility of water assets[2].

This paper examines the surge in the implementation of digital technologies across two themes: sectors and solutions.

1. Sectors: The role of digitalization has moved beyond automation, and the evolving technologies can be utilized across various focus sectors of Digital Rajasthan, such as:
    a. Health
    b. Identity management
    c. Citizen and service delivery
    d. Transport
    e. Tax and public finance
    f. Agriculture
2. Solutions: Governments aim to improve delivery of public services and meet citizens' expectations by considering implementation of the following emerging and disruptive technologies in their existing practices:
    a. Cyber security
    b. Blockchain
    c. Smart cities
    d. Internet of Things (IoT)
    e. Cloud technologies
    f. Digital payments
    g. Robotic process automation (RPA) and artificial intelligence (AI)
    h. Analytics

The opportunities in the digital era are limitless and without precedent. This paper explores the potential opportunities for governments to aid their digital enablement programs.

[1] http://www.ndtv.com/india-news/we-will-digitally-empower-every-citizen-of-rajasthan-vasundhara-raje-1255295
[2] http://www.financialexpress.com/industry/technology/cisco-partners-with-rajasthan-govt-for-digital-classrooms-and-smart-water-management/501966/

INTRODUCTION

"The role of governments in shaping the future of their citizens has never been as important as it is today." – Professor Klaus Schwab, Chairman of World Economic Forum[3]

Governments need to innovate to drive economic growth while keeping pace with today's rapid changes. Governments also need to be more responsive than ever due to the proliferated growth in data, connectivity, citizen expectations and emerging technologies. The following five drivers that demand innovation from governments are forcing them to rethink traditional development and management models: access to technology and an increasingly connected world; rising expectations from citizens demanding greater accountability; global competition for talent and brain drain; growing financial constraints as populations' age and economic growth remains sluggish; and urbanization and changing resource landscapes.

Section 1: Digitalization as an instrument for effective public service delivery across sectors

Governments around the world need to pursue an agenda to increase efficiencies, cut costs and improve the quality of public services. The potential for innovation in government is immense but it comes with its own set of challenges. The aim should not be to just introduce digital technologies in the public sector but integrate them with the basic fabric of governance. Any change or shift in the governance system has implications on the various sectors within the government, such as public finance management, governance and service delivery, infrastructure and transports, health and agriculture, defense and cybersecurity. In this section of the report, we examine the trends in the key sectors that have significant scope for digitalization.

1. Health

With the intent of the Government of India (GoI) to achieve "universal health care," there is a pressing need for it to bring forth policy reforms to foster commitment and reach closer to equitable distribution of accessible, affordable, efficient and quality health care to all. India is emerging as the market segment leader in information technology (IT) and pharmaceutical space globally. However, the health sector is yet to leverage the potential of medical technology and information and communication technology (ICT) to provide quality health care for all.

Despite several growth-orientated policies, India has one of the lowest public health spending among developed and a few developing countries, with relatively very high out-of-pocket spending. In the last decade, mission mode programs such as the National Rural Health Mission (NRHM) and the national Reproductive and Child Health (RCH) program I and II made a significant impact on Millennium Development Goals. Yet, India grapples with provisioning of basic maternal and child health services to achieve the Millennium Development Goals (MDGs) that it had signed up for.

Current scenario

To understand the current state of affairs in the health sector, it is imperative to analyze the challenges across public and private sectors and levels of care in an integrated manner. The challenges can be classified into demand and supply side challenges.

1. Demand side challenges:
    a. Dual burden of disease with growing non-communicable diseases: Affordability and accessibility continue to remain a major cause for the double burden.
    b. Poor health-seeking behavior: The current incentive mechanisms stimulate curative health-seeking behavior as compared to preventive care.

[3]Source: World Government Summit, February 2017

c. Unreliable information environment: There is lack of comprehensive data on the health sector. The exact count of facilities (public or private), beds, human resources (HR), disease burden and health outcomes to support state and national level planning and decision making is not available

d. Deficiency of trust in Public-Private Partnership (PPP) models: While strategically PPP models are being adopted, failure to focus on the drivers of long-term value, due to weak contract management and monitoring capacities of the states, has rendered such collaborations not as useful as desired.

2. Supply side challenges:

a. Poor health care infrastructure and resources: Our public health system is weak in terms of availability of basic human resource (HR), advanced diagnostic facilities and therapeutic equipment.

b. Poor quality of care and unregulated market: India continues to be plagued with unregulated/unaccredited mushrooming of providers in health care service delivery without any oversight of the minimal standards to operate a safe facility and ensure patient safety.

c. Inadequate public financing and substantial out-of-pocket spending: Although in the last decade the Government has increased investments in district hospitals, almost 50% of secondary and tertiary care remains the purview of the private sector.

d. Insufficiencies of governance and management arrangements: Hierarchical management followed in public health care leaves no space for decentralization of authority. Even as hospital heads are responsible for managing the centers, they have little decision-making authority. Therefore, the sense of accountability for performance and its quality gets diluted.

Solutions

Even as we are aware of the existing and emerging challenges, the moot issue is how to address the ever-increasing demand with limited resources? This points toward the need for a comprehensive revisit into the way we operate, govern and manage cross-functional interventions. To facilitate such analysis, we will need digitalization to track relevant information across the country. Digitalization will be able to qualify the following and many more:

1. Real time information on facilities and beds, doctors, nurses, paramedics and service providers available/operational in different systems of medicine across India
2. Relevant information for the citizens in a unified manner to avoid information asymmetry across service provision, especially for issues of larger public health ramification
3. Data quality for large data analytics by connecting medical devices, applications and data/information sources through secured exchange boards
4. Relevant qualitative and quantitative analysis to draw correlations and analysis to support management and policy decisions by offering a platform for sharing research and development in the sector transparently and comprehensively in one centralized database

There is considerable scope for using digitalization as a tool to support the ongoing reform and transformational activities to make the services more citizen centric. The key intervention areas and the outcomes expected for these are mapped against the possible solutions in the figure:

	Key outcomes expected	ICT enablement
Governance / Policy Public health administration	**1. Universalization of health care and enabling environment**	
	• Health information exchange for convergence • Standardized processes and consistent service quality in health facilities • Transparency and accountability in delivery of health services	• Aggregate state and national level dashboards • Integrated disease surveillance system and decision support systems
Hospital administration Service delivery and improved accessibility	**2. Improved quality of health care services**	
	• Availability of medical facilities and paramedical staff at health facilities • Availability of affordable treatment and benefits of public health schemes • Linking citizen IDs to health systems • Alternative access mechanisms to health care services	• Hospital information systems • Electronic medical records • Electronic health records • Online consultations through internet/smart phones/ SMS • Online access to specialists
Disease control Emergency medicine	**3. Increased operational efficiency**	
	• Improved competency level of health care workers • Automation at provider- patient touch points • Reduce/remove paper work • Empower department with better information management • Mobile-based monitoring for real time information • Skill development to upgrade health care capabilities	• GIS mapping and tracking for emergency management • Hospital information system • Point of care diagnostics • Tele-diagnostics, telemedicine, tele-radiology
Training and capacity building Community mobilization advocacy and dissemination	**4. Enhancement of health awareness**	
	• Creating awareness on preventive health measures among people • Prevention and control of communicable and non-communicable diseases • Standardized clinical and para clinical protocols	• Mobile technologies for front line workers and service providers • Online / virtual learning tools • Online certification

Key enablers

With the focus of the Government on universalization of health coverage, ICT is slated to play a much-enhanced role. A holistic approach to the adoption of ICT would significantly enhance the possibilities of its successful uptake in the hospital and community environment.

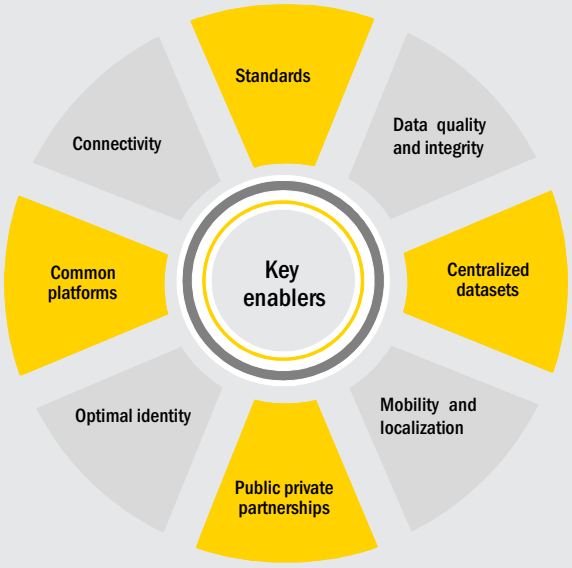
Key enablers for digitalization

For seamless data/services sharing, use of standards is essential. Priority areas are MDDS, EHR, biometrics, localization, security and mobile governance. This will help seamless data collection even in the absence of connectivity.

Establishment of reliable connectivity through web-based and mobile versions of applications, across healthcare facilities for real time data reporting, information dissemination and effective program monitoring is critical. The traditional telephonic access channel will help enable universal access to health care.

There is a need to set up ICT models with a simple on-boarding and de-boarding process for new, multiple applications.

Identity platforms such as UIDIA (Aadhaar) can catalyze the creation of unique and electronic health records across multiple services and social security programs.



To enhance data quality, electronic data capture should happen at source using web or mobile applications. This mitigates data quality issues while digitizing from paper. Data quality can also be maintained by having standardized data formats

To analyze trends and assess life cycle of individuals, it is imperative to create government-owned logically centralized datasets (at central/state level) with uniquely identified beneficiary health records in a secure environment.

Developing relevant mobile applications can enhance efficiency and outreach. Telemedicine/tele-diagnostics, SMS and USSD based services can be used to disseminate information to a large population. Providing applications and services in the local language will help to increase adoption of these services

There is a need to encourage private-public partnership models for innovation in development and maintenance of ICT systems and applications.

Key opportunities for the Government and way forward

Digitalization in health care in India is at a unique juncture where a platform-based approach and mobility are fundamental to leapfrog straight into an era of mobile health care systems, thus bypassing many e-health system phases of maturity. This calls for the need to prioritize the ICT initiatives, based on their socio-economic/business impact and implementation complexity. These can then be plotted in a priority matrix with four quadrants (as depicted in the figure alongside) for facilitating decision making. Hence, to build a well-designed integrated IT system for the health sector at large in India, there is a need for an implementation strategy with clearly defined milestones/outputs and an enabling environment.

Therefore, the focus in health should be on:

1. Starting big for generic solutions to achieve scale for globally accepted generic large-scale ICT programs to succeed (such as HR MIS, e-procurement and hospital administration MIS), i.e., prepare for an early scale-up without pilots.
2. Starting small for high-tech/specialized solutions before integrating and scaling up for solutions such as integration of point of care diagnostics/medical devices with Enterprise Information Solutions (EIS), Electronic Medical Record (EMR), Electronic Health Record (EHR) etc., which deal with highly confidential individual data.
3. Emphasizing on change management to enhance adaptability, which is essential in the Indian context to consider technology projects and invest adequately in stabilizing the change.
4. Providing an enabling environment to integrate all stakeholders to allow participation and buy-in of all the stakeholders to overcome project implementation hurdles and streamline processes.
5. Creating business models that incentivize focus on health outcomes and build trust

2. Identity Management

For years, there have been concerns over effective governance in India due to the absence of unique identification of residents. This need gap is magnified in the case of marginalized and poor sections of the society, where, among others, lack of identify equals to denial of basic welfare services provided by the Government. Aadhaar, the unique resident identification initiative of the GoI, attempts to cater to this need. With more than one billion enrollees, Aadhaar is the world's largest national digital identity system. It offers numerous opportunities for innovations in citizen service delivery and has the potential to support the development agenda of states in many ways.

What does this mean for governments in emerging economies?

Digital identity is a fundamental part of the major drivers of change shaping the public and private services ecosystem ...



A universal digital ID enables legal rights for every individual, strengthens governance, accelerates social and financial inclusion, promotes commerce and entrepreneurship, and achieves compliance with global Know Your Customer (KYC) standards for citizen service delivery.

- Unique and centralized online identity verification
- Ease of integration into existing service delivery processes
- Authentication-enabled service delivery and benefits disbursement
- Reduced KYC cost for service providers, thus broadening and deepening of service
- Empowerment of the marginalized with access to organized financial sector
- From subsidized prices to direct subsidy transfer to beneficiaries
- Unified view of beneficiary
- Reduced transaction costs and enhanced user interface

Current scenario

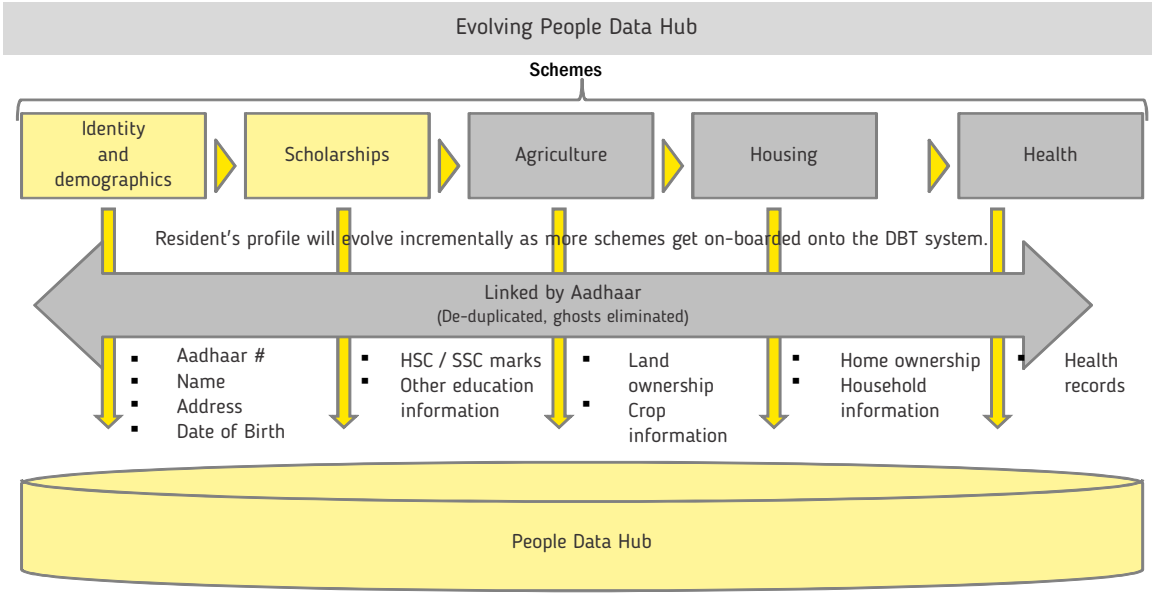
Aadhaar is playing a key role in a wide variety of citizen services today in several Central and state government initiatives and has been able to demonstrate substantial impact. Broadly, these enablement areas and some illustrative impacts are as follows:

Beneficiary identification	Financial	Delivering	Development planning
Helps in sanitizing the state's/department's databases and uniquely identifying beneficiaries	Enables state governments to directly transfer benefits to beneficiary accounts	Enables instant paperless bank account opening, issuance of life insurance, etc.	Enables valuable anonymized demographic data to help development planning.
▪ Enabled removal of ghost identities from databases for liquefied petroleum gas (LPG), PDS etc. ▪ Attendance monitoring in government offices	▪ DBT under various schemes such as MGNREGS, NSAP, PAHAL and scholarships	▪ More than 282 million bank accounts opened under the Jan Dhan scheme, and Aadhaar e-KYC used to open 44.7 million bank accounts, eliminating the need for other identity documents	• Social registry kind of platform already created in a few states for more effective and efficient service delivery

Marquee case study

One of the most distinguished applications of Aadhaar is the Direct Benefit Transfer (DBT) in Maharashtra through the DBT and Services Portal. The vision and objectives that the portal is helping in achieving are:

1. Capturing information from residents / beneficiaries only once to create a Citizen Profile.
2. Increasing the time window and channels for applications for schemes.
3. Providing a single-window for multiple departments, institutions and schemes.
4. Integrating with institutions and agencies for auto validation and verification of resident profile and applications.
5. Automating back-end functions and processes of DBT.
6. Enabling speedy and transparent execution of DBT.
7. Building / deploying components in line with a state enterprise architecture.
8. Planning, implementing and monitoring benefit schemes effectively.
9. Moving from reactive to proactive beneficiary identification.



