FROST & SULLIVAN

India Video Surveillance and Biometrics Solutions and Services Market

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1. Global Macroeconomic Trends

1.1. Economic Overview

Global growth, while stable through 2024, proved to be underwhelming, and the economic landscape has since undergone a profound transformation as governments worldwide reorder policy priorities. A significant development has been the series of new tariff measures initiated by the United States, met with countermeasures from its trading partners. These actions have culminated in near-universal US tariffs by early April 2025, elevating effective tariff rates to levels unobserved for a century. This constitutes a major negative shock to growth prospects. The unpredictable way these measures have unfolded further weighs on economic activity and the overall outlook, making it exceptionally challenging to establish a consistent basis for projections.

The swift escalation of trade tensions, coupled with an unprecedented surge in policy uncertainty, is exerting considerable and broad-based pressure on global economic activity. Consequently, the global growth outlook has been significantly downgraded, reflecting the direct effects of these new trade measures and their indirect spillovers through trade linkages, heightened uncertainty, and deteriorating sentiment. This marked deceleration pulls projected growth well below historical averages and represents a notable cooling from earlier expectations. Advanced economies are experiencing a distinct slowdown as these headwinds impact key growth engines, with greater policy uncertainty and direct trade frictions tempering demand momentum in major economies like the United States, while the euro area also navigates a more subdued growth path. Similarly, emerging market and developing economies confront a more challenging environment, with significant downward revisions for those most exposed to the new trade measures or reliant on global trade, complicating their growth trajectories. The disinflation process has grown more complex, as new supply-side shocks and increased uncertainty have caused inflationary pressure to reappear or remain more persistent in some economies.

1.2. GDP Growth

Global growth projections for 2025 now indicate a slowdown due to new trade policy shifts. Inflation forecasts suggest a continued, but slightly slower, decline, with some upward revisions. Fuel prices are estimated to decrease significantly amid commodity price fluctuations. Monetary policy in major economies is expected to ease, while fiscal policies in advanced economies generally tighten. These evolving dynamics will critically shape the global economic landscape.

Exhibit 1: Overview of the World Economic Outlook, actual and projections, 2020 - 2026

(Real GDP, annual percentage change)

	2020[1]	2021[2]	2022[3]	2023[4]	2024[5]	2025[5]*	2026[5]*
World Output	-3.1	6.0	3.5	3.3	3.3	2.8	3.0
Advanced Economies	-4.5	5.2	2.6	1.7	1.8	1.4	1.5
United States	-3.4	5.7	2.1	2.9	2.8	1.8	1.7
Euro Area	-6.3	5.2	3.3	0.4	0.9	0.8	1.2

Germany	-4.6	2.6	1.8	-0.3	-0.2	0.0	0.9
France	-8.0	6.8	2.5	1.1	1.1	0.6	1.0
Italy	-8.9	6.7	3.7	0.7	0.7	0.4	0.8
Spain	-10.8	5.1	5.8	2.7	3.2	2.5	1.8
Japan	**-4.6**	**1.7**	**1.0**	**1.7**	**0.1**	**0.6**	**0.6**
United Kingdom	**-9.8**	**7.4**	**4.1**	**0.3**	**1.1**	**1.1**	**1.4**
Canada	**-5.3**	**4.5**	**3.4**	**1.2**	**1.5**	**1.4**	**1.6**
Other Advanced Economies[a]	**-1.9**	**5.3**	**2.6**	**1.8**	**2.2**	**1.8**	**2.0**
Emerging Market and Developing Economies	**-2.1**	**6.6**	**4.1**	**4.4**	**4.3**	**3.7**	**3.9**
Emerging and Developing Asia	**-0.8**	**7.2**	**4.5**	**5.7**	**5.3**	**4.5**	**4.6**
China	2.3	8.1	3.0	5.2	5.0	4.0	4.0
India[b]	-7.3	8.7	7.0	8.2	6.5	6.2	6.3
Emerging and Developing Europe	**-2.0**	**6.8**	**0.8**	**3.3**	**3.4**	**2.1**	**2.1**
Russia	-3.0	4.7	-2.1	3.6	4.1	1.5	0.9
Latin America and the Caribbean	**-7.0**	**6.9**	**4.1**	**2.2**	**2.4**	**2.0**	**2.4**
Brazil	-4.1	4.6	2.9	2.9	3.4	2.0	2.0
Mexico	-8.3	4.8	3.9	3.2	1.5	-0.3	1.4
Middle East and Central Asia	**-2.8**	**4.5**	**5.6**	**2.1**	**2.4**	**3.0**	**3.5**
Saudi Arabia	-4.1	3.2	8.7	-0.8	1.3	3.0	3.7
Sub Saharan Africa	**-1.7**	**4.7**	**4.0**	**3.6**	**4.0**	**3.8**	**4.2**
Nigeria	-1.8	3.6	3.3	2.9	3.4	3.0	2.7
South Africa	-6.4	4.9	1.9	0.7	0.6	1.0	1.3
Memorandum							
World Growth Based on Market Exchange Rates	**-3.5**	**5.8**	**3.0**	**2.8**	**2.8**	**2.3**	**2.4**
European Union	**-5.9**	**5.4**	**3.6**	**0.6**	**1.0**	**1.0**	**1.4**

ASEAN-5[c]	-3.4	3.4	5.5	4.0	4.6	4.0	3.9
Middle East and North Africa	-3.2	4.1	5.6	1.9	1.6	2.7	3.5
Emerging Market and Middle Income Economies[d]	-2.3	6.8	4.0	4.4	4.2	3.5	3.6
Low-Income Developing Countries	0.1	4.1	5.2	4.0	3.9	4.2	5.3