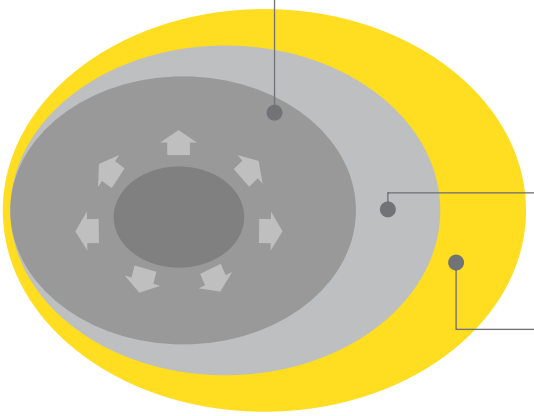
Key opportunities for the Government and way forward

A number of state governments have already taken up implementation of Aadhaar-based services on a mission mode basis. It is critical to understand and appreciate that state governments do not need to have a high level of IT maturity to be able to initiate some or all of these activities. By undertaking initial steps such as digitizing scheme databases, linking Aadhaar to beneficiary databases and setting up Aadhaar-based authentication, governments can move toward a phase-wise agenda to improve administrative processes, resident experience in public service delivery and larger human development objectives.

The government can tap the potential of the two areas outlined below for increased efficiency in government services through identity management:

1. Improving efficiency of administrative process and establishing eligibility for better targeting of beneficiaries

Building Digital ID: Level of Maturity



Phase 1 — **Preparatory: Build Aadhaar**

Universal coverage for Aadhaar and adopting innovative ways for last-mile coverage
Initial activities such as digitization of databases, seeding/linking of Aadhaar with beneficiary databases, account opening and seeding/ linking of Aadhaar with bank accounts

Phase 2 — **Intermediate: Build on Aadhaar**

Use of Aadhaar platforms for paperless, instant ration card provision, health insurance, etc.
Use of Aadhaar payment platforms, i.e., APBS, AEPS, to make all scheme payments under DBT programs, thereby reducing delays, eliminating middlemen and curbing leakages/ diversion

Phase 3 — **Advanced: Build around Aadhaar**

Reach out to EACH resident in the State. By using Aadhaar as the single identification across resident lifecycle through stages such as birth, immunization, school, higher education, skills training, employment and old age etc., the Government can communicate with and improve service delivery for each and every resident

   a. State governments fund a number of social welfare schemes focused on the poor and vulnerable sections of society. Some of these schemes at times suffer from administrative inefficiencies in their implementation, many of which can be addressed through Aadhaar. Aadhaar verification platforms can facilitate the creation of customized dashboards as shown below to monitor attendance of government employees, check daily outlay of goods/payments [e.g., mid-day meals and Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGS) wages] to residents, or even track births in the state.

   b. Rural population, particularly the poor, utilizes a number of government services and schemes across sectors such as education (scholarships), healthcare (insurance and maternity benefits for institutional delivery) and pensions (old age, widow and disability). However, each of these departments operates independently and has a department-specific database. With Aadhaar enablement, governments can gain a unified view, thereby allowing them to target scheme benefits more effectively as per the eligibility of residents.

2. Advancing human development making everyone count

   a. Some key opportunities for advancing human development for a state include improving well-being and reducing poverty. Ministries and departments have budgets for disbursement of welfare benefits to the marginalized and the poor. However, one of the persistent challenges for state governments is to accurately identify these beneficiaries. Aadhaar can help in significantly mitigating such challenges and enabling state governments to plan better, both in

terms of financial estimation and policy development. It can help ensure that every child is healthy, immunized and in school, vocational training is imparted to the youth etc. It can also equip state governments to ensure human development improvements at an individual/beneficiary level across the different stages of a beneficiary's lifecycle.

3. Citizen and service delivery

Citizen services delivery is arguably the most crucial aspect of citizens' perception of governments' performance, essentially because it is one of the most visible and tangible aspects of government-citizen interaction. It impacts all facets of their lives, from paying taxes to receiving social security benefits to obtaining crop and weather information. Therefore, the concept of customer experience, i.e., "citizen experience," is gaining traction among governments.

Citizen experience – the next frontier in citizen service

Customer experience is the journey that a customer goes through while interacting with and consuming the products and services of an organization. With citizens being the primary customers of government services, "citizen experience" can be defined as the amalgamation of three aspects: the journey that the citizen goes through while accessing government services, the various touch points the citizen interacts with and the environments the citizen experiences.



Why is citizen experience important?

As governments seek to transform the delivery of citizen-facing services to meet citizens' increasing expectations, citizen experience becomes critical both as a goal as well as a tool to measure public satisfaction with government services. Emergence of digital technologies has changed citizens' expectations from governments. Moreover, digital content and services are now widely accessible and affordable in the private sector. This has brought about a paradigm shift as illustrated below:

...citizens' behavior	...the way citizens work	...the business environment
Citizens now have a **digital persona** that reflects a new set of preferences and expectations for how things should look, feel and be experienced	Citizens now **Interact** with government, manage their time, discover services and build communities	Entrepreneurs have easy access to **business models** market information – needs, services and costs
Citizens now expect government services the same way as they consume private sector services	Citizens now expect information about benefits and services anytime, anywhere	Village Level Entrepreneurs (VLEs) and businesses are now more digital-savvy and expect revenue-rich business models

Enhanced citizen experience is key to delivering improved citizen services in the public sector.

An outside-in, citizen-centric view on how services should be delivered

Helps drive efficiencies and accountability

Reveals opportunities for improvement and innovation

Helps governments arrive at key delight points and pain points of citizens

Helps create awareness amongst beneficiaries and improve service delivery

Acts as a strategic tool to ensure every interaction with the citizen is positive.

Citizen experience is increasingly becoming; the single-most important pivot around which governments around the world are designing citizen services, as evidenced by the following examples:

D5

The Digital 5, a network of the world's most advanced digital nations UK, Israel, South Korea, New Zealand and Estonia has identified citizen service delivery as the **top principle in its joint charter**[4].



The Dubai Smart Government department[5] (DSG) launched a Customer Experience Lab focused on systematically **involving citizens in co-designing citizen services** through various engagement techniques.



Over **80%** of US Government agencies have identified **"Improving Citizen Experience" as top priority** and plan pursue it despite continued budget concerns[6].

What constitutes good citizen experience?

The endeavor of enhancing citizen experience begins with acknowledging that citizens are the most important customers, and then working toward meeting their needs.

Characteristics of a good citizen experience

Personalization
Providing flexible systems that allow each citizen to interact in their preferred ways

Empowerment
Enabling citizens to perform the tasks with maximum convenience, speed and transparency of information

Access
Creating multi-channel convenience and responsive design to facilitate seamless experiences between various delivery channels.

South Korea initiated **Government 3.0**[7], a new paradigm for government operation to deliver **customized public services** and generate new jobs in a creative manner by opening and sharing government-owned data to the public and encouraging communication and collaboration between government departments.

The UK is transforming 25 major services, making them **digital by default**[8]and simpler, clearer and faster to use. The services are being redesigned based on the **needs of users**, not the needs of the Government.

Estonia launched a common **e-Health**[9] system in which all patient data can be accessed through a **ePatient portal**. The system also compiles data for national statistics, better health trends measurement, tracking epidemics and ensuring efficient resource usage.

[4]D5 Charter - https://goo.gl/wFXrUi
[5]Dubai Smart Government CX lab - https://goo.gl/tHMkUz
[6]Digital government engagement trends 2017 report- https://goo.gl/5Y3wTQ
[7]South Korea government 3.0 - https://goo.gl/xJhvL4
[8]UK transformation program - https://www.gov.uk/transformation
[9]Estonian e-Health system - https://goo.gl/pAXd5D

Current scenario

Thirty-three percent of the global poor[10] live in India, 21.2% Indians[11] live below the poverty line and 68.8% of the population lives in rural areas[12] where access is an issue. Moreover, Indians speak 22 languages[13] and expect government services in their language. A combination of these factors affordability, access, literacy and multi-linguistic needs makes effective citizen service delivery in India a mammoth challenge. Successive governments have made significant strides in improving citizen services delivery through a number of far-reaching initiatives including improved ICT infrastructure, digitization, establishing citizen service centers, and Open Government Data Platform. However, in terms of improving citizen experience in public service delivery, India is at a nascent stage. The current public service delivery system in India can be characterized by the following aspects:



ICT across geographies: Low connectivity in rural areas can slow down or halt service delivery, which leads to long waiting times for citizens and an overall diminished citizen experience.



Awareness among stakeholders: Inadequate dissemination of information regarding availability of services, eligibility for benefits and locations of the service centers can limit adoption of services.



Integration among existing data systems: When citizen data is not uniform in all systems, mismatches can lead to time-consuming process of rectification, thus impacting citizen experience.



Reluctance to adopt new processes: The bureaucracy and administration's broader inability to adapt to the challenges of the digital age hampers their ability to adopt new ways of doing things, which in turn impacts citizen experience.



Lack of citizen-centric mindset: As a direct result of the lack of the 'citizen is customer' mindset, departments do not engage with citizens about how they should design new services or improve existing ones.

Citizen experience vs. Customer experience

A comparison with the private sector and its adoption of customer experience as a means of better serving its customers can reveal further insights into the attributes of good customer/citizen experience. The 2017 Connected Citizen Report by Salesforce[14] gives insights on how citizens view government service. Although the report covers only US government services, the broad findings resonate with citizen experience of other countries.

68%
Over two-thirds of people have better customer experiences with private sector organizations

62%
felt that private enterprises resolve customer service issues more quickly

52%
felt that private enterprises care more about people as customers

45%
felt that private enterprises provide easier ways to communicate

44%
felt that private enterprises have more engaged employees

Connected Citizen Report 2017 – Salesforce

[10]UN Millennium Development Goals report 2014 - https://goo.gl/kvwTNo
[11]Poverty data World bank - https://goo.gl/QAtuvK
[12]Rural Urban division, Census India 2011 - https://goo.gl/4Ke3P5
[13]Languages, Census India 2011 - https://goo.gl/zfel5m
[14]Salesforce Connected Citizens Report - https://goo.gl/V4n9jw

Governments would do well to adopt best practices in customer experience from the private sector, especially as citizens expect to consume government services in the same way as they do private sector services.

	Private Sector	Public Sector
Differences in service	• Multiple delivery channels • Responsive and accountable • Customer-centric attitude • Quick and fixed turnaround times	• Limited delivery channels • Lack of transparency in services • Authoritarian attitude • Variable and long turnaround times
Focus	Need of customers Customer retention	Internal processes Scheme execution
Drivers	Profits	Governance and welfare

Key opportunities for governments and the way forward

High-performing governments are going digital: delivering high levels of citizen experience when and where needed. India has a long-term digital strategy and vision. It needs to focus on execution with greater transparency and citizen involvement. This will involve greater political will, openness to co-developing services with citizens, and measuring departments on their ability to deliver citizen experience.

How India can strengthen Customer Experience (CX) in delivery



Political Will

A critical success factor for CX initiatives around the world has been political will. For example, the US issued an Executive Order specifically mandating government agencies to enhance citizen experience.

Include Citizen Experience as a priority within the **Digital India** strategy.



Utilize existing infrastructure and capabilities

India's **1.44 lakh**[15] **Citizen Service Centres (CSCs)**serve as vital touch points for citizens engaging with the government. With 1 lakh CSCs in rural areas, there is a huge opportunity for India to drive high levels of citizen experience for a large part of the populace.

Enhance CSCs to function as digital CSCs to help improve citizen experience.



Set service performance benchmarks

Establish **citizen services as a cross-departmental priority** and set performance benchmarks.

Create the role of a **Chief Citizen Officer** (CCO) who reports to the departmental secretary and will develop a holistic view of their constituents and integrate citizen-centric thinking.



Standardization

Digitally advanced governments are developing **more fluid websites and apps** to address citizens' needs seamlessly across all channels.

Define standards for uniform citizen experience across all departments and channels mobile, tablet, desktop, government ffices and CSCs.



Feedback programs

Mobile-phone apps such as SeeClickFix and FixMyStreet in the US and UK let citizens report potholes, graffiti, and illegal dumping. Departments can then report back on fixes, closing the feedback loop.

Enable citizens to give specific feedback quickly to help improve performance and lower resolution times.

Improving citizen experience will not only reinforce the faith of the citizens in their governments but also enhance governments' ability to bring governance to the doorstep of the citizen.

[15]Ministry of Electronics and Information Technology - https://goo.g/Zft3CL

4. Transport

The number of metro cities in India with population of 1 million and above is expected to rise to 87 by 2031. These numbers indicate the requirement of increased investment in urban infrastructure to improve the livability of the cities. Urban transportation is an important pillar of the quality of life of citizens in a city. Lack of quality and safe public transportation, road safety concerns, congested roads, poor traffic management and parking issues remain the key issues in most of Indian cities. Most cities also lack integrated transportation plans[16].

For transport operators, huge demand-supply gap and poor asset management remain the key issues. Technology can help in forecasting demand and supply data for transportation planning. It can also help in improving the reliability of transport services by providing visibility on arrivals/departures/route information to travelers. Common fare media across different modes of transport can facilitate seamless journeys for passengers. Intelligent transport systems can increase service delivery and organizational efficiencies. Today, there are many digital solutions available for various modes within the transport sector some niche for a particular mode while others cutting across multiple modes[17].

In the next few sections, we have tried to touch upon important modes of transport prevalent in Rajasthan, their current status in terms of digital progression and a brief on other digital solutions available in the market that can be readily adapted under each mode.

Current scenario

Road transport

Rajasthan is India's largest state by area, spanning across 342,239 square kilometers[18], comprising 38 National Highways with total length of 8016.18 km and 85 State Highways with total length of 11,716 km[19]. The state has been distributed in 12 regions and these regions comprises 53 transport districts with 12 Regional Transport Office (RTOs) and 39 District Transport Office (DTOs). The Rajasthan Transport Department implements departmental activities in accordance with Motor Vehicle Act 1988, Central Motor Vehicle Rules 1989 and Rajasthan Motor Taxation Act & Rules 1951. In the past year, around 480,500 vehicles were registered in Rajasthan, with over 134,000 new learning license and 95,000 permanent license issued. Out of the 434 National Highways Authority of India(NHAI) tolls of India, 54[20] are in Rajasthan. These numbers are indicative of the fact that Rajasthan is one of the prime states in India with respect to road transport and is also visited by tourists across the world. That only makes it more imperative that the state's road transport should be of world-class quality. But the fact remains that Rajasthan was also ranked fifth in the country in terms of the number of deaths due to road accidents for the year 2015, with 9,305 fatal accidents, 60% more than the year 2005[21].

Key Drivers		
Managerial & Operational	**Technical**	**People**
• Prevalent middlemen and agent system • Reconciliation and assessment of taxes, fees • Lack of defined KPI's for performance monitoring of staff and assets • Lack of visibility of on-ground operations • Lack of Road Safety Plan • Need of revision of policies as per new digital requirement	• Challenged and outdated IT Infrastructure • Poor net connectivity • Lack of trained staff • Lack of plan for migration of legacy data to Digital system • Real time updates of data • Lack of Technical Onsite Support	• Limited Online Citizen Centric Service • Lack of public awareness about digital services • Inefficient change management • Behavioral issues: public not trusting digital systems or online payments

[16]https://www.pressreader.com/india/the-times-of-india-mumbai-edition/20130723/282059094611446
[17]http://www.millenniumpost.in/smart-cities-will-need-smart-transportation-65175
[18]http://statisticstimes.com/geography/area-of-indian-states.php
[19]http://timesofindia.indiatimes.com/city/jaipur/sc-ban-on-highway-booze-shops-to-turn-raj-dry/articleshow/56485843.cms
http://www.nhai.org/doc/23june12/nh_nh%20wise.pdf
[20]http://tis.nhai.gov.in/tollplazasataglance?language=en
[21]https://data.gov.in/catalog/stateut-wise-total-number-fatal-road-accidents

Therefore, like other big states in India, Rajasthan's Road Transport Department needs to adopt digital transformation. Across country, Central and state governments are implementing or testing many digital solutions to resolve road transport related challenges and issues. Some of these solutions are shown in the diagram below:

Vahan

Currently 21 states are in process of migrating to latest version of Vahan (Vahan4) with Delhi, Tripura, West Bengal, Jharkhand & Uttarakhand been implemented over all RTO/DTO sites.

- Used for Vehicle Registration – New, Old, Temporary, Fancy Number
- Issuance of Permits
- Road tax, fee collection on existing vehicles
- Fitness, Inspection, Conversion, Retention
- Vehicle related services – Transfer of ownership, change of address, duplicate RC, hypothecation addition / termination

Vehicle search application

Sarathi

Currently 20 states are in process of migrating to latest version of Sarathi (Sarathi4) with Harayana, H.P., Rajasthan, Jharkhand & Tamil Nadu been implemented over all RTO/DTO sites Almost all the sites of Rajasthan are running on Sarathi 4(latest version) but

- Issuance of learner/driving licences- Driving, Commercial, conductor
- Slot booking for license tests
- Modify/cancel application and appointments
- Camp registration
- International driving license, Driving school
- Integrated Enforcement Module

eChallan

Many States, districts and cities are in the process of implementing/testing eChallan solution. States like Uttar Pradesh has already starred using eChallan for challaning process.

- Complete digital and online solution of Challaning
- Detailed access of Vahan-Sarathi data for enforcement officers.
- Offline challaning and Automatic online syncing of challans
- Onsite payment through digital payment modes
- SMS and e-mail notifications
- Better data analytics

The critical success factors for these solutions are as follows:

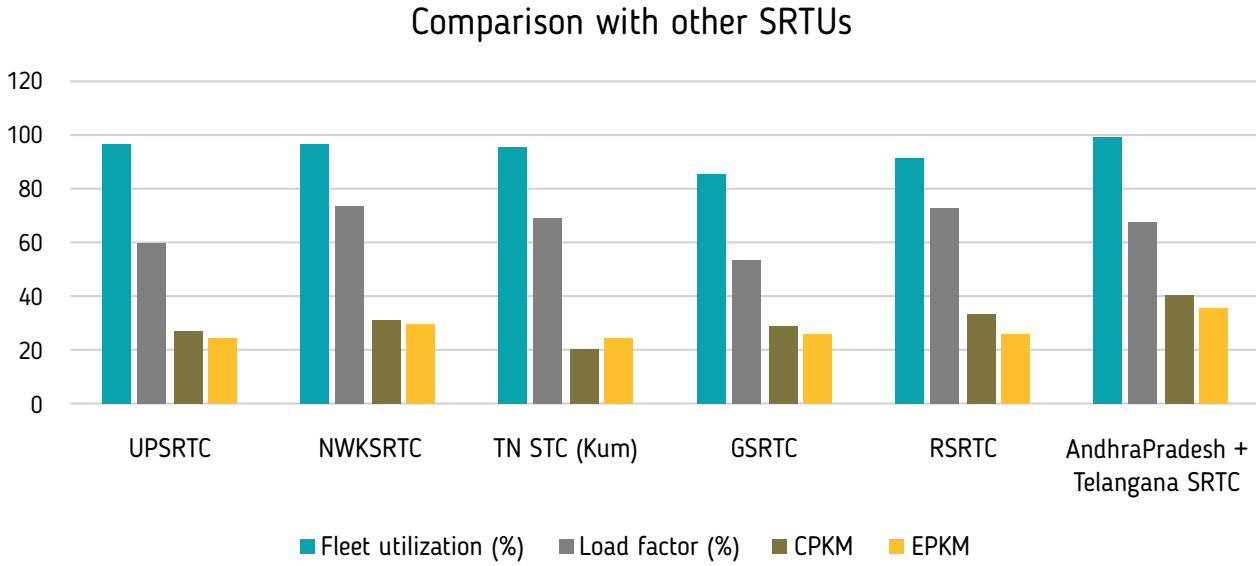
1. Services with primary focus on ease of service delivery to citizens
2. Comprehensive and stable IT infrastructure
3. Proper migration of legacy data
4. Proper planning, strategy and management of the solutions
5. Integration of transport solution with various related and relevant systems
6. Behavioral changes in the working and awareness of digital solutions among relevant departments and citizens

Bus transport

Established under the State Transport Corporation Act 1950 on 1 October 1964, Rajasthan State Road Transport Corporation (RSRTC) is headquartered in Jaipur. RSRTC provides bus transport services through a network of 52 depots spread across 10 regions within the state. It is the largest provider of inter-city bus transportation to the citizens of the state. The Transport Department of the state is the governing body for RSRTC, with the Secretary of the Transport Department appointed as the Chairman of RSRTC. In 2008, Rajasthan Transport Department also started its city bus service (JCTSL), which is parented by RSRTC[22].

RSRTC overview



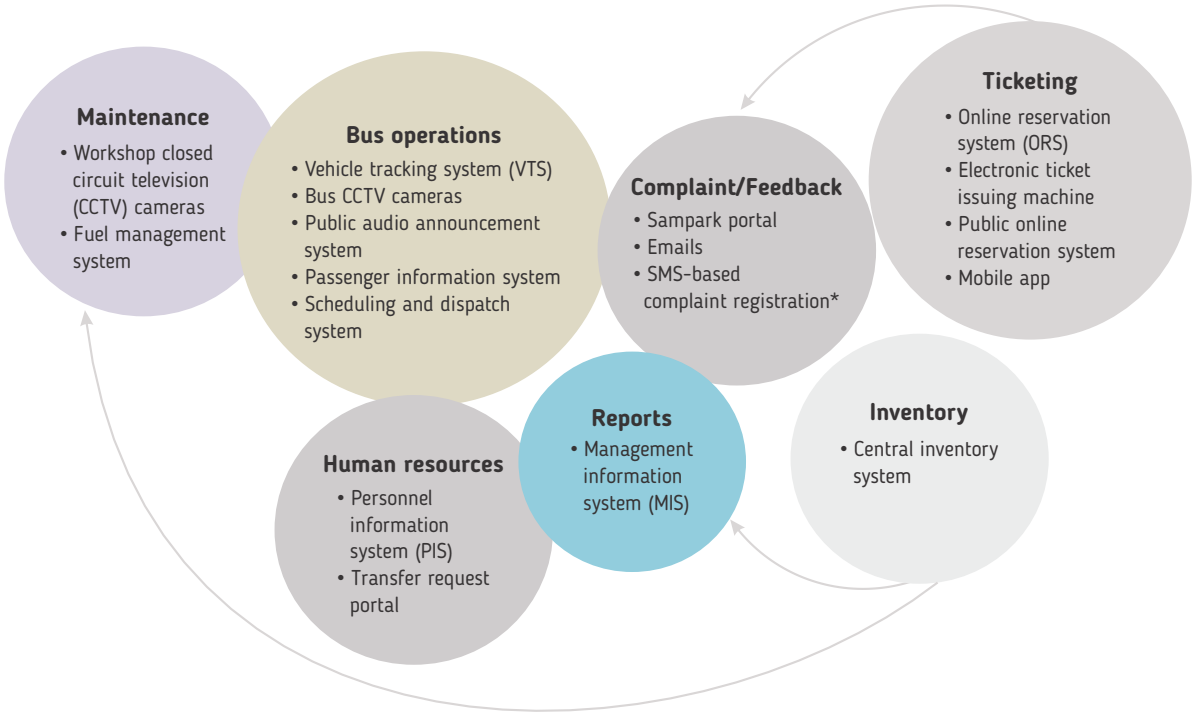


Some of the key growth drivers for progression are as follows:

1. Congestion on road
2. Providing commuters instant access to information
3. Increasing out-of-pocket expenses
4. Attracting public toward public transport
5. Need for effective and efficient monitoring system
6. Effective MIS system for management to see the trends
7. Increase revenue fare as well as non-fare
8. Improving staff productivity

[22]State Transport Undertakings – Profile & Performance 2013-14, CIRT Pune & Review of Performance of State Road Transport Undertakings FY2010-11, FY2011-12, FY2012-13, FY2013-14, FY2014-15, MoRTH
Annual Report of RSRTC for FY2010-11, FY2011-12, FY2012-13, FY2013-14, FY2014-15

Current systems in place are as illustrated below:



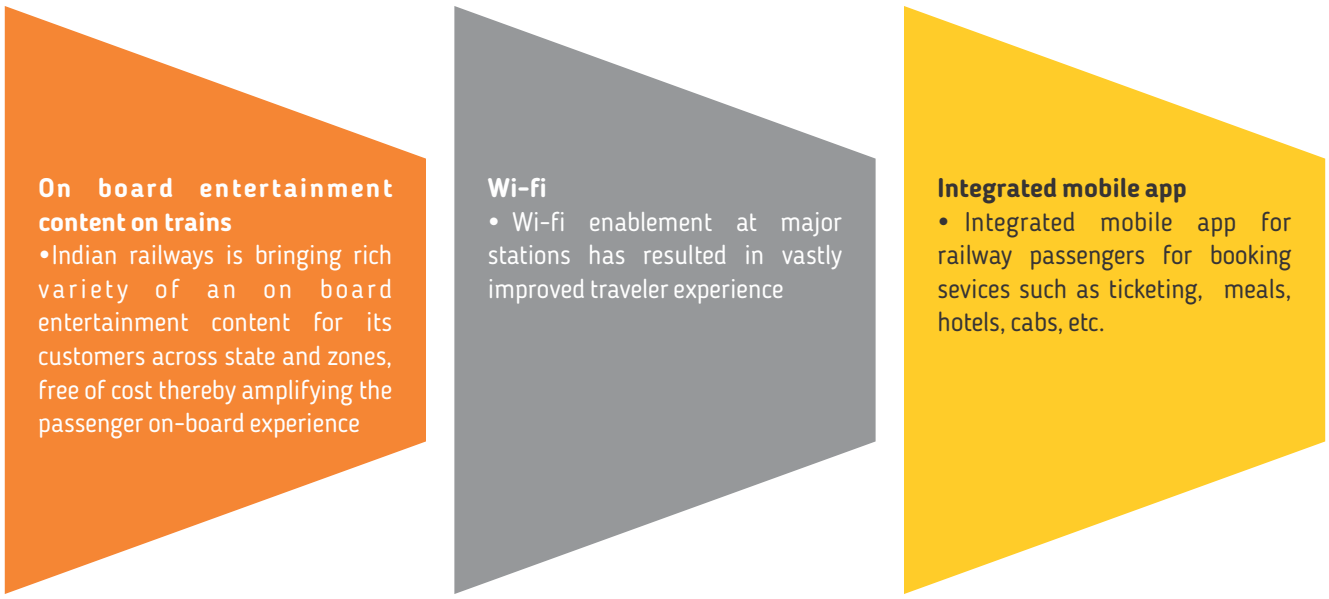
Some of the digital solutions that other states are readily adopting in bus transport domain are as follows:

1. Bus depot management system
2. Bus scheduling and route planning system
3. IntegratedMIS system
4. Grievance redressal system
5. File management system
6. Integrated ticketing system
7. Open loop smart card ticketing system
8. Vehicle tracking system

Railways

Since its inception, Indian Railways has been instrumental in the socio-economic development of regions by integrating various far-lying places in an energy-efficient and economical manner. Rajasthan, being a geo-strategically critical state, has been a major beneficiary of the infrastructural vision of connectivity for Railways. Being committed to the development of railway facilities in Rajasthan to accelerate growth has also been the focal priority of the Honorable Railway Minster, Mr. Suresh Prabhu, who recently listed down a list of overhaul plans for Rajasthan in a keynote. Rajasthan has one of the most extensive rail networks in the country, covering 5,551 route kilometers and 7,547 track kilometers. About 500 trains, inclusive of special trains such as the Palace on Wheels, which are famous for their grandeur across the globe, cover different sections of network every day. Good rail connectivity has also helped in enhancing the tourism revenue of the region. In addition, the share of the state in the railway budget has been increased by around 183%[23], increasing to INR1, 960 crore in the last two years from INR 682 crore in the previous year. Rajasthan also has three railway stations classified as "A" stations (Jaipur, Jodhpur and Ajmer), which have been identified by the Railways for a special overhaul. Some of the initiatives taken by the Railways and non-governmental organizations to change the landscape of the Railways are given as follows:

[23] cmapp.rajasthan.gov.in/cmapp/frontend/frontmediacoveragedetails/2492.html



Metro Rail

Metro Rail has been operational In Rajasthan in Jaipur since 2015, with 9 stations operational at present and plans for 22 more stations. Feeder buses are also planned to provide a connected and common mobility solution to commuters. Going with the trend in other city metros in India and globally, the following digital solutions can be considered for Jaipur Metro as well:

1. Open loop based smart card ticketing solution
   a. Usually, a smart card can be used for a single-purpose such as payment in metro or bus or utility payments, but an open loop EMV (Europay, MasterCard, and Visa) card is interoperable and can be used for multiple purposes such as metro ticket, parking payment, feeder bus ticket, utility payments and retail payments.Hence, it helps in furthering the agenda of common mobility and encourages the use of public transport by providing ease and convenience to commuters.
   b. From a transit operator's perspective, it helps save significant capital and operational costs involved in a ticketing system, and also helps in earning additional revenue in terms of royalty premium and non-fare revenue.
   c. It is especially helpful for metro rails under construction, which have funding constraints. Open loop ticketing is prevalent in London (Oyster Card), Hong Kong (Octopus Card) etc. Kochi Metro (KMRL) commenced operations in June 2017, introducing an open loop smart ticketing solution in the metro rail sector in India.