*Projected

a. Excludes the Group of Seven (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and euro area countries

b. For India, data and forecasts are presented on a fiscal year basis, and GDP from 2011 onward is based on GDP at market prices with fiscal year 2011/12 as a base year

c. Indonesia, Malaysia, the Philippines, Singapore, and Thailand

d. Vietnam is removed from the Low-Income Developing Countries group and added to the Emerging Market and Middle-Income Economies group. The reported differences from January 2024 and October 2023 are for Low-Income Developing Countries excluding Vietnam and Emerging Market and Middle-Income Economies including Vietnam

Source: World Economic Outlook Update, IMF, [1]October 2021, [2]October 2022, [3]October 2023, [4]October 2024, [5]April 2025

The global growth rate, estimated at 3.3% in 2024, is now projected to fall to 2.8% in 2025 before recovering modestly to 3.0% in 2026. This outlook represents a significant downward revision from the January 2025 Update, with growth for 2025 lowered by 0.5 percentage points. These figures are considerably below the historical (2000–19) average of 3.7%, largely due to the implementation of new trade measures, heightened policy uncertainty, and deteriorating global sentiment.

Advanced economies: Growth in advanced economies is projected to slow from an estimated 1.8% in 2024 to 1.4% in 2025 and then edge up to 1.5% in 2026. The 2025 forecast for advanced economies has been revised down by 0.5 percentage points since the January update, reflecting broad-based weaknesses.

The US economy is expected to see growth decrease to 1.8% in 2025, a 0.9 percentage point downward revision from January, because of greater policy uncertainty, trade tensions, and a softer demand outlook. Tariffs are also anticipated to weigh on growth in 2026, which is projected at 1.7%.

The euro area's economy is expected to see growth decline slightly to 0.8% in 2025, before picking up to 1.2% in 2026. Rising uncertainty and tariffs are key drivers of the subdued growth in 2025. The modest pickup in 2026 is supported by stronger consumption from rising real wages and a projected fiscal easing in Germany. Within the region, Germany's growth is forecast at 0.0% in 2025, while Spain's momentum remains stronger.

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[1] World Economic Outlook, International Monetary Fund, October 2021
World Economic Outlook, October 2021: Recovery During A Pandemic
[2] World Economic Outlook, International Monetary Fund, October 2022
World Economic Outlook, October 2022: Countering the Cost-of-Living Crisis
[3] World Economic Outlook, International Monetary Fund, October 2023
World Economic Outlook, October 2023: Navigating Global Divergences
[4] World Economic Outlook, International Monetary Fund, October 2024
World Economic Outlook, October 2024: Policy Pivot, Rising Threats
[5] World Economic Outlook, International Monetary Fund, April 2025
World Economic Outlook, April 2025: A Critical Juncture amid Policy Shifts

The UK is projected to grow by 1.1% in 2025, a downward revision reflecting a smaller carryover from 2024, the impact of recent tariff announcements, an increase in gilt yields, and weaker private consumption amid higher inflation.

Japan's growth projection for 2025 is 0.6%, a downgrade due to the effects of newly announced tariffs and associated uncertainty offsetting an expected strengthening of private consumption.

Emerging and developing economies: Growth in the emerging markets and developing economies is projected to drop to 3.7% in 2025 and 3.9% in 2026, following an estimated 4.3% in 2024. This is a downward revision of 0.5 percentage points for 2025 from the January update.

Emerging and developing Asia is expected to see growth decline to 4.5% in 2025 and 4.6% in 2026, with ASEAN countries particularly affected by recent tariffs. China's GDP growth for 2025 is revised downward to 4.0%, reflecting the impact of recently implemented tariffs, which offsets stronger carryover from 2024 and fiscal expansion; growth is also projected at 4.0% in 2026 due to prolonged trade policy uncertainty. India's growth outlook is relatively more stable at 6.2% in 2025, supported by private consumption, but this is slightly lower than previous forecasts due to higher trade tensions and global uncertainty.

In **Latin America and the Caribbean**, growth is projected to moderate to 2.0% in 2025 before rebounding to 2.4% in 2026. The forecasts are revised downward, largely owing to a significant downgrade for Mexico, reflecting weaker-than-expected activity, the impact of US tariffs, associated uncertainty, and tighter financing conditions. Brazil's growth is projected at 2.0% in 2025.

The **Middle East and Central Asia** region is projected to see growth accelerate from 2.4% in 2024 to 3.0% in 2025 and 3.5% in 2026. However, this projection is revised downward from January, reflecting a more gradual resumption of oil production, persistent spillovers from conflicts, and slower-than-expected progress on structural reforms.

Sub-Saharan Africa is expected to see growth decline slightly from 4.0% in 2024 to 3.8% in 2025, recovering modestly to 4.2% in 2026. Growth forecasts for Nigeria are revised downward owing to lower oil prices, and for South Africa due to slowing momentum, deteriorating sentiment from heightened uncertainty, and the intensification of protectionist policies.

2. India Macroeconomic Trends

2.1. GDP and GDP Growth

With a population of 1.44 billion (Bn.) in 2024, the International Monetary Fund estimates the Indian GDP (at current prices) to be $4,187.0 Bn.[6] by end of 2025. GDP per capita (at current prices) stands at $2,711.4, still considered lower among the advanced and some of the emerging economies. For the year 2025, inflation is expected to remain at 4.2%.