2. Non-fare revenue generation
   a. To reduce revenue deficits and cross-subsidize the fares, transit operators have started exploring non-fare opportunities. There are various revenue streams available for non-fare revenue generation.
   b. Traditional methods include advertisements and real estate development.
   C. Some of the recent digital revenue generation streams include providing multiple value added services through a single mobile application, digital advertisements, Wi-Fi monetization and data monetization.

Aviation

India has 464 airports and airstrips[24]. Rajasthan has one international and five functional domestic airports. Ajmer airport is yet to be functional and Neemrana Airport is proposed. The appetite for travel is increasing in India due to demographic development and push schemes such as UDAN (UdeDeshkaAamNaagrik), which aims at affordable flying for people who want to travel to tier 2 and 3 cities, and the Open Sky Policy, which aims at liberalization of the aviation sector.

[24] http://www.aai.aero/allAirports/udaipur_technicalinfo.jsp

Digital disruption in the travel ecosystem can be seen across the entire value chain in the form of ticket searches through metadata search, booking tickets through Open Travel Alliance (OTA), web check-in facilities, inflight experiences, etc. Some of these trends are shown in the illustration below.

Segments	Solutions	Enablers	Implementations
Airport Process Optimization	Real time asset management, intelligent preventive maintenance, predictive analysis and data-based asset management, real-time energy & utilities management	BIM, data-based asset management, GIS, AODB, collaborative decision Making (CDM)	Integrated Analytics across assets: Changi Airport Singapore
Passenger Flow Improvements	Mobile / NFC Boarding, Self-check-in, baggage drop, self -boarding, automated security check points	RFID baggage tagging, facial/ Biometric recognition technology	Biometric- Facial Recognition Based Entry: Aruba Happy Flow
Safety and Security	Digital technologies such as Biometrics, facial recognition, crowd analytics and video monitoring are implemented at various airports across the globe.	Facial Recognition, Crowd analytics, Video monitoring	Video Analytics, Biometrics entry: Dubai airport
Customer Engagement	Mobile self service solutions, Location awareness navigation at the airport, retail promotion/loyalty offers, Intelligent interactive displays, Bluetooth proximity marketing	Interactive Displays, Beacon technology, airport specific mobile apps, CRM systems	Mobile App: Incheon Seoul airport app

Key opportunities for the government and way forward

While the digital transformation of the transport sector in Rajasthan is already underway, some steps that can further this transformation are enumerated below:

1. Collaborating with other government departments: Digital information access and collaboration can help the transport sector. And therefore, government authorities should help in bringing together transport and other govt. agencies together to carry forward the agenda,e.g. multi-modal ticketing.
2. Ensuring data security and privacy: Passenger data should be handled and secured in the best possible manner. Regulations on data privacy and storage need to be formulated and enforced across all transport agencies to ensure that data remains safe and the passengers continue having faith in digital solutions.
3. Adopting design thinking for improving service delivery: In the transport sector, especially in a culturally strong state such as Rajasthan, it is important to use ethnographic research, feedback from passengers and tools to create a picture of what passengers really value, and radically re-think services and interfaces to imagine a simpler, better and seamless service delivery.
4. Planning and defining transformation vision for the department: It is advantageous to have a dedicated IT cell and panel of advisors from the industry to define the technology vision and plan the digital transformation for any sector
5. Developing infrastructure and skills to adopt the transformation: Successful implementation of digital solutions requires corresponding provision of a scalable and cost effective technology infrastructure. The KPIs should be defined for each such digital solution and staff should be monitored to ensure that the digital solution is being used to meet those KPIs.
6. Enhancing passenger journey experience: Transport agencies across the state can adopt digital solutions to enhance customer experience for example, online bookings, information visibility through passenger information systems, and integration with e-wallets and online payment systems.

7. Generating awareness of existing online services: Rajasthan transport departments have been pioneers in the country in adopting digital solutions, be it e-ticketing for RSRTC buses or applying for driving license online through the Sarathi portal. Creating awareness among the citizens on such digital solutions is critical to achieve the outcomes.
8. Facilitating change management: Change management is an extremely important component of the successful implementation of smart transport projects.

5. Tax and public finance

Tax and public finance provides the fuel (finance through tax collections) as well as the steering control (accounting) for the massive vehicle, i.e., the government administrative machinery. Technology has been a major lever in driving various initiatives in this space around the globe. In India, too, the sector has seen the rollout of various e-governance initiatives, from the erstwhile mission mode projects under the National e-Governance Plan (NEGP) such as the Commercial Taxes program and the Treasury Computerization Project to the recent rollout of the ambitious Goods and Services Tax (GST) platform.

Current scenario

The GST platform rolled out by the Goods & Service Tax Network (GSTN) is undoubtedly the largest current initiative in the sector in India. Over75 lakh[25] taxpayers from the subsumed taxes are expected migrate to the GST by August 2017. Over 45 lakh[26] taxpayers had already completely migrated and nearly 12 lakh[27] new taxpayers had registered by the first week of August since the system was rolled out on 25 June 2017. Rajasthan, too, has migrated over 5 lakh[28] taxpayers from VAT and added over 60,000[29] new taxpayers. The system will allow for invoice level data capture and online reconciliation of input tax credit to provide complete transparency to the entire tax ecosystem.

Analytics adoption is also increasing across tax administrations in India, with the Income Tax Department adopting analytics solution and various state commercial tax departments, including that of Rajasthan, investing in the creation of Electronic Intelligence Units (EIU) with analytics and cyber-forensic capabilities. Various treasuries and finance departments across state and Central government too have adopted technology to ensure optimal use of allocated funds, to perform budgeting and to keep a track of expenditures and receipts.

Growth drivers

Technology will continue to be a key growth driver for the sector, and the adoption of emerging technologies will usher the next era for tax and public finance. The table below lists some of the possible early benefits from the new technologies:

Technology		Benefits
Advance analytics		• Targeting high-risk networks • Using predictive analytics for audit case selection and processing refunds • Improving debt recovery with behavioral analytics • Identifying trade patterns of the cash economy
RPA		• Using virtual agents to provide faster customer service • Automating the mundane tasks for tax and public finance authorities, such as issue of notices and reminders to defaulters
Design thinking		• Providing mobility-based solutions for taxpayers • Providing a 360-degree view to taxpayers, tax or public finance officers • Personalizing customer services
Blockchain		• Managing budgeted and allocated funds across different departments of the government • Creating a tax ledger for taxpayers

[25] http://www.livemint.com/Industry/dB7O9EuvPmvZ62CBBwKMmJ/Number-of-taxpayers-under-GST-set-to-eclipse-that-under-prev.html
[26] http://profit.ndtv.com/news/economy/article-over-12-lakh-businesses-applied-for-new-gst-registration-1730847
[27] http://profit.ndtv.com/news/economy/article-over-12-lakh-businesses-applied-for-new-gst-registration-1730847
[28] http://rajtax.gov.in/vatweb/Acts/actsMain.jsp?viewPageNo=34
[29] http://rajtax.gov.in/vatweb/Acts/actsMain.jsp?viewPageNo=34

Marquee case studies

The following are some of the leading practices of technology adoption and business practices adopted by revenue and public finance agencies across the world:

Big data analytics

Implemented at: Various agencies in Australia, Canada, Europe, India, Singapore and the UK

Filing and payment compliance

- Blended predictive modeling and controlled experimentation are used to identify cases that are likely to fail to meet payment or filing obligations. Also, interventions that are likely to remedy the problem are suggested.

Audit case selection

- Analytical models are used to identify fraudulent or non-complaint claims.
- Social network analysis is carried out to detect carousel fraud.

Policy

- Various analytics applications are used for tax gap measurement, forecasting the impact of financial policy change etc.
- Visual analytics and simulation methods are used to explore the impact of policy change.

Debt management / recovery

- A mix of predictive modeling and experimental techniques is applied to identify cases that should be subject to intervention, as well as the specific interventions that should be carried out.
- Predictive analytics is used to identify taxpayers found to be a payment risk.

Taxpayer service

- Taxpayer segmentation is done to identify and serve the needs of different types of individuals using techniques such as:
  - Cluster analytics to identify taxpayers who are similar to each other
  - Analysis of emails, complaints, suggestions etc. across customer interactions to identify key issues affecting the taxpayers or to identify common trends to find out demography-specific issues

Fluid workforce

Implemented at: Dutch Revenue Agency

- Traditionally, tax authorities deploy their workforce into geographic or function specific units.
- A '"fluid workforce" allows for a dynamic allocation of the taxpayer workforce to ensure optimal utilization of the manpower available to the leadership.
- This is possible through the capture of KPIs through detailed dashboards and all-round capacity building of the workforce.

Refund claim filtering and electronic fund transfer

Implemented at: Various agencies in Australia, Europe, Ireland, India and the UK

- Ease of doing business is facilitated by faster disbursement of refund claims.
- Electronic disbursements result in reduced overheads for the public finance administration.

Mobile apps and Application program interfaces (APIs)

Implemented at: Various tax agencies in Australia, Canada, Europe, Singapore, the UK and the US

- Taxpayer and revenue / public finance officer convenience
  - Mobile apps provide greater connectivity for taxpayers by providing a convenient channel for interacting with the tax administration.
  - Officers have easily accessible dashboards to aid decision making.
- Increased participation of intermediaries
  - APIs provide a platform through which intermediaries can directly communicate with the tax administration, driving tax compliance.
- Enhanced intelligence
- Apps are used to seek information from consumers regarding incidents of non-compliance, fraud, incorrect invoicing, feedback on policy etc.

Key opportunities for the government and way forward

Public finance institutions are expected to continue leaning on technology to facilitate astute financial planning and better utilization of the budgeted funds through simulated scenarios and close control/monitoring aided by customized dashboards. In the tax domain, pre-filled tax returns, design thinking, wider use of mobility and extensive use of emerging and conventional technologies by revenue agencies are expected to simplify the overall taxpayer experience, making taxation seem like a regular occurrence than the unwanted intrusion it is widely considered to be today.

6. Agriculture

Agriculture is a data-intensive enterprise. Variability factors specific to soil, weather, crop variety and crop stage play a pivotal role in determining the timing of key operations such as planting, input management and harvesting, thereby influencing crop productivity. Its value chain is complex with several actors along the chain; therefore, information symmetry plays a vital role between the farmer and intermediaries in strengthening the coordination within the chain and increasing profitability. These two-way information networks and large domain-specific data models when driven by technology systems can facilitate informed on-farm efficiency and influence policy decisions.

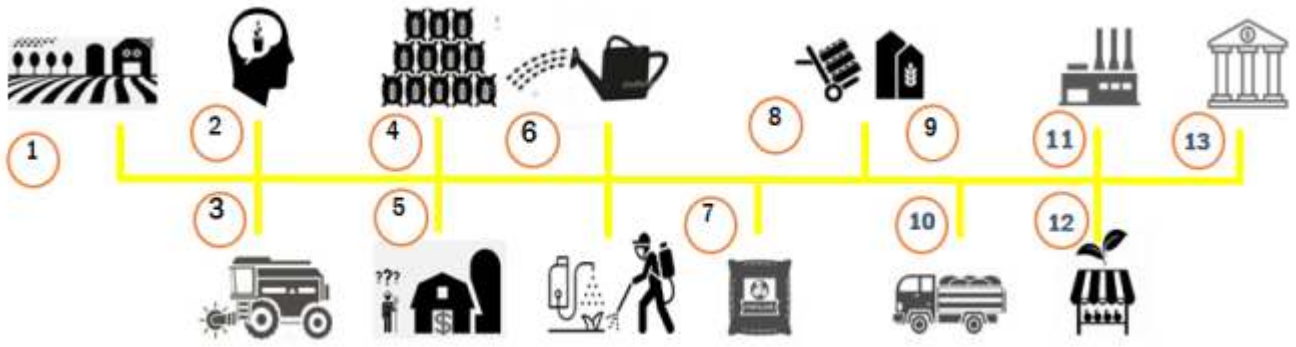
The application of technology in agriculture has paved the way for making farming sustainable economically, environmentally and socially. It includes:

Combining rich and dynamic data ecosystems coupled with ICT to provide timely and targeted information and services to all the stakeholders in the agricultural value chain. Technology systems utilizing advanced crop and environment models such as big data analysis, remote sensing and unmanned aerial vehicles influence farm-specific decision making, i.e., precision farming, thereby increasing water-use efficiency.

1. Communication tools such as smart phones, community radios and call centers enable extension services to maximize profitability and minimize risks two critical variables in farming.
2. Digital infrastructure, connectivity, low-cost data and hardware are essential for creating an inclusive platform to support rural farming communities and reaching the mofussil.
3. Backbone platforms such as Unique Identification (UID), supported by schemes such as DBT, would contribute to government policies percolating at the grass-root level.

Within the mandate of Digital India, there is immense scope for digital agriculture. Technology has the power to help close the gap between our agriculture potential and productivity. Optimizing the decision-making process in agriculture will not only help preserve the environment, but also stimulate economic growth and benefit the farmers' quality of life. As technology makes way for a more connected world, the connection of people, places and perspectives becomes even more paramount.

Current Scenario



S.No.	Stage	Key Issues	Existing support systems	Technology interventions
1	Raw Farm	Lack of knowledge on: • health of farm • soil composition advisory based on findings	Soil health card, soil health app, digital seva and common service centers	• Real-time, digitized information on soil health • Relevant analytics-based advisory on the soil and crops suitable
2	Crop Planning	• Lack of knowledge on 'suitable' crops for given weather and soil • Insufficient market information	Crop advisory through television with shows like Krishi Sahayak, KCC and mobile apps like Kisan Suvidha, m-Kisan, Shetkari Masik, etc.	• Integrated crop advisory based on real time weather and soil data, using sensors and automatic weather stations. • Advisory in local language with 'user' friendly interface. • Analytics on location specific crops and market rate projections.
3	Farm input machinery	• Lack of knowledge on modern farming tools and vendor information. • High costs of farm machinery.	Kisan Suvidha App: functionality to display list of existing service providers with address and contact Custom Hiring Centers- farmers can list their farm machinery for rent based model for small farmers	• An ICT tool to capture and handle the existing farm machineries in a cluster and the requests for renting by small farmers could create a local ecosystem where expensive machinery could be affordable by small farmers. • EM3: bringing tech & mechanization for the farming community on a pay-for-use basis.
4	Crop insurance	• Insufficient real-time data on village level crop growth progress.	Pradhan Mantri Fasal Bima Yojana (PMFBY), an online platform for filing application	• The service to file an online application for crop insurance is provided by CSCs at the village level. Policy makers to obtain a real time view of crop progress in fields, so that support systems could be deployed well in time.
5	Seed bank	• Non-availability of quality seeds and information on seed vendors. • High cost of seeds.	Kisan Suvidha App: functionality to display list of existing service providers and their contacts.	• The functionality on an e-platform for the seed procurer to contact seed suppliers. With map view of distance between vendors, contact information, traceability and accountability. The vendors could upload their products and their updated quantity.
6	Irrigation	• Lack of information on water table and rain fall. • Lack of rain water harvesting.	Jalyukt Shivar, Krishi Sinchai Yojna, GIS mapping of water assets by WRD, GoM, etc.	• The functionality on an e-platform for the farmer to contact irrigation systems providers. Information around weather, crop requirements advisory for farmers. Policy makers a view of water table and rain water harvesting structures etc.
7, 8	Pesticides and fertilizers	• Lack of Information on crop-specific pests and pesticides. • Lack of information on fertilizer vendors.	Kisan Suvidha: List of dealers, KCC and m-Kisan push messages (SMS).	• The functionality on an e-platform for the farmer to contact Vendors. With map view of distance between vendors, contact information, traceability and accountability. The vendors could upload their products and their updated quantity. Two-way information around potential crop specific pests, warning system and advisory for farmers.

S.No.	Stage	Key Issues	Existing support systems	Technology interventions
9	Packaging and storage	Lack of Information on storage centers.	72 Warehousing Development and Regulatory Authority (WDRA) registered warehouses in PoCRA districts.	• e-platform with map view of distance between warehouses, contact information, traceability and accountability. The warehouse vendors could upload the updated quantity of their storage.
10	Logistics	No organized logistic services are available.	Unorganized information on vendors.	• e-platform with map view of distance between transport vehicle, contact information, traceability and accountability. The logistic service providers could upload their availability
11	Food processing industries/units	• Lack of information on price and location of food processing units. • Lack of organized information of farmer's produce for FPIs.	Dominated by private players.	• e-platform with functionality of 2-way information sharing - map view of distance between food processors, crop-specific farmers, contact information etc. An online farmer's database with crop grown and contact and requirements of food processors could enable communication between them.
12	Trading markets	• Low bargaining capability of individual farmers. • Small produce, shelf-life factor and logistics costs • No organized farmer's network for aggregation of produce.	• Kisan Suvidha providing: nearest market and commodity prices date wise. • IFFCO Kisan – farmer registration.	• Online aggregator based platform for trading, grading wise with accountability and traceability.
13	Banks/Agri-banks	Lack of documents and knowledge on financial products.	Government schemes, district level branches of agri-banks, BC, IFFCO, etc.	Information through SMS, online applications etc. of bank loan schemes, enables by secure identity platforms.

Solutions

The use of ICT tools, smart data management and farm management systems has shown great promise in overcoming the challenges faced by farmers globally. The key components to support the implementation of digital agriculture are Spatial (and Temporal) Data Infrastructure (SDI), smart phones/ devices and sensing equipment to support the bi-directional flow of data and information to consumers. Some of the key technology solutions available for agriculture can be categorized as below

1. Knowledge dissemination through ICT tools: Farmers can be empowered with knowledge and critical information at various stages of cultivation with an objective to enhance productivity and quality of produce, successively increasing their incomes. The key domains of customized information available to farmers are customized technical know-how on cultivation, agri-inputs and crop management, smart maps and agro-meteorology based data and interpreted advice.
2. Precision farming: Precision farming is a sophisticated management strategy based on observing and responding to intra-field variations to optimize returns on inputs while preserving natural resources[30]. Precision or smart farming enables farmers to utilize technologies to better understand their farms and requirements so as to undertake informed farming decisions. Some of the technologies/equipment used for precision farming are wireless sensor networks, digital soil maps, nutrient and moisture management, field monitoring through drones/ satellites etc., Geographic Information System (GIS) and global positioning system (GPS) etc.
3. E-marketplace/agri-business portal: Agri-business portal is a holistic value chain enablement concept that brings together all the stakeholders in the value chain on a unified digital platform. This enables direct trade (minimizing intermediaries), increases accessibility of agri-inputs, especially farm machinery to small and marginal farmers, and also brings in operational efficiency in the system.

[30]FAO - http://www.fao.org/docrep/018/i3325e/i3325e04.pdf (Accessed on 28 December 2016)

Growth drivers

Some critical factors that will enhance the growth of this sector are:

1. Penetration of mobile network and smart phones.
2. Evolution of efficient and reasonably priced technology.
3. Information dissemination and agri-business management tools catering to crop growth management, harvest, market prices and logistics.
4. Government efforts toward resource-use efficiency, especially water and doubling farmer income.
5. Rising consumer incomes and inclination toward food quality.
6. Export requirements.

Key opportunities for the government and way forward

The agriculture sector requires technology interventions in various areas such as: for the creation of market linkages from farm to buyer, market demand assessment, Agricultural Produce Market Committee (APMCs), Follow On Public Offers (FPOs), etc. Creation of integrated e-Agriculture platform, value chain analysis and creation of base line data base from disintegrated data sources. State governments should urge technology partners to integrate their knowledge assets for dissemination of accurate location based agriculture advisory, consolidation of agri-service providers and new market segment creation.

Section 2: Accelerating the digital transition: emerging trends

"We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before." - World Economic Forum, 2016

Social media is fueling the digital revolution and transforming the customer landscape. Mobile has become the device of choice for sharing, communicating and transacting. Analytics has becoming a strategic focus area in a dynamic business environment. Cloud has evolved from a cost-reduction initiative to a key enabler of digital transformation. The Internet of Everything (IoE) is becoming pervasive with the mainstream adoption of IoT devices and solutions. Increased demand for cybersecurity solutions calls for converged security solutions and market consolidation[31].

The last few years have seen a significant transformation in the ways government departments are managing digital and information technologies. The exponential growth in digitization and internet connectivity is the backbone of the Fourth Industrial Revolution. Cutting-edge technologies such as Social Media, Mobility, Analytics, and Cloud (SMAC) are disrupting multiple sectors such as e-commerce, content creation and dissemination, e-gov services and retail. Spending on SMAC by Indian IT enterprises and the Government is expected to reach US$10 billion by 2020, growing at 24% annually[32]. Blockchain, artificial intelligence, machine learning and robotic process automation are changing and disrupting the private and public sectors and challenging governments to re-examine the way they fundamentally operate. These technologies have the potential to propel societies forward, enable innovative business models and help governments address legitimate policy concerns. Governments are now more than ever in the need to embrace and integrate digital technologies into their processes and service delivery. In this section, we will examine the emerging technologies and their relevance and adoption in the public sector.

1. Cyber security

Organizations need to understand that cyber-attacks are a matter of "when" and not "if." The number of attacks is doubling every two years, and cybercriminals are becoming increasingly persistent and sophisticated in their activities. The stakes are becoming much higher, too. As governments become more aware of the existing risks, they will bring in legislation and demand that

[31] EY Analysis, January 2016 – Further details in Appendix
[32] "SMAC spending to touch $10 bn by 2020: Core Quandran," Financial Express, accessed 14 September 2016

organizations become more secure. Meanwhile the situation is getting more complex with the IoTchanging the game completely. For example, cybercriminals are launching coordinated attacks that hijack objects such as Wi-Fi routers, closed-circuit television (CCTV) cameras and other digital infrastructure. All of this means that governments must embark on a cybersecurity transformation to protect itself now and in the future to be successful.

Need

A rapid increase in the number of cyber-attacks correlates to rising damage (financial and trust) to companies, governments and individuals. This situation demands stricter and rapid response. Kaspersky Labs found that India was among the worst hit nations by the WannaCry ransomware. According to Quick Heal India, over 48,000 systems were found infected in the country[33].

Reports of these attacks came from West Bengal, where the State Electricity Distribution Company's computers at its office in West Midnapore district were affected, as also panchayat offices in Kerala's Wayanad district. Some affected sectors in India are government, automobile, banking and finance, retail and manufacturing.

Impact

Cyber criminals today are more sophisticated than before. More than just stealing personal information of individuals or targeting financial organizations, we are seeing cyber criminals trying to gain access to government and public sector systems, which pose a significant threat to national security. Securing critical infrastructure is a key component of national security, stability and economic growth. It also determines the functioning of societies and individuals. In recent years, it has become even more vital to ensure its safety. Cyber threats are becoming a growing concern for Critical Infrastructure operators due to the reliance on technology solutions, and the potential impact and disruptions they can bring to an entire nation

*The cost of cyber-attacks in India in 2016 is estimated to be in excess of US$4 billion (INR25,000 crore). It is important to keep in mind that there are attacks that go undetected and unreported, so the number could be much higher.

Current scenario

Technology is a critical component in businesses and governments today. But there is an increase in cybercrime which needs to be addressed. From the hacker or cyber criminal's point of view, the risks are limited and the potential rewards highturning to digital crime is an easy calculation.

The best-prepared businesses now recognize that responsibility for deflecting cyber-attacks is no longer just the responsibility of their IT departments; it is an enterprise-wide boardroom issue. The only sure way to counter the threat is with an approach that roots the organization's cybersecurity strategy in the real world of its business strategy.

Decision makers understand the relationship between your responsibility, the scale of cyber threat, and a suggested approach that's sharply focused on your business structure, culture and risks.

- **Increasing cyber risk:**The growing complexity and speed of cybersecurity risks, what they mean to the organization and the response gap.
- **Board responsibility:**The current state of C-level engagement in cybersecurity, and the challenges of integrating risk management into strategic planning.
- **Potential solutions:** The advantages of adopting a holistic cyber program management approach to information security, based on meaningful analytics.

A sharp focus on business structure, culture and risks will enable safeguardingentities essential data. For many, this requires a fundamental transformation in how information security is understood within the business. Creating a security program around intelligence on threats and also business risks will support resilience in a constantly shifting landscape of risk.

[33]http://economictimes.indiatimes.com/tech/internet/india-third-worst-hit-nation-by-ransomware-wannacry-over-40000-computers-affected/articleshow/58707260.cms

Benefits

The advantages of a multi-tiered approach that ties security management to business performance:

- Improved alignment to business objectives
- Enhanced readiness, scalability and flexibility
- Global cross-standard application
- Rigorous risk identification and managementcycle
- Foresee emerging challenges

Growth drivers

According to International Data Corporation (IDC), the most prevalent areas for growth in security industry are security analytics/SIEM (10%), threat intelligence (more than 10%), mobile security (18%), and cloud security (50%). According to a report from Markets and Markets, the cloud security market is expected to be worth US$8.7 billion by 2019.

Recent MoUs and Government initiatives:

1. India and the US have signed MoU for close cooperation and exchange of information pertaining to cyber security (12 January 2017).[34]
2. India and Spain have signed MoU for cooperation in Cyber Security (3 June 2017).[35]
3. Through Indian Computer Emergency Response Team (CERT-In) and Bangladesh Government Computer Incident Response Team (BGD e-Gov CIRT) have signed MoU for cooperation in cyber security.[36]
4. The Government through CERT-in has launched "Cyber Swachhta Kendra" a desktop and mobile security solution for a secure cyberspace in the country.[37]
5. As part of its Digital India initiative, the National Critical Information Infrastructure Protection Centre (NCIIPC) recently released 40 tenets to improve cybersecurity in organizations essential to the economy, health and defense of India.[38]
6. The National Association of Software and Services Companies (NASSCOM) Data Security Council of India (DSCI) launched a report Growing Cyber Security Industry, Roadmap for India. The report defines a roadmap for the next 10 years to grow the cybersecurity market in India.[39]
    a. NASSCOM envisages that the Indian IT industry will grow to a size of US$350 billionUS$400 billion by 2025.[40]
    b. With the aim of making India a global cyber security hub, 16 initiatives have been formulated by NASSCOM-DSCI alongside a Cyber Security Task Force (CSTF) initiative to give shape to the Honorable Prime Minister's vision of Digital India. The CSTF aims at growing the Indian cyber security products and services industry to US$5 billion, creating 1 million cyber security jobs and 1,000 cyber security start-ups by 2025.[41]

Marquee case studies

The following recent events in the cyber security space have been striking:

1. The Petya (28 June 2017) cyber-attack affected the Dutch firm AP Moller-Maersk, causing at least one terminal in Mumbai's Jawaharlal Nehru Port Trust to go out of action.

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[34] pmindia.gov.in
[35] pradhanmantriagreement.in
[36] pradhanmantriagreement.in
[37] cyberswachhtakendra.gov.in (Cert-In)
[38] digitalterminal.in
[39] http://www.livemint.com/Industry/g5z1oULU74Myba12iqhrFP/Nasscom-unveils-10year-cybersecurity-roadmap-for-India.html
[40] http://www.livemint.com/Industry/g5z1oULU74Myba12iqhrFP/Nasscom-unveils-10year-cybersecurity-roadmap-for-India.html
[41] http://www.livemint.com/Industry/g5z1oULU74Myba12iqhrFP/Nasscom-unveils-10year-cybersecurity-roadmap-for-India.html

2. Rufus (14 June 2017) involved the use of Chinese malware to clean out cash machines running the outdated Windows XP software across states.
3. WannaCryptor WannaCryransomware (12 May 2017), impacted 200,000 computers across 150 countries, infecting hospitals, businesses, rail stations, universities, at least one national telco, and more organizations.

Key opportunities for the government and way forward

With the growing threat of the potentially disastrous impacts of cyber-attacks on international stability, there is an urgent need to protect and secure the governable cyberspace. This means taking steps to bring individuals and groups perpetrating such acts into account. Several governments around the world have already begun taking independent steps to enhance their own cybersecurity. India, too, is progressing at a very rapid pace, and the Government has taken into consideration various measures to speed-up this process by formulating new reforms. The only way this progress can be ensured is by ensuring that cybersecurity finds its way into the boardroom agenda.