Exhibit 2: GDP at current prices ($ Bn.) and Real GDP growth (%), India, 2019 to 2030
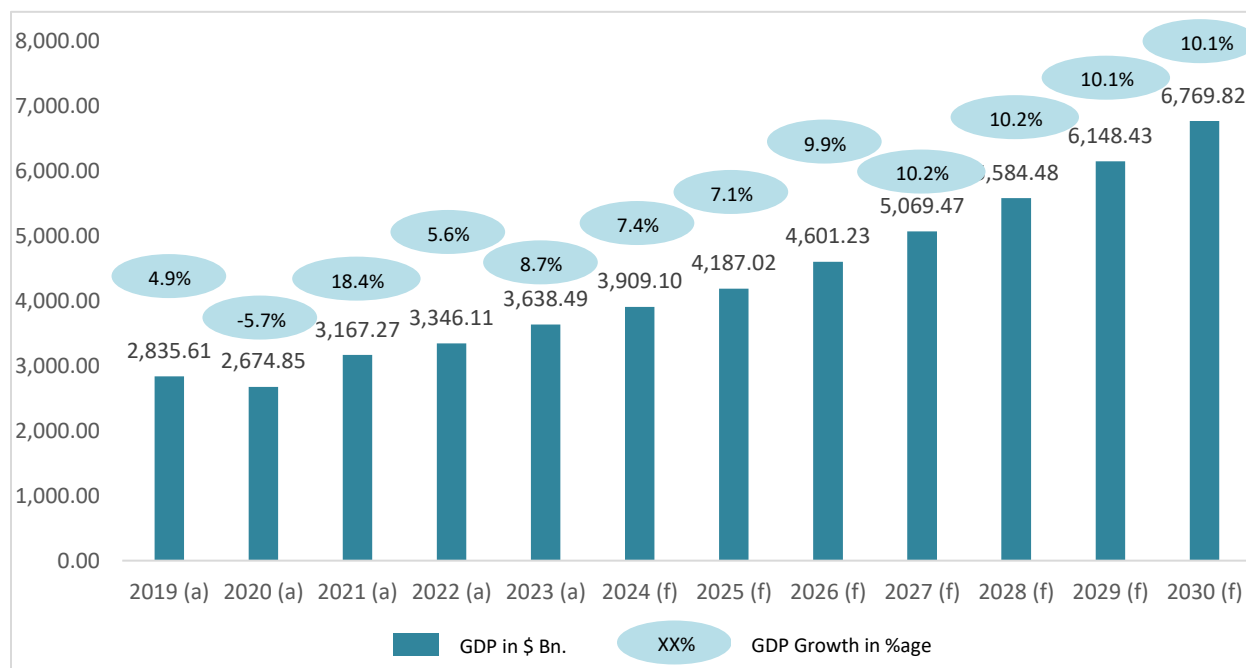
Source: India Dataset, IMF (accessed on 7th July 2025)

Over the last few years India has been one of the fastest growing large economies. From $270.11 Bn. in 1991 to $1,216.74 Bn. in 2007 (at current prices), India is likely to touch $4,187.02 Bn. by the end of 2025. The country is expected to cross the $5,000.00 Bn. mark by 2027 to become the 3rd largest economy in the world behind USA and China in the same year. India has emerged as a bright spot in the global economic map amid a scenario of economic uncertainties. This is evident from the fact that the country has always grown (real GDP) at over 6% YoY since 2010 (except for 2011, 2012, 2019, and 2020), much higher than the world average. India stands tall driven by the strong macroeconomic fundamentals, fiscal policy, high savings rate, high domestic demand, and a young employable population. India surpassed UK to become the 5th largest economy in the world in 2022. With exports contributing to 20% of its GDP, the country has proven to be a domestic-led economy especially due to the rise of the middle class.

2.2. Economic Growth Drivers for India

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[6]   India   Datasets,   International   Monetary   Fund,   as   accessed   on   7th   July   2025, https://www.imf.org/external/datamapper/profile/IND

India's high economic growth is characterized by a combination of various growth levers that remains critical to the country's growth trajectory. Central to growth is a strong domestic demand fueled by rising income levels and an expanding middle class. GDP per capita (at current prices) sees an upward trend and is likely to reach $4,468.54 in 2030. The investment scenario has also been encouraging with the government bringing in fresh thoughts and launching several new projects to ramp up India's infrastructure. India's exports have increased by 6.01% from $778.1 Bn. in 2023-24 to $824.9 Bn. in 2024-25[7]. The government has brought in several initiatives aimed at enhancing manufacturing capabilities and promoting digitization. Mentioned below are some of the important economic growth drivers listed for a better understanding:

- **Strong domestic demand:** India's domestic consumptions accounts for nearly 70% of the economic activity
- **High public investment:** The government has allocated 3.1% of the GDP in FY 2026 towards capital expenditure[8]
- **Foreign direct investment (FDI):** Initiatives like production linked incentive (PLI) scheme designed to boost manufacturing and attract foreign investments
- **Export growth:** India aims to reach $2,000 billion in exports by 2030 with technology services and pharmaceuticals taking the lead
- **Structural reforms and government initiatives:** Digital India (aimed at transforming India into a digitally empowered society and knowledge economy), Gati Shakti (focused on infrastructure development to improve logistics efficiency), and Make in India (encourage manufacturing within the country to boost job creation and economic output) programs remain transformational for India.
- **Resilience in the services sector:** The rise and expansion of IT, business process outsourcing (BPO), and global capability centers strengthen the services sector's contribution towards economic growth.
- **Macroeconomic stability:** Stable macroeconomic indicators with controlled inflation rates and a narrowing current account deficit.
- **Demographic advantage:** A young population (India's median age of 28.8 yrs. in 2025) remains as a potential for sustained economic growth due to increased productivity and labor force participation.

2.3. Government Initiatives in India that include Video Surveillance and Biometrics

2.3.1 Video surveillance

Video surveillance plays an important role in ensuring security and public safety. In several of the central and state government initiatives, video surveillance plays a pivotal role in creating a safe and secure environment for its citizens. Mentioned below are some of the important government initiatives that utilize video surveillance:

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[7] India's Total Exports Grow by 6.01% to Reach Record $824.9 Billion in 2024–25, Up from $778.1 Billion in 2023–24:RBI Report, PIB, https://www.pib.gov.in/PressReleasePage.aspx?PRID=2126119
[8] Union Budget 2025-26, india.gov.in, https://www.india.gov.in/spotlight/union-budget-2025-2026

- **Smart Cities Mission:** Launched in June 2015 by the Government of India, the Smart Cities Mission (SCM) is an initiative aimed at promoting sustainable and inclusive urban development across the country. The mission seeks to improve the quality of life for people residing in cities by using smart solutions, thereby addressing the challenges posed due to rapid urbanization. The main objectives of SCM include core infrastructure development, sustainable environment, and creating a citizen centric approach that emphasizes improving the quality of life for its residents, ensuring safety, especially for the vulnerable groups (eg. women and children).

  Smart Cities increasingly rely on advanced surveillance technologies to improve urban security and safety. Systems include sensors, cameras, facial recognition, and AI-powered analytics to gather real-time data on traffic, public spaces, and potential threats. These CCTV networks provide real-time visibility to security authorities for effective monitoring and quick response to incidents. Cameras are connected to Central Command-and-Control Centers that monitor activities in cities 24x7. Here are some of the CCTV camera deployments made or planned in few of the Smart Cities in India[9]:

  - Agra Smart City to deploy 1200 CCTV cameras (Bharat Electronics Ltd. is the master system integrator)
  - Bilaspur to deploy more than 500 cameras
  - Chandigarh deployed 907 fixed cameras and 133 PTZ cameras at 277 locations, additional 60 (360 degree) cameras installed on the rotaries of major traffic junction
  - Jaipur installed more than 180 cameras as part of the SCM project
  - Karimnagar would have 335 CCTV cameras, 85 red-light violation cameras, 85 vehicle detection cameras, 174 automatic number plate recognition cameras
  - Rourkela to have 450 CCTV cameras
  - Udaipur installed 348 high resolution cameras

- **Delhi CCTV Project:** The project is an initiative by the current state government to enhance public safety and security in the national capital. As of January 2024, around 2.5 lakh CCTV cameras were installed by the state government which is likely to reach 2.8 lakhs by the end of the year (2024). As part of the project, 10,000 CCTV and automatic number plate recognition cameras were installed by the Delhi police. Automatic number plate recognition (ANPR) and facial recognition capabilities enable law enforcement agencies with better insights in real-time allowing swift response to incidents as these cameras can identify vehicles and individuals associated with criminal activities. The project also encourages community involvement by promoting the installation of private CCTV cameras in residential areas, creating a collaborative environment for safety. Notably, Delhi, Hyderabad, Chennai and Mumbai remain among the most surveilled cities (outside China) in the world in terms of # of CCTV cameras per square mile.

- **Indian Railways video surveillance system:** RailTel, a government of India enterprise, provides IP based video surveillance system at all railway stations in India and train coaches. The

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[9] Safety & Security, Smart Cities, Government of India, accessed on 14th October 2024, https://iccc.smartcities.gov.in/iccc/sector/use-case/8d8e353b98d5191d5ceea1aa3eb05d43

surveillance system has video analytics and facial recognition software to ensure high-tech security at railway stations. The company also provides monitoring facility in all Railway zonal/divisional Head Quarters to improve the surveillance activity ensuring better security for the passengers and railway properties. The aim is to provide an IP based video surveillance system at 5,102 railway stations in India[10].

- **CCTV camera installation in courts and police stations:** The Supreme Court of India has issued comprehensive guidelines for the installation of CCTV cameras in court complexes across the country. The aim is to address security concerns following several incidents that compromised the safety of the judges and other court personnel. Likewise, the premier court had ordered (in December 2020) the Centre and state governments to mandatorily install CCTV cameras in police stations and offices of investigation agencies. The directive is seen as a part of the broader effort to curb human rights abuse and ensure accountability within the police force. CCTV cameras are to be placed at all critical areas within the police station premises including entry and exit points, lockups, corridors, and reception areas, leaving no part of the station uncovered.

- **Video surveillance in schools and school buses:** For the education sector, bodies like CBSE and the CISCE have already instructed affiliated schools to install CCTV cameras at vulnerable points. State governments of Delhi, Maharashtra, and Karnataka, have already made it mandatory to install CCTV cameras in schools. Beyond just classrooms, state governments are also making it mandatory to install CCTV cameras in school buses. One such example is that of the UP government that has issued a notification making installation of CCTV cameras in school vans and buses a must[11].

- **Installation of CCTV cameras in bus shelters and transport systems:** Several state governments in India have started to deploy surveillance systems across high-traffic and accident-prone areas and toll plazas to get real-time traffic data. This is done not only to identify traffic violations and offenders but also to revamp the road infrastructure.

- **Video surveillance in banks:** In one of the most critical sectors like banking and financial services, the Reserve Bank of India (RBI) in 2016 instructed all banks to have their transactions under CCTV surveillance. Later in 2018, the central bank even instructed cash vans transporting money should also have CCTV surveillance.

2.3.2 Biometrics

Biometrics that include iris scan, fingerprint scan, facial recognition, and palm vein scans play an important role in modern security and identity verification system, leveraging unique physical and behavioral characteristics to enhance safety and efficiency across various sectors. Biometric systems structurally have a higher level of security as compared to traditional password or PIN based methods

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[10] Video Surveillance System, RailTel, https://www.railtel.in/key-projects/video-surveillance-system.html
[11] Transport Department revs up security: Plans rollout of CCTV cameras in school vehicles across UP – 3 January 2024, Ministry of Road Transport & Highways, Government of India, accessed on 4th February 2025, https://parivahan.gov.in/parivahan/en/content/transport-department-revs-security-plans-rollout-cctv-cameras-school-vehicles-across-%E2%80%93-3

since it is significantly difficult to impersonate or forge. Mentioned below are some of the important initiatives undertaken by the Indian government that leverages the use of biometrics:

- **Aadhaar:** Maintained by the Unique Identification Authority of India (UIDAI), Government of India, Aadhaar is the world's largest biometric identification system. It is a unique 12-digit identification number provided to each resident of India linking it to their biometric data that includes fingerprint and iris scan. This interlinkage ensures the identity of the individual which is distinct and verifiable thereby reducing the chance of identity fraud. Fingerprint scans capture the unique pattern of an individual's fingerprint, which is collected by using high-resolution scanners. Similarly, iris patterns are used for authentication. Iris recognition is considered highly secured since an iris is complex whose unique patterns are difficult to replicate. Although less emphasized than fingerprint and iris scan, facial recognition is also used as a part of biometric data used in Aadhaar for identity verification.