Future trends in Government:

- With the number of connected devices estimated to exceed 50 billion by the year 2020, the Internet of Things (IoT) holds a major stake in the evolution that will end up affecting every individual and every business.
- Advance Security operation centres' (SOC), OT Security, Big Data Analytics, Cyber Modelling and Simulation, Greater connectivity, more embedded systems and areas in which Governments are going to get aggressive.
- Government's s need to invest not only in the right security technologies but in better understanding their ecosystem and working with trusted partners to further protect that ecosystem together. A resilient cyber ecosystem is a valuable goal that can provide the organizations operating in it with an increased confidence in the security of their systems and data.
- Governments need to further increase the level of collaboration (rather than just monitoring) of their ecosystem, working more closely with industry, and other governments to combat the threats that face them all as a team.
- The cyber ecosystem requires collaboration requires more than words or written agreements scripted by legal and commercial teams. It requires a true commitment to cyber resilience and to enforcing the behavioural attributes of resilience leadership, partnership and change-readiness. Most of all, it requires the unwavering commitment of individuals and leaders.

2. Blockchain

Blockchain, the most common distributed ledger technology (DLT), has the potential to revolutionize transactions across sectors in the government domain. It was first used within Bitcoin, which is a type of cryptocurrency that enables secure transactions in an anonymous and decentralized manner.

Blockchain is a distributed decentralized database technology that administers a growing list of transactions, interactions and data records without a centralized oversight. It is a digital ledger of transactions shared among a distributed network of participant computers that can manipulate the ledger securely without the need for a central authority. It consists of blocks holding time-stamped sets of validated transactions and hashes, linked the blocks together into a chain. Based on the permissions to access the ledger and verify transactions, it can either be public or private.

A key benefit of using a blockchain is complete record integrity, security and transparency, and increased efficiency. The system's non-repudiation capability can benefit in fraud and dispute resolution cases.

Current scenario

In India, banks and financial services organizations are keen on using blockchain in various existing practices and solutions. Preliminary experiments for specific use-cases are already in progress with Indian private sector banks exploring their options with FinTech firms to tap the technology in banking. In February 2017, the largest government-owned bank in India, State Bank of India (SBI), announced "Bank Chain," a financial consortium that includes public- and private-sector banks developing

blockchain solutions with technology companies such as IBM and Microsoft.[42]

Furthermore, the Reserve Bank of India has initiated testing of blockchain for trade applications in collaboration with MonetaGo, domestic banks and other financial institutions.[43]

The Central and state governments in India also intend to adopt the technology despite initial reservations[44]. The Central Government is deliberating on legalizing Bitcoins[45], while the Karnataka, Gujarat and Maharashtra state governments have started assessing the application of the technology in e-governance. The Andhra Pradesh government has launched pilots for implementation of blockchain in civil supplies and land records departments[46]. It will be the first in Asia to launch the Block Chain Technology Institute on December 2017.[47] The Telangana state government has also initiated a pilot program in parts of Hyderabad using blockchain technology for land registration and integrating with the state revenue department in association with the Centre for Development of Advanced Computing (C-DAC).[48]

Growth drivers

A mindset shift from reliance on a single point of accountability toward wider industry collaboration is a key enabler for blockchain. The following factors will also aid the growth of blockchain:

1. Large corporations and governments can serve as catalysts of trust and desire to try out blockchain, thus promoting trust and confidence in the technology by other enterprises and common public.
2. Blockchain can become an integral part of IoT. Blockchain-powered devices can spread the adoption throughout the IoT ecosystem as the number of connected devices continues to grow.
3. Clear definition of regulations by the Government for blockchain can drive its adoption.
4. A rich ecosystem with a wide range of easily available, off-the-shelf, plug-and-play technologies from industry vendors will diminish the industry innovation barriers.
5. Lack of alternatives, mobile phone access and a marginal cost advantage over traditional systems can boost the adoption of blockchain, especially in emerging countries.

Marquee case studies

The following are some recent examples of successful blockchain implementation across the globe:

1. Assigning digital identity to citizens using blockchain while providing permissioned access to enable services: Government of Estonia, US Homeland Security and Australia Post
2. Maintaining electronic health records on blockchain: U.S. Food and Drug Administration (FDA) and Government of Dubai
3. Processing of property registration and verification on blockchain: Government of Sweden, Republic of Honduras, Republic of Georgia, Chicago's Cook County, Government of Dubai and Government of Ghana
4. Digital voting using blockchain and cryptography: Government of Estonia, National Settlement Depository, Abu Dhabi Stock Exchange, Liberal Alliance (Danish Political party)
5. Sharing and analysis of data within departments and with other governments using blockchain: Government of Russia, Government of Dubai, US state of Delaware

[42]http://economictimes.indiatimes.com/markets/stocks/news/sbi-takes-lead-in-blockchain-to-use-it-to-prevent-fraud/articleshow/57178212.cms
[43]http://www.indiabitcoin.com/indian-central-bank-research-institute-completes-blockchain-test/
[ht]tp://www.idrbt.ac.in/assets/publications/Best%20Practices/BCT.pdf
[44]https://www.forbes.com/sites/sindhujabalaji/2017/06/21/bitcoin-india-regulation/#569d7bf97e4a
[45]http://www.indiabitcoin.com/indian-government-to-make-bitcoin-legality-decision/
[46]http://cio.economictimes.indiatimes.com/news/strategy-and-management/blockchain-tech-is-joining-e-gov-dots-in-ap-telangana/59331436
[47]http://timesofindia.indiatimes.com/city/visakhapatnam/AP-govt-plans-blockchain-tech-institute-in-port-city/articleshow/55298937.cms
https://telanganatoday.com/cm-to-inaugurate-block-chain-technology-institute-on-dec-17
[48]http://cio.economictimes.indiatimes.com/news/strategy-and-management/blockchain-tech-is-joining-e-gov-dots-in-ap-telangana/59331436

Key opportunities for the government and way forward

Despite having a world-renowned technology industry, India has been wary of adopting new forms of digital currency and blockchain in comparison to other developing regions such as Africa. However, the overall focus on digital by the Central Government can act as a catalyst for implementation of blockchain.

The Government can deliberate on the use of blockchainin the following scenarios:

1. Transactions:
    a. Involving multiple levels of verifications and authentication such as birth and marriage certificates, academic records, business licenses and property titles
    b. Real-time transactions such as payments, payroll, reimbursements and claims
2. Registry systems for validation of signed documents
3. Identity verification in digital transactions
4. Contracts and records management and verifications such as property ownership and rights, and patents
5. IoT to aid a decentralized IoT

To harness blockchain in the above applications, the Government requires an open and transparent standards process that promotes interoperability, as well as compatibility between existing systems allowing technology to be deployed effectively.

3. Smart cities

Cities are critical for economic, geographic and administrative growth of a country and their prevalence in terms of opportunities as well as risks will only intensify in the coming decades. Between 2014 and 2050, the global urban population is set to increase by about 2.5 billion people. By the time this century reaches its halfway point, two-thirds of the world's 9 billion people will live in urban areas. But cities are at a tipping point due to large populations, scarce natural resources, demographic shifts and limited funds. Hence there is a need to find new solutions for cities to survive, adapt and grow. Technology will be crucial in finding solutions, with the global smart city market estimated to reach US$1.3 trillion by 2020[49].

But technology alone cannot solve the social, environmental and logistical issues that growing cities face. How well entrepreneurs, corporations and governments work together will determine how effectively cities can transform to build a better working urban world. For government and business to collaborate on smart, sustainable urban development solutions, the citizen must be at the center. Cities, after all, are for their citizens and cannot grow and thrive without them. Citizens should feel connected to their city through infrastructure and digital delivery, physical and social interaction, and emotional engagement.

Marquee Case Studies

Government of India's (GOI's) Smart City Mission and AMRUT (Atal Mission for Rejuvenation and Urban Transformation) are the two flagship schemes in the urban sector that support the creation of world-class urban environments in select cities to make them competitive, and the creation of basic infrastructure services in water supply, sanitation and transport in a larger set of cities and towns. These two initiatives complement the Swacch Bharat Mission and other schemes of the GoI.

The funding needs of these programs expand telescopically with the inclusion of more cities each year, and the multi-year implementation cycle of projects kick in. Unfortunately, the budget allocations have not kept apace this year. This move clearly signals the need for urban India to get more "smart" about the way it funds its infrastructure and service delivery.

Expectations among the digitally connected urban middle-class for sure have risen high. A whole spectrum of industries and technology players, including those from the developed world, are hugely excited about the new opportunity set. While the allocations may be disappointing to many across city leaders and private sector this may been seen as an opportunity to drive some serious change.

[49]Source - http://www.ey.com/gl/en/industries/government---public-sector/ey-citizen-today-if-cities-are-getting-bigger-how-can-we-make-them-better

Building blocks for smart cities implementation

Some key smart city solutions that can be adopted by the governments are:

1. **Smart transport:** Smart transport infrastructure is a critical enabler for economic growth and competitiveness and should be the backbone of any effective smart city strategy.
2. **Smart metering and smart grid:** Smart metering and grid addresses the major strategic, operational and technical challenges in this area.
3. **Asset information and digital:** Digital information is transforming the built environment, providing substantial economic, social, safety and performance benefits. Infrastructure intelligence enables significant outcomes for citizens, transport, construction and infrastructure management organizations. This is done through better generation, collection, management and exploitation of information to support technology-enabled transformation.
4. **Emergency planning:** It enables cities to recover financially after disasters through insurance claims and disaster grant programs.

Key opportunities for the government and way forward

If effective outcomes for smart and resilient cities focus on citizens' well-being, collaborative solutions are critical for a prosperous future. In fact, smart cannot solve everything alone. Entrenched policies, rules and regulations, and existing relationships among government departments, across jurisdictions, and with the private sector and non-profit organizations are all significant factors in play. It is also telling that cities within the same country can face different urban development costs and experience vastly different productivity levels, indicating that policy and citizen interaction can certainly influence outcomes.

As a result, successful initiatives for smart and resilient cities are home-grown and developed across government, business and civil society. Cities need to consider a strategy to work across all stakeholder groups to drive the best outcomes for their residents. Government, business and entrepreneurs can work together to redefine connection to each other and to the city's infrastructure, for example to drive smart strategies for resilient growth.

In these collaborations, government, business and entrepreneurs each have several burning considerations. These different dimensions of smart and resilient cities focus on outcomes for residents, including their connection to their city. They cut across the physical, digital and community elements of the challenges facing cities today, and they provide a common playbook for investment and collaboration in the years to come.

4. IoT

IoT is a world where physical objects are seamlessly integrated into the information network, and where the physical objects can become active participants in business processes. These "smart objects" are made accessible over the internet through remote software services by querying and changing their state and any information associated with them, taking into account security and privacy issues.

IoT has become an important need today as data has become valuable and machines no longer need human intervention to operate. Data from parking sensors helps manage parking spaces in a smart city, while on the other hand a washing machine can invoke its warranty and request service for repair automatically. These types of applications not only enhance user experience of a product or service but also provide unique insight into how complex systems work by leveraging data and machine automation.

The benefits of IoT include the ability to control devices, monitor status, configure devices, update firmware and automate behavior through rule engines, stream and batch analytics of device data and triggering alerts. These benefits can be utilized in a variety of ways in business processes and applications. The impact of IoT is seen in almost all verticals, including manufacturing, smart cities, retail, metals and mining, telecommunications, automotive, healthcare and energy.

Internet-connected devices are expected to number 26 billion globally and around 2.7 billion in India by 2020. The total revenue generated from the IoT industry would be US$300 billion out of which the IoT industry in India is expected to create US$15 billion by 2020.[50]

Current scenario

The electronic system design and manufacturing (ESDM) industry is the largest and fastest growing manufacturing industry in the world. The worldwide ESDM industry was reported at US$1.75 trillion in 2009 and is expected to reach US$3.8 trillion by 2018. Despite accounting for only about 3.5% of the global electronics market, India is witnessing uninterrupted growth, with the ESDM industry in India being globally renowned for its consumption potential[51].

The Indian electronics market is estimated to reach US$400 billion by 2020.[52] Production is estimated to reach US$104 billion by the year 2020[53], creating a gap of US$296 billion in demand and production. Around 65% of the current demand for electronic products is met by imports.[54] The sector is expected to grow at a projected CAGR of 26% for the period 2014-20.[55] The Government has allowed 100% FDI in this area looking at this huge potential.[56] IoT equipment manufacturing is one of the key areas and is growing significantly.

Growth drivers

The Government has provided the following goals under its IoT Draft Policy[57] for the country:

1. Creation of an IoT industry in India with connected devices increasing to over 2.7 billion, revenues of US$15 billion and 5% to 6% global market share by 2020.
2. Capacity development for skills and technology for domestic and international markets.
3. Research and development for all the technologies that are part of IoT/ICT/Smart Cities/M2M.
4. Development of IoT products specific to Indian needs in the IoT/ICT/Smart Cities/M2M domains

In addition to this, there are multiple government programs such as Digital India and Make in India that have become key enablers of IoT in India.