  Based on the latest available data (as on 7th July 2025), the total number of Aadhaar generations stand at 1,420.9 Mn.

**Exhibit 3: Aadhaar trend, monthly values and cumulative values (in Mn.)[12],
July 2024 to June 2025**

	Jul-2024	Aug-2024	Sep-2024	Oct-2024	Nov-2024	Dec-2024	Jan-2025	Feb-2025	Mar-2025	Apr-2025	May-2025	Jun-2025
Monthly Value (in Mn.)	2.48	3.15	2.70	1.43	0.44	1.82	1.56	3.19	2.05	1.80	1.86	1.20
Cumulative Value (in Mn.)	1,399.71	1,402.86	1,405.56	1,406.99	1,407.44	1,409.26	1,410.82	1,414.00	1,416.05	1,417.85	1,419.72	1,420.91
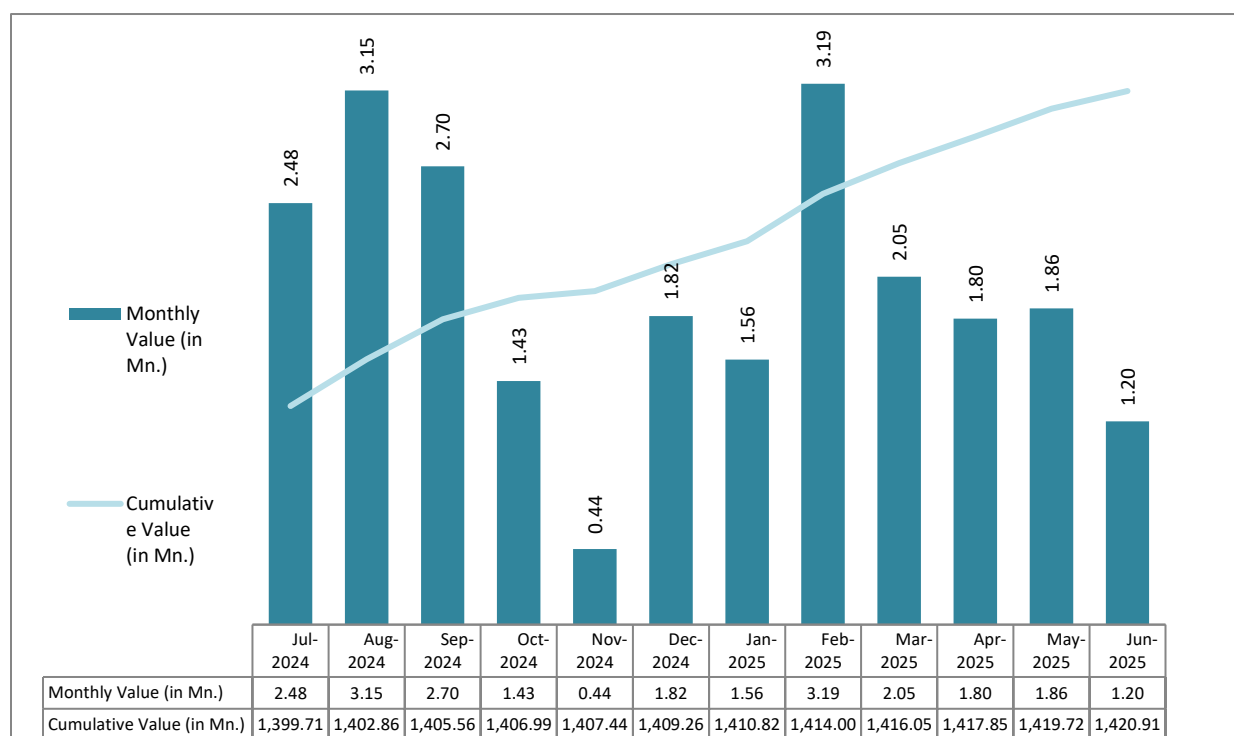
Source: UIDAI

- **Banking and financial services:** Banks employ biometric authentication to create a robust security layer surpassing traditional approaches such as passwords and PINs, which are susceptible to hacking, phishing, and cyberattacks. It uses facial recognition cameras, iris readers

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[12] Aadhaar Dashboard, UIDAI, accessed on 7th July 2025, https://uidai.gov.in/aadhaar_dashboard/india.php

and fingerprint scanners to capture and store a user's unique physiological or behavioral features. When an individual (for instance) attempts to access a secure system or application, the system prompts the user to provide their biometric data. It compares the data to stored records to verify and authenticate the user's identity. Some of the use-cases where biometric authentication is used in the banking and financial sector include customer onboarding (e-KYC), secure transactions (online, ATMs or physical branches), re-authentication, fraud prevention, compliance with regulatory requirements, etc.

Another use-case of biometrics in banking transactions is Aadhaar Enabled Payment System (AEPS). NPCI defines AEPS as a bank led model which allows online interoperable financial inclusion transaction at PoS (MicroATM) through the business correspondent of any bank using the Aadhaar authentication. The objective is to empower a bank customer to use his/her Aadhaar to access his/her respective Aadhaar enabled bank account and perform basic banking transactions like cash deposit, cash withdrawal, Intrabank or interbank fund transfer, balance enquiry and obtain a mini statement through a Business Correspondent. This is specifically helpful for users who do not have access to traditional banking accounts yet can access financial services.

Exhibit 4: AePS Total Approved Transaction[13] – in Volume (in Mn.), India, FY 2020 to FY 2025

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025
AePS Approved Transaction	2,330.08	3,627.36	4,314.03	4,859.44	5,533.09	6,109.36

Source: National Payments Corporation of India

- **Border security and immigration:** Biometrics find big use-case in strengthening India's border security and immigration control. Biometric systems installed at airports and border crossings enable swift and accurate identification of travelers, helping authorities to efficiently monitor and manage traveler movement. Facial recognition and fingerprint scanners deployed at country exit points are used for criminal identification and investigation purposes. The integration of biometric databases allows for quicker and more accurate identification of individuals, aiding in the prevention and solving of crimes.

- **Law enforcement and public security:** Fingerprint, palm and facial recognition technologies are used by law enforcement agencies to create databases of criminals. Facial recognition technique is used to perform face identification in a crowd in real-time or post event. It is believed that biometric identification data of criminals remains critical in identifying and solving criminal cases easily.

- **DigiYatra:** Launched in December 2022, DigiYatra is a biometric enabled seamless travel experience (BEST) based on facial recognition technology that aims to provide paperless and seamless travel experience to air passengers. With this technology, a passenger's entry would

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[13] AePS Product Statistics, NPCI, accessed on 7th July 2025, https://www.npci.org.in/what-we-do/aeps/product-statistics

be automatically processed based on the facial recognition systems allowing passengers to check-in, pass through security, and board their flights without having to present physical documents like boarding passes or ID cards at each stage. To access the facility at the airport, passengers need to register on the DigiYatra app using biometric data (like face scan) and link it with their travel details.

Exhibit 5: DigiYatra passenger user base[14], India, 2023 and 2024

Airports	Cumulative DigiYatra PAX till 31st December, 2023	Cumulative DigiYatri PAX till 11th February, 2024
Delhi	34,24,937	42,62,167
Bengaluru	30,19,149	38,21,829
Kolkata	15,85,350	20,34,544
Hyderabad	10,61,638	14,92,776
Pune	83,42,63	10,68,112
Others (Varanasi, Mumbai, Cochin, Ahmedabad, Lucknow, Vijayawada, Guwahati, Jaipur)	21,69,814	18,15,863
Total	**1,12,60,888**	**1,44,95,291**

PAX: Passenger
Note: The Digi Yatra was initially launched at three airports, New Delhi, Bengaluru, and Varanasi in December 2022. Later, it was launched in 10 more airports
Source: Press Information Bureau, Government of India

2.4. Growth Drivers for the Video Surveillance and Biometrics Market in India

2.4.1 Video Surveillance

The video surveillance market is expected to grow strong given the various use-cases it caters to. While video surveillance primarily helps in improving the security and safety posture, it is also used in enabling various other scenarios like counting people, identifying objects, number plate recognition, etc. Listed below are some of the growth drivers for the video surveillance market:

- **Increased need for security:** The escalating concerns surrounding safety and protection in a variety of settings, including commercial establishments, residential areas, and public spaces, have spurred the demand for advanced surveillance solutions. With the prevalence of heightened security threats and the growing need for proactive monitoring and rapid threat identification, video surveillance has taken up a pivotal role in protecting assets and ensuring individual safety. This increased need for security has not only fostered the evolution of cutting-edge surveillance technologies but has also paved the way for the integration of recent

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[14] Digi Yatra app users number crosses 45.8 Lakhs, Press Information Bureau, February 2024, https://pib.gov.in/PressReleseDetailm.aspx?PRID=2007679&reg=3&lang=1

advancements such as artificial intelligence (AI), facial recognition, and predictive analytics. These technologies have revolutionized surveillance capabilities, enabling intelligent threat detection, behaviour analysis, and real-time alerts, thus elevating the efficacy and responsiveness of security operations.

- **Good alternative to manned guarding:** Video surveillance is increasingly becoming a suitable alternative to manned guarding. It has several advantages over traditional physical manned guarding. While typical guarding suffers from lack of efficiency, cost effectiveness, and limited coverage, video surveillance has lower long-term cost compared to hiring security personnel, wider coverage, and can monitor large number of sites simultaneously. The presence of visible cameras can deter potential criminals from attempting theft or vandalism. Video surveillance offers 24x7 monitoring, day and night, and can detect any suspicious activity. CCTV footage collected during monitoring acts as proof of evidence and acceptable in the court of law.

Exhibit 6: Comparative advantages of video surveillance over manned guarding

Comparative Parameter	Video Surveillance	Manned Guarding
Cost Efficiency	Less expensive than manned guarding	Costly since it includes increasing labour costs
Coverage Area	Can cover/monitor large areas by use of multiple cameras	Limited to physical presence of guards
Response Time	Can immediately alert authorities after a security incident	Takes time to co-ordinate among staff and initiate an incident response
24x7 Monitoring	Provides continuous surveillance without breaks	Guards work in shifts, leading to potential gaps in coverage
Evidence Collection	Admissible to the court of law as the evidence is recorded	Relies of the memory of the individual which is less reliable and could be mis-leading
Environment Fit	Can be installed at locations where manned guarding cannot be deployed	Has limitations of deploying human being in all weather or terrain conditions
Manpower Requirement	Less	High
Return on Investment	High	Less
Maintenance and Upkeep	Requires initial setup and occasional maintenance but generally low ongoing costs	Continuous personnel training and management required, adding to costs

Source: Frost & Sullivan

- **Technological advancements in video surveillance:** Technological Advancements like cloud video surveillance or VSaaS introduces scalable and service-based models that revolutionize

security operations and management. Organisations can optimize their surveillance systems to adapt to changing needs efficiently. Cloud video surveillance enhances this adaptation by providing remote accessibility, scalability, and cost-efficiency that surpasses traditional on-premises setups. The integration of advanced video analytics, leveraging AI and machine learning, elevates surveillance capabilities by enabling precise data analysis and proactive threat detection. Likewise, the rise of dash cams, body cams, and GoPro cameras expands the applications of video surveillance even further, catering to various needs from personal use to law enforcement and adventure activities.