Key opportunities for the government and way forward

Some of the key applications of IoT across various sectors are outlined below:

Index	Generic IoTUse Cases	Smart Cities	Metals and Mining	Healthcare	Energy
1	Asset Identification	Identification of Solid Waste Management (SWM) bins for pickup confirmation using UHF Radio Frequency Identification (RFID) tags	Unique identification of heavy machinery used in mining for utilization report using active RFID	Identification of patients and hospital assets using Wi-Fi tags	Unique identification of millions of smart metering devices
2	Asset Tracking	Tracking of municipal SWM trucks and public transport such as busses using GPS trackers	Tracking miners underground for their safety using Radio frequency (RF) triangulation and positioning, as well as tracking heavy machinery	Location tracking of patients and assets in hospitals for better utilization	Tracking of drive through vehicles with water meter reading collection systems

[50]http://www.gartner.com/newsroom/id/2636073
https://www.forbes.com/sites/louiscolumbus/2017/01/29/internet-of-things-market-to-reach-267b-by-2020/#3afd422e609b
[51]http://meity.gov.in/writereaddata/files/
[52]http://www.assocham.org/newsdetail.php?id=632709b
[53]http://www.assocham.org/newsdetail.php?id=632709b
[54]http://www.business-standard.com/article/economy-policy/65-per-cent-of-electronic-items-demand-met-by-imports-report-114011300761_1.html
[55]https://www.sequitur-consult.com/single-post/2017/05-Indian-Electronics-And-Semiconductor-Sector-A-Business-Guide
[56]http://meity.gov.in/writereaddata/files/FAQ_FDI_ESDM.pdf
[57]http://meity.gov.in/sites/upload_files/dit/files/Revised-Draft-IoT-Policy_0.pdf

	Generic IoTUse Cases	Smart Cities	Metals and Mining	Healthcare	Energy
3	Energy Management Systems	Smart energy , water and gas metering and applications such as prepaid metering	Automated energy audits for metal foundries	Automated energy audits for large hospitals	Advanced metering infrastructure and demand response programs
4	Performance Management Systems	City Key Performance Indicator (KPI) dashboard displaying data collected from various sources e.g., average traffic speed in congested areas	Remote performance and operations monitoring for furnaces to make sure that they are fully utilized and do not stop due to raw material shortage	Remote monitoring of patient health parameters such as blood pressure, heart rate, body temperature and blood oxygen by doctors	Remote performance and diagnostic monitoring of solar plants to maintain optimal yield
5	Warehouse Management Systems	Asset management of geographically distributed assets of a municipal corporation or city on GIS maps with real-time status	Tracking of finished metal products in warehouse using on-metal RFID labels and intelligent shelves that send inventory status	Automatic detection of the expiry of unused stored medicines using intelligent labels	Real time inventory management systems for utilities
6	Supply Chain and Distribution Management Systems	Monitoring Municipal solid waste collection systems and intelligent routing based on real-time waste generation from intelligent bins	Tracking and monitoring radioactive materials , heavy metals and toxic materials during transit in supply and distribution channel	Dispatch of critical medicines automatically to remote government hospitals based on smart labels , automatic order placement and distribution truck integration	Monitoring distribution losses and theft of energy during distribution using energy audits via smart meters
7	Safety and Disaster Response	Getting water level status of flood sensors installed in city for quick response to flood disasters	Guidance and Evacuation system for mines in case of mine collapses	Remote tracking of vital parameters of patients in ambulance to prepare them before arrival at hospital	Intelligent electrical grid outage management systems
8	Environment Sensors	Getting air quality data from pole-mounted sensors from various points in the city to build air quality database for the city	Remote monitoring of gas sensors in mines to detect abnormal levels for safety of miners	Monitoring parameters of ICU environments through various sensors	Saving energy by integrating environment monitoring sensors with Heating, ventilation and air conditioning (HVAC) systems
9	Predictive Maintenance	Getting real-time status of street light poles in the city based on energy meter data such as voltage, current and power factor to trigger maintenance alerts	Predictive maintenance of drilling machinery based on vibration analysis of drill strings	Predictive maintenance of hospital equipment based on data collected from these equipment	Analyzing heat signature of transformers, surge arrestors in energy grids and substations using thermal cameras to trigger maintenance or replacement
10	IoT Based Big Data Analytics	Traffic detection sensors and cameras for solving complex city problems such as congestion based on big data analytics	Predicting yield of metal recovered from recyclables based on composition , source and other available data	Collecting data for mother and child after birth and storing on wearable devices and analyzing the data for a large population to find trends in diseases, growth patterns etc. during and after child birth	Estimating wind energy generation based on wind patterns data for multiple locations and predicting pricing models in energy markets based on generation and demand data

5. Cloud Technologies

"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." National Institute of Standards and Technology (NIST)

The Government and public sector organizations have complex, ageing ICT platforms nearing end of life, requiring costly upgrades and maintenance, and the local market for ICT skills is tightening. At the same time, the Government's budget is becoming increasingly constrained. The demands of this already challenged environment are growing as citizens' needs and desires change. Citizens and businesses are demanding anytime, anywhere transactions with the Government, a better, real-time understanding of government activities and spending, and increased participation in service delivery. The current ICT landscape is not capable of responding to these demands. The Indian government sector is generally lagging in the adoption of cloud technologies. This can be a bottleneck in the success of the Digital India campaign.

Need for cloud computing in e-governance

GoI is implementing cloud computing technology to expand its e-governance initiatives throughout the country. The focus of e-governance is to reduce corruption and guarantee that the government schemes are reaching the people living in rural areas of the country. Its initiatives ensure quicker service delivery and eliminate the involvement of middlemen, to decrease discrepancy through ulterior involvement. The Ministry of Electronics and Information Technology (MeitY) is working hard toward adopting cloud computing in governance and has made plans for the creation of IT-enabled services, applications and policies to achieve the full benefits in different government initiatives.

Benefits: Reducing cost by achieving cloud economics

Cloud services and its emergence is leading to a fundamental shifting of IT economics. Automation of manual maintenance tasks, pooling of IT resources and standardization are the biggest positives that we achieve from this technology along with elastic consumption, self-service and pay-as-you-go pricing which is facilitated by the usage of architectures based on the Cloud technology. Cloud allows core IT infrastructure to be brought into large centralized data centers that take advantage of significant economies of scale in three areas:

1. Supply-side savings: Large-scale data centers lower costs per server.
2. Demand-side aggregation: Aggregating demand for computing smoothens overall variability, allowing server utilization rates to increase.
3. Multi-tenancy efficiency: In a multi-tenant model, we increase the number of customers or users. With this, we achieve a lower cost for the application management and server, per customer or user.

Impact of cloud computing

- The flexibility provided by the cloud infrastructure can be leveraged by the Government to provide e-Governance services in a more time-efficient manner.
- One of the tenets of the cloud is ubiquitous access wherein services offered through the cloud can be accessed by general public from remote locations.
- Cloud should also be used to enable centralized storage of data across government bodies. Many current governance-related requirements revolve around sharing of information among governments; efficiency levels will increase with the use of the cloud for this sharing.
- Time for provisioning of the services / schemes on ICT infrastructure can be reduced drastically

Current application in e-governance

e-Pramaan: e-Pramaan is a national e-authentication service offered by MeitY. It provides a simple, convenient and secure way for the users to access government services via internet/mobile as well as for the Government to assess the authenticity of the users. It builds up confidence and trust in online transactions and encourages the use of the e-services as a channel for service delivery.

Marquee case study

A state government wanted to adopt the cloud approach for a data center project. The objective was to reduce the cost of IT while increasing the flexibility and efficiency of the data center, such that it would allow the IT team to kick-start projects quickly and in a scalable manner.

Through the Government cloud, the state government is offering infrastructure-as-a-service (IaaS) and platform-as-a-service (PaaS) to its various departments, such as Public Health, Housing, Charity Commissioner, Textile, Law and Judiciary, Water Supply and Sanitation, Food and Drugs, School Education, Social Justice, Relief & Rehabilitation, Forest and Tribal.

Departments are currently using the cloud to host their applications and web portals.

The deployment has helped the state government lower the cost of hosting, improve the management of the data center infrastructure and drastically reduce the time required to provision infrastructure for various state departments. This has encouraged state departments to host their mission critical applications on the cloud.

The flexible provisioning features and the pay-as-you-go model have yielded several benefits for the governments using the cloud. Virtual machines for departments can be provisioned on the fly. The IT Department of the state has been encouraging all state departments to proactively opt for cloud services for their IT requirements because of benefits such as low investment and reduced time to start a project.

Key opportunities for the government and way forward

As of now, there are no significant ICT investments in cloud services across government organizations. Some organizations have slowly adopted cloud services for low risk assets, while others have not started on the journey. For the Government, a 'Cloud-First' policy should be set for any future ICT capital investment. Establishment of foundations for strong governance, pragmatic policy making, continuous portfolio management and sustained businesses and ICT transformation, that is required to support an agency on their Cloud journey, is of primary importance.

The objectives of cloud computing in e-governance should be set as follows:

1. Optimum utilization of infrastructure
2. Speeding up the development and deployment of eGov applications
3. Easy replication of successful applications across states to avoid duplication of effort and cost in development of similar applications
4. Availability of certified applications following common standards at one place

The government cloud strategy should be to create a common, secure and flexible infrastructure that would be available across the public sector. To achieve this, the focus should be on implementing the following key aspects:

1. Public sector network
2. Government cloud (cloud first)
3. Government application store (app store)

6. Digital payments

In order to promote transparency, and reduce corruptions and frauds as well as costs involved in managing cash-based payments, governments the world-over are pushing for a cashless economy.

As of today, India is considered as a cash-friendly economy. Cash-based payments account for more than 90% of all transactions. According to a paper released by Visa titled The Growth of Digital India in payments A Five Year Outlook, 2016, India's net cost of cash is 1.7% of Gross domestic product (GDP), which is very high compared to growing economies such as Brazil, China and Russia.

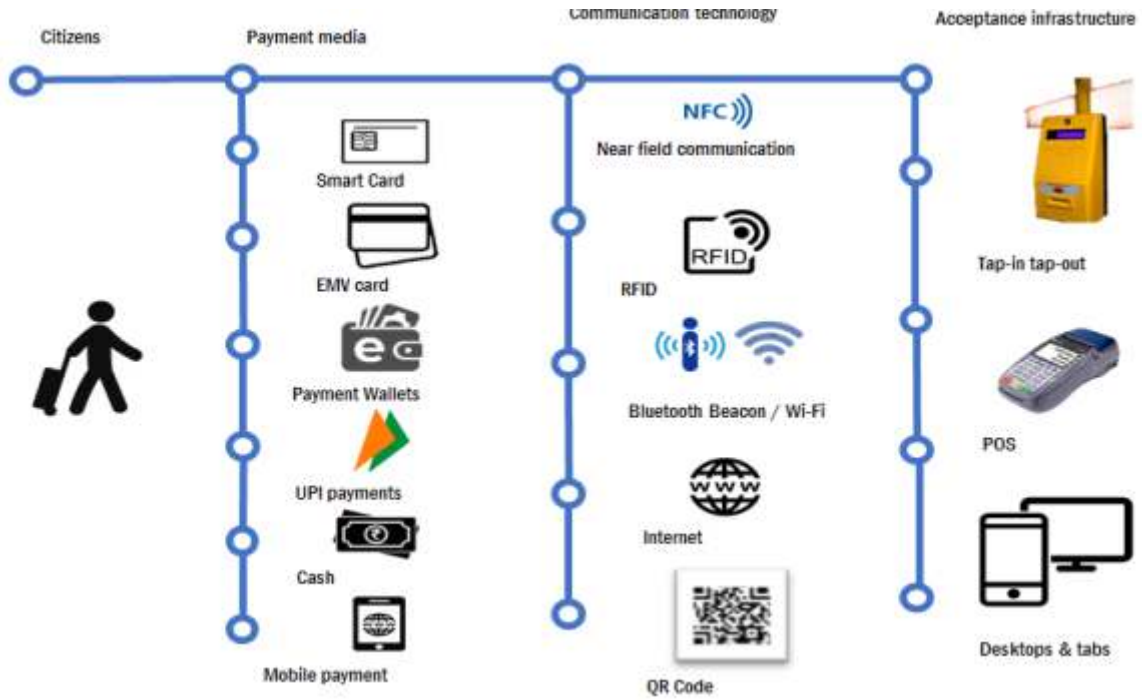
In order to reduce this cost and promote transparency in the economic system of India, the GoI and Reserve bank of India have been promoting the use of cashless modes of payment, including digital payments. Some of the initiatives of the GoI and Reserve Bank of India (RBI) in the recent past to promote cashless transactions in India are as follows:

1. Announcement of incentive scheme to promote digital payments through credit/debit cards, mobile wallets
2. Discount on booking of Liquefied Petroleum Gas (LPG) and payment for LPG online
3. Launch of BHIM app to encourage mobile based payments

India, which is the second most populous country in the world, also stands second in terms of smartphone users as well as internet users. With increasing per capita income, advent of new payment technologies and widespread internet coverage, people in India have started to adopt digital channels of payments. This is evident from a nearly 8% drop in check-based transactions from 2011 to 2016.[58]

Current scenario

Though there is an overall thrust towards moving to digital channels of payment, the adoption rate of these channels is low. Digital payments involve payment media, communication technology and acceptance infrastructure. While there are varieties of payment media available today along with innovative payment technologies for digital payments, inadequate acceptance infrastructure to enable payment processing is considered as the major reason for the slow adoption rate of digital payments in the country.



[58] https://dbie.rbi.org.in/DBIE/dbie.rbi?site=home

The need for digital payments was surged further by the recent demonetization drive by the GoI. To reduce the cost of Point of Sale (PoS) machines and thereby promote its usage, the GoI on 28 November 2016 waived off excise duty on PoS machines.[59] Rajasthan is visited by nearly 1.5 million international tourists every year. Though these visitors do carry payment media, lack of acceptance infrastructure is a major cause of inconvenience from them.

Marquee case studies

The following are some digital payment initiatives taken by the government of Odisha:

1. **Launch of DBT scheme for state's farmers[60]:** The farmers can now get themselves registered online to purchase seeds and get the subsidy amount in their bank account directly under the scheme.
2. **Plans to launch a state-wide awareness campaign on digital payments[61]:** The government plans to engage students possessing smartphones to assist them in the drive by paying them a commission. The students will have to register people who do not make digital payments and train them. They will get their commission after the first successful digital transaction by the persons trained by them. These payments will be tracked thorough a management information system (MIS) mechanism.
3. **Government offices preparing for a shift to digital payments[62]:** The state government has kicked off the process for procurement and installation of PoS devices such as mobile PoS and Aadhaar-based PoS machines. Apart from government offices, state-controlled Public Sector Undertakings (PSUs) and societies would also be enabled for receiving digital payments. The finance department has designed a set of guidelines to enable government departments to install PoS devices.
4. **Mobile-based wage payment for MNREGA workers[63]:** The beneficiaries would have to subscribe to the Airtel Money service to link their mobile number to their Axis Bank accounts. The state department of Panchayati Raj Odisha, private sector lender Axis Bank and Airtel M Commerce Services Ltd have inked an agreement for starting mobile-based disbursement of wages to job card holders of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA).
5. **Workshop on "Digital Payment in Government" in collaboration with the Reserve Bank of India[64]:** it was conducted in July 2017 at Madhusudan Das Regional Academy of Financial Management, Bhubaneswar, Odisha. The daylong workshop was attended by officers from Odisha Financial Service, including the probationers, from all over Odisha.

Key opportunities for government and way forward

Considering the importance of Digital Payments and it being adopted across the nation, the below mentioned would be tools, utilities or avenues for the government, through which it would reap various benefits along with ease, seamlessness and convenience in processing of transactions and carrying out of financial activities involving the people of the state and the visitors.

Rajasthan State Wallet:

A state-level wallet can provide for a common payment media for citizens of Rajasthan for various paid services offered by government authorities. This wallet can also be used for benefit transfer such as subsidy payments once the wallet is linked to Aadhaar number.

1. It can act as a single payment media to pay for various paid services such as utility services offered by government authorities in the state.