Listed below are the top technological advancements in video surveillance.

Exhibit 7: Top technological advancements in video surveillance

Key Technological Advancements	Overview
Artificial Intelligence (AI) and Machine Learning (ML)	Enables real-time threat detection, thereby helping video surveillance systems improve accuracy over time, making them more effective.
Cloud-based Video Surveillance	Outsourcing video monitoring, storage, and management of the video footage to a service provider thereby eliminating the need for on-premise infrastructure
IoT Integration	IoT enabled video surveillance triggering cameras based on specific sensor inputs
Video Analytics	Enables license facial recognition, number plate recognition, motion detection, heatmaps, monitoring customer dwell time, queue management, employee efficiency, customer journey analysis, etc.
5G Technology	Enhances video surveillance by providing faster speeds and lower latency for real-time streaming of high-definition video
Advanced Camera Technologies	Higher resolution and improved low-light performance, ensuring clearer images even in poor light conditions
Network Video Recorders (NVRs)	Ability to manage video footage from multiple IP cameras efficiently
Cybersecurity	Encryption of video data transmitted or stored thereby protecting sensitive data from cyber threats

Source: Frost & Sullivan

- **The rise of industry regulations:** The video surveillance industry has seen a significant increase in regulatory mandates. Several state governments in India (Delhi, Maharashtra, Karnataka, etc.) have already made it mandatory to install CCTV cameras in schools. Beyond just classrooms, state governments are also making it mandatory to install CCTV cameras in school buses (eg. Uttar Pradesh). Similarly, the Reserve Bank of India (RBI) in 2016 instructed all banks to have their transactions under CCTV surveillance. Later in 2018, the central bank even instructed cash

vans transporting money should also have CCTV surveillance. From a public safety standpoint, the Indian government through its Safe City Project focuses on installing CCTV cameras in urban areas.

- **Affordability of video surveillance products and solutions:** The affordability of video surveillance products and solutions has played an important role in driving widespread adoption across various sectors. With the decreasing costs of surveillance hardware and the availability of scalable solutions, the implementation of tailored security systems has become more accessible to businesses, individuals, and organisations without imposing significant financial burdens. This enhanced affordability has not only broadened access to security solutions but has also spurred innovation, competition, and diversity within the video surveillance industry.

- **Growing use-cases of video surveillance:** Beyond offering security, video surveillance finds several use-cases across different industry verticals – specifically with the use of video analytics. Video analytics transforms the retail industry by providing valuable insights that enhance operations, improve customer experience, and increase security. It helps retailers to track and analyze customer journeys within the store. It tracks footfall, customer behaviour, dwell times, movement patterns, high demand store sections, etc. thereby helping retailers to optimize store layouts and product placements. It also enables retailers to streamline operations by assessing employee performance and productivity. Some of the advanced video surveillance systems also help provide energy efficiency as light, fan and air conditioning systems get switched off in the absence of any human being in the vicinity.

2.4.2 Biometrics

India is currently experiencing a high demand for biometric technologies. It has been adopted across several government initiatives as well as enterprise use cases. Following mentioned below are the growth drivers for the biometric market in India:

- **Need for increased security:** Biometrics provides security through various mechanisms that leverage unique physical traits for identity verification. Biometrics traits that include facial recognition, fingerprint scan and iris patterns are unique to an individual and almost impossible to replicate. This is unlike the use of traditional security systems like password or PIN, that can be forgotten or easily stolen. Combining multiple biometric techniques (like fingerprint and facial recognition) or biometric with traditional authentication methods could be even more effective as it creates a multi-layered approach to security. Moreover, biometric templates are typically stored in a secure format that does not reveal the actual biometric data, making it difficult for hackers to misuse the information after the event of successful data theft.

- **Government initiatives:** Aadhaar is the biggest use case of biometric technology in the world. It leverages biometric data - fingerprint identification and iris scanning – to eliminate duplication and fraud in identity verification ensuring that everyone has unique identity linked to essential services like banking, healthcare, and government subsidy. It was highly effective even during the COVID-19 pandemic when it facilitated the distribution of medical aid and vaccinations through platforms like CoWIN, ensuring that assistance reached the intended beneficiaries

efficiently. Other government initiatives like DigiYatra also uses Aadhaar to make passenger experience seamless, paperless, and delightful.

- **Integration in consumer electronics, demand for contactless solutions:** Biometrics technology has seen widespread adoption within the consumer electronics space especially smartphones, laptops, and smart home devices. It has increased user convenience and security by eliminating the need to remember lengthy passwords or patterns. Biometric authentication allows for quick access to devices and applications as users can unlock their smart devices or authorize payments with a single touch or glance. Unauthorized users would not be able to access personal devices thereby maintaining the aspect of privacy. The technology gained higher adoption during the COVID-19 pandemic as some of the biometric authentication methods are contactless, making it highly appealing. In the modern home setup, biometric technology is being integrated with smart home devices and wearables, increasing security across various applications such as smart locks and home automation systems.

- **Rise of Biometrics-as-a-Service:** BaaS or Biometrics-as-a-Service is an emerging concept which is offered through the cloud with solutions like facial recognition, fingerprint scanning, voice recognition, and iris recognition to enhance security and improve operational efficiency. One of the major users of BaaS are the small-and-medium businesses (SMB) that struggle to make upfront investments. From an industry vertical perspective, the banking and financial services industry, ecommerce, retail, and healthcare are the biggest adopters of BaaS.

- **Technological advancements:** Artificial intelligence (AI) and machine learning (ML) increase the accuracy, efficiency, and security of biometric systems. AI algorithms have the potential to analyze large biometric data sets to identify patterns and nuances that traditional security systems (password or PIN based) fail to provide. Similarly, ML models can adapt to variations in biometric data due to changes in an individual's appearance or environmental conditions. This adaptability is important for maintaining accuracy in real-world scenarios where factors like exposure to lighting or facial expressions may vary. AI systems continuously learn from new data inputs, improving their performance over time.