[59] https://yourstory.com/2017/03/catalyst-ngo-digital-payments/
[60] https://www.magzter.com/news/656/1817/042017/4up6j
[61] http://timesofindia.indiatimes.com/good-governance/odisha/Odisha-CM-launches-DBT-scheme-for-farmers/articleshow/52188812.cms
[62] http://www.business-standard.com/article/economy-policy/govt-offices-in-odisha-to-switch-to-digital-payments-117041700766_1.html
[63] http://www.business-standard.com/article/economy-policy/mobile-based-wage-payment-for-nrega-workers-114022401028_1.html
[64] http://informatics.nic.in/news/newsdetail/newsID/968

2. It can be issued in the form of an RFID smart card or as an application on the smartphone as per the preference of citizens.
3. Multiple financial institutions in the state can be engaged by the government for issuance of state wallet and set up acceptance infrastructure to enable digital payments.
4. Citizens can link the state wallet with other payment channels such as UPI to enable peer-to-peer fund transfer.

Benefits to stakeholders

Citizens: Ease of use of services

Government departments: More efficient and available systems

Service providers: Reach to customers

The key features of the state wallet should be as follows:

1. Seeded with **Aadhaar** for identification and authentication
2. **Open payment:** Based on open standards to promote wider usage
3. Can be linked to Unified Payment Interface (UPI) to promote cashless transactions
4. Should support **offline authentication** to reduce dependency over network

Rajasthan State Tourist Wallet:

Rajasthan is the fifth most visited state in India. Worldwide, the tourism industry is adopting innovative payment solutions to provide more convenient and hassle-free payment experience to tourists. This is evident from the examples of Singapore Tourist Pass and London Pass. Similar initiatives in Rajasthan would help to address the pain points discussed earlier in the report.

The key benefits of the tourist wallet initiative should be as follows

1. The tourist wallet should eliminate hassles of currency conversion. The tourist wallet can be issued in the form of a smart card or a mobile wallet. The smart card can be purchased over the internet and can be delivered as per the purchaser's preference.
2. Convenience: It should act as the single payment media for international as well as domestic tourists visiting the state to purchase goods and services.
3. Dynamic pricing rules: It should support the dynamic pricing strategy based on the category of tourist and purpose of travel – for example, pricing offered for a pilgrimage tour would be different from that of a luxury vacation.
4. It should create an ecosystem of recognized merchants and intermediaries to provide quality assurance and security to tourists visiting the state.

Some examples of successful implementation of tourist pass/wallets across world are as follows:

Tourist wallets around the world:

Destination	Type	Services/Features
Singapore Tourist wallet	• EZ-Link card • Electronic smart card for travel	• Collaboration between Land Transport Authority and Singapore Tourism Board • Unlimited travel on Singapore's basic bus services, Mass Rapid Transit (MRT) and Light Rail Transit (LRT) trains • Dedicated website
The London Pass	• Discounted sight-seeing pass and travel pass	• Free entry to 60+ attractions and tours • Fast track entry at popular attractions • Unlimited travel across central London on the Underground, bus and train networks • Can be purchased in advance and can be shipped to users • Supported by a mobile application • Dedicated website

Destination	Type	Services/Features
Istanbul Tourist Pass	• Discounted sight-seeing pass and travel pass	• Provision of accessing Wi-Fi across the city • Discounted sight-seeing packages • Unlimited internet connection services • Discounted public transport • WhatsApp instant guidance for queries and assistance • Dedicated website
Paris Pass	• Discounted sight-seeing pass and travel pass	• Free entry to attractions and tours • Includes Paris Metro card and metro map • Comes with a guidebook – Paris Events Guide and Paris Area Guide • Discounted tour offers

7. RPA and AI

Robotics Process Automation (RPA) is defined by the Institute for Robotic Process Automation & Artificial Intelligence (IRPAAI) as "the application of technology allowing employees in a company to configure computer software or a 'robot' to capture and interpret existing applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems."[65] "Artificial intelligence is the science of making machines do things that would require intelligence if done by men", says Marvin Minsky.[66] AI is software that is capable of automating and enhancing the knowledge-based work done by humans. Other labels and technologies that are used synonymously include smart machines and cognitive computing. At the onset, RPA and AI are summarised as below:

To understand what AI is and why it is now developing, it is necessary to understand the nature of the human intelligence that it is trying to replicate. For instance, solving a complex mathematical equation is difficult for most humans. To do so, we must learn a set of rules and then apply them correctly. However, programming a computer to do this is easy. This is one reason why computers long ago eclipsed humans at "programmatic" games such as chess, which are based on applying rules to different scenarios. On the other hand, many of the tasks that humans find easy, such as identifying whether a picture is showing a cat or a dog, or understanding what someone is saying, are extremely difficult for computers because there are no clear rules to follow. AI is now showing how this can be done, and much of it is based on a field of computer science known as machine learning.[67] Machine learning is essentially algorithms that power AI. Machine learning is a way for computer programs (or algorithms) to teach themselves how to do tasks. They do so by examining large amounts of data, noting patterns and then assessing new data against what they have learned. Unlike traditional computer programs, they do not need to be fed with explicit rules or instructions. Instead, they just need a lot of useful data.

Technology		Key Features
RPA		• Robotic Process Automation (RPA) is rule-based automation which performs methodical and systematic processes without the need for constant human supervision. It is implemented for streamlined processes and needs digitized, structured inputs. • RPA allows for smooth collaboration between humans and robots. It aims to use a computer to manipulate existing application software (CRMs, ERPs, help desk) in the same way that a person works with those systems to perform a specific task. • Some of the key applications of RPA include: back-office tasks in finance, supply chain management, accounting, customer service and human resources, such as data entry, purchase order issuing.
AI		• Artificial Intelligence (AI) is the simulation of human intelligence processes created by machines or computers. AI is applied for judgement-based processes and can deal with unstructured inputs. • These processes include learning (the acquisition of information and rules for using the information), reasoning (using the rules to reach approximate or definite conclusions), and self-correction. • Some of the key applications of AI include: programming computers to play games with human opponents; to assist doctors with disease diagnoses; to react to sensory stimuli such as sound/sight; to drive cars autonomously

[65]http://irpaai.com/definition-and-benefits/
[66]M Minsky (ed) (1968) Semantic Information Processing, The MIT Press, Cambridge, Mass.
[67]The Economist Intelligence Unit Limited 2016

The Benefits of RPA and AI are tabulated below:

Technology	Benefits
RPA 	• Automating frequent, manual, repetitive tasks can help reduce human effort substantially • Human errors can be reduced by automating error prone activities imparting control and consistency over the process and reducing risk and non-compliance • Integration with disparate sources through automation can reduce end to end processing time • Freed up man power can be engaged in activities requiring human effort which can lead to improved work satisfaction
AI 	• IT resources can be freed up to do more strategic work • Robotics combined with AI can create Intelligent machines that can replace human beings in laborious tasks • Intelligent machines can be used to perform tasks deemed dangerous for humans and tasks requiring precision. • AI's main use is making predictions based on what it has learned.

Current scenario

RPA implementation opportunities are present in various functions such as IT services, supply chain, HR services, and finance and accounting. RPA can augment existing workforces, and essentially allow them to do more with less. Correspondingly, this can help governments to increase productivity and lower costs. Instead of RPA replacing humans, it can enable and elevate them. AI is commonplace in today's world more than we realize. GPS systems use advanced algorithms to determine the fastest route for us to take. The various digital personal assistants such as Siri, Google Now and Cortana use AI. Banks generally send out communication asking you if you actually made a specific purchase on your credit card if they think there is a chance of fraud being committed. The technology deployed to monitor such fraud is often AI. The most common but inconspicuous use of AI is in your emails specially for spam email filtering. One of AI's main uses is making predictions based on what it has learned. Governments can make the most out of this and enhance how police services and courts work; use it in fraud detection, health care and public and finance management; and support the strategies of policy makers. Some of the uses of AI are automated exam grading and adaptive learning platforms in the education sector, online dispute resolution and predictive policing in legal departments, automating visa processing, patent applications, and fraud detection in administration and public finances.

Growth drivers and growth trends

Prime drivers for RPA and AI:

1. Increasing productivity by automating manual, repetitive work
2. Turning digital intelligence into actionable insights based on availability of unprecedented amount of data

Combined together, RPA and AI are a potent force that can enhance the way private and public sectors operate. RPA and AI are expected to witness 55%–60% growth in coming years as below:

The RPA market grew 64% to $200 million last year and is expected to grow 70% to 90% by 2018. successful pilot projects are inspiring buyer confidence in the technology.[68]	The RPA market is estimated to reach USD 2,467 million by 2022, at a CAGR of 30.14% between 2017 and 2022. North America held the largest market share in 2016. Asia Pacific is expected to grow at the highest rate between 2017 and 2022 among all the regions. Among all the industries in 2016, the BFSI domain held the largest share, of the RPA market.[69]
	 The RPA market, while only $250 million in 2016, will grow to $2.9 billion in 2021. Adding AI to RPA will free it from an exclusive focus on rote tasks. AI will account for an increasing portion of the digital workforce and RPA will be a small fraction of the overall AI "cubicle" market spend.[70]

[68]"Robotic process automation market poised for explosive growth", CIO May, 2017
[69]"Robotic Process Automation Market Growing at a CAGR of 30.14% during 2017 to 2022", Reportsnreports, March, 2017
[70]"The RPA Market Will Reach $2.9 Billion By 2021", Forrester, February, 2017

Marquee case studies

RPA and AI have the potential to greatly enhance the work of governments. These improvements are possible today and government agencies around the world have already started adopting these technologies as below:

- Sefton Metropolitan Council has successfully implemented RPA. For processes such as Council Tax direct debit registrations, reducing input time by 80% using the technology. These improvements allowed the employees freed up to work on more strategic projects[71]
- The Malaysian Government has automated mail sorting, which used to be a manual task, according to Foong. Now, advanced postal automation systems sort letters at great speed –up to 41,000 mail items an hour.
- The City of Edinburgh Council has launched on a transformation and cost reduction program, which includes the Council's back office transformation. Their focus area is the Business Support and Customer teams, which are performing admin/repetitive tasks, making them suitable for RPA implementation.
- National Health Service (NHS) Shared Business Services (SBS) uses "Automic Workload Automation" to automate all financial accounting rules and validations are performed throughout the month-end close process.
- Intelligent Operations Center software helps the Philippine government respond to natural disasters and emergency situations using AI. The system is capable of integrated data visualizations in near real-time to alert the officials and intervene as per the situation at hand.
- The Singapore Government has kicked off an initiative called "Conversation as a Platform" to allow citizens and constituents to interact with their public services digital lives. It involves intelligent services that respond, act and communicate in new ways that can augment human abilities and experiences in a trustworthy manner using artificial intelligence and natural language processing.
- The Government of Netherlands is using text mining and machine learning for detection of child abuse in depth using open source technology as a base.

Key opportunities for the government and way forward

A report on emerging disruptive technologies published by McKinsey & Company estimates that as the use of disruptive technologies such as RPA grows at the rate it is expected to, as many as 110 to 140 million FTEs could be replaced by automation tools and software by the year 2025.[72] A clearly defined automation journey balancing short-term gains with long-term perspective will enable governments to enhance their work by leveraging the strengths of RPA and AI. Such automation will not necessarily spell the end for the employee in question. Rather, it could free up their time to do more valuable tasks. However, simultaneously, governments would need to tackle the concerns around security, employment, privacy and legal issues pertaining to these technologies at a global level.

8. Analytics

Analytics as a business discipline has existed for decades. Its application and acceptance have increased recently because of the pace and scale of data generation, the increase in processing speeds, rapidly reducing storage costs, and the sophistication of enabling tools and technology. These advances have led to the promise of better business decisions informed by the science of analytics. Analytics now sits at the top of the business agenda for many leading organizations looking for new ways to create competitive advantage. Government agencies have significant volumes of data, and more often than not there is little/no dialogue between departments. The insights that can be derived out of tapping into the collective knowledge of various departments is left to one's imagination. It would generate outcomes more than sum of its parts.

[71] https://www.blueprism.com/7266
[72] McKinsey Global Institute. "Disruptive technologies: Advances that will transform life, business, and the global economy." May 2013. Print. July 2014.

Governments can harness the power of analytics in a way that very few organizations can, for example, to reduce/eliminate financial leakages from social welfare schemes, to detect the most crime-prone areas in a city, to plug revenue leakage by identifying fraudulent transactions in taxation and expenditure, to improve emergency services, and to improve disaster response using predictive analytics. These are just a few ways that Governments can utilize the potential of analytics and big data to help serve people better.

Current scenario

Analytics for governments implies handling, processing and sharing massive amounts of data. That data may be structured data, such as the data managed within a database system, or it might be unstructured data, requiring additional technologies for interpretation and conversion into a usable format. It also requires having the right skill sets with different kinds of analytics solutions, such as descriptive analytics (analyzing what happened), predictive analytics (in which historical data is scanned to find behavior patterns that can be used to predict upcoming events or decisions) and prescriptive analytics (which uses the discovered patterns to decide the course of action). The government and public sector are harnessing the benefits of analytics using customer and behavior segmentation, churn and user engagement analytics, enhanced financial controlling and reporting, tax risk and opportunity assessment, predictive planning and forecasting for budget and fraud analytics.

Marquee case studies

Government agencies around the world have already started adopting and implementing analytics:

1. Formally instituted by Michael Bloomberg, Mayor of NYC, at the beginning of 2013, the Mayor's Office of Data Analytics (MODA) represents a paradigm shift in how governments work – one that is guided primarily by data and the expertise of the people behind it. Its key implementations include the response to 911 and the Fire Department New York (FDNY).
2. Using big data and analytics to reduce crimes on the streets is also getting traction these days. Predictive policing is one such endeavor. Los Angeles Police Department (LAPD) has achieved significant success by deploying PredPol. Crimes in the Los Angeles foothill division came down by 13% in the 4 months following the rollout of PredPol compared to an increase of 0.4% in the rest of the city where the rollout had not happened.
3. Washington State Department of Labor and Industries: This department initiated an effort to identify all gaps in its detection and its management of possible workers compensation fraud. The group automated the fraud analysis process and improved business analytics to move the organization from detecting fraud after the fact (and working toward recouping payments), to being a more proactive organization that can quickly detect fraud, stop it and prevent it from happening in the future.
4. US Metropolitan Finance Agency: The agency conducted a 14-week pilot project to define a standard for identifying and quantifying non-compliance, and employed analytics to identify likely violators. An initial assessment of 100 properties (of 26,000) from the prioritized candidate list yielded an additional 21% noncompliance identification. As a result of identifying non-compliance, the agency stands to collect an estimated $26 to $50 million in additional revenue.

Key opportunities for the government and way forward

An easy-to-use analytics solutions has the potential for creating value, but there are times when the desire to adopt solutions such as analytics are hindered by government management turnover, the long time frames of the budgeting process, reliance on legacy platforms, and the overall complexity of the government's technology environment. To overcome challenges of introducing analytics, governments need to look for solutions that enable incremental adoption methods and technologies. At the same time, they should make sure that the transition allows them to overcome the change management issues. They should choose tools with a low barrier to entry that are easy to use and integrate, can parse both structured and unstructured data, and fit well into the existing technology architecture, thus making analytics a part of the government enterprise environment.

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