3. Technological Trends in India

3.1. Advancements in Surveillance

Technological advancements in surveillance have transformed the landscape of security and monitoring, reshaping how governments, organizations, and individuals observe and analyze behaviour. Video surveillance cameras, which remain at the heart of surveillance systems, have become much more advanced and sophisticated. IP cameras have enhanced the video surveillance experience by integrating advanced technologies that enhance image quality, data management, and real-time analytics. AI and ML capabilities incorporated in IP camera systems have transformed them into intelligent surveillance tools capable of performing tasks like facial recognition, object detection, and anomaly detection in real-time. Provided below are some of the technological advancements and trends noticed in the Indian video surveillance market.

3.1.1 Adoption of IP Cameras

IP cameras have been experiencing high growth in India (expected CAGR of 17.8% from FY 2024 to FY 2029), much like the global trend. It is fast replacing analog cameras as users realize the advantage of IP camera systems that include real-time monitoring and enhanced image quality. The integration of the latest technologies like IoT, AI and video analytics has made IP cameras more appealing. The availability of cost-effective IP camera solutions makes it accessible to a broader audience. Competitive pricing from home grown and local manufacturers further stimulates customer adoption.

IP cameras offer higher resolutions, often exceeding 30 megapixels offering clearer and more detailed images compared to analog cameras. It is critical for cases where face recognition and detailed profiling of the individual is required. Users can access live video feeds from anywhere and through any smart device connected to the internet. This remote access capability allows for continuous monitoring and quicker response times to incidents. IP cameras come with sophisticated features like motion detection that remain crucial for identifying theft, burglary or unauthorized access. Unlike analog cameras that require multiple cables for power and video transmission, IP cameras can operate on a single cable (power over ethernet) that provides both data and power, making the camera installation process simple and hassle free. These types of cameras can be easily scaled up and down depending on the need, allowing additional cameras to be integrated into existing networks without the need for any extensive rewiring. Video footage can be stored in the cloud thereby eliminating the need for physical media like tapes or disks. Importantly, any video transmitted by IP cameras can be encrypted, offering a greater level of protection against unauthorized access. Summarily, IP cameras are a superior choice for contemporary security needs, especially for scenarios that require high-quality surveillance and advanced monitoring capabilities.

3.1.2 Demand for HD Cameras

In today's scenario, customers look for cameras that offer better clarity. High definition (HD) cameras provide clearer and more detailed video footage, often at resolutions such as 1080p or even 4K. HD cameras help identify faces, license plates, and other critical details during an incident, making video footage more reliable for investigations and evidence gathering. Law enforcement agencies use this

high-quality footage from HD cameras as proof of crime and submit it to the court for legal proceedings. The clarity of the images helps the court accurately determine the event as it occurred, which becomes critical for successful prosecutions.

HD cameras often come with mobile applications that allow users to monitor their assets in real-time from anywhere. This provides peace of mind to asset owners to stay connected to their security systems while they are away. These cameras come with night vision and infrared capabilities, allowing them to capture clear images in low-light conditions. Integration of HD cameras is possible with other security technologies like alarm systems and access controls, creating a comprehensive and structured security network. While the CAPEX investment for HD cameras may be higher than standard analog systems, their maintenance requirements are less leading to cost benefit in the long run.

3.1.3 High use of video analytics

Video analytics has been one of the most useful advanced technologies used in video surveillance. It provides numerous benefits that enhance security, offers insights, and maintains operational efficiency. It enables immediate identification of suspicious activities or anomalies, allowing security personnel to respond promptly to potential threats. Video analytics is seen as a proactive approach to security to prevent incidents before they occur.

Video analytics leverage algorithms and AI to continuously monitor video feed with minimum human intervention. It reduces the need for manual oversight, releasing security personnel from less productive and mundane tasks, and focusing on the more critical job. Raw video data can be converted into actionable intelligence by using video analytics, enabling businesses to analyze patterns, behaviors, and trends. The information is often insightful that helps in informed decision making and helps improve security strategies. During an incident, video analytics allow quick searches through recorded footage based on a specific criterion such as timeframes or detected anomalies. With several regulated industry verticals coming up with mandates, video analytics enabled video surveillance systems help monitor compliance in real-time and provide documentation that protects businesses from liability claims by offering clear evidence of events.

3.1.4 The rise of cloud video surveillance or VSaaS

Video Surveillance-as-a-Service or VSaaS is a cloud-based solution for managing video surveillance systems. Through this model, businesses and enterprises have the option to outsource video monitoring, storage, and management of the video footage to a service provider thereby eliminating the need for on-premises infrastructure. Organisations who plan to scale quickly often opt for the VSaaS model where cloud is used for video recording, storage, and surveillance.

VsaaS has seen a high demand due to the advantages it offers against traditional video surveillance systems. In a VsaaS setup, video footage is captured by IP cameras and transmitted directly to a cloud-based platform. This eliminates the need for a local recorder (network video recorder or digital video recorder), reducing the associated hardware costs and maintenance requirements. Using VsaaS, users can access live and recorded video feeds from anywhere with an internet connection making cloud-based video surveillance more flexible and cost-effective than traditional on-premises setups. Cloud-based video surveillance technology is highly scalable, helping businesses to easily add or remove

cameras while adjusting the storage capacity. This is especially beneficial for enterprises that would need to expand their surveillance range over time.

VSaaS systems receive automatic updates from service providers, ensuring that users can benefit from the latest available features and security enhancements. This eliminates the need for in-house security teams and admins to keep track of the latest features and update the systems manually. VSaaS is considered as one of the most cost-effective video surveillance methods, reducing the need for upfront CAPEX like traditional surveillance systems. Instead, businesses can focus on paying the services cost which is specifically beneficial for small and medium businesses. VsaaS solutions come with robust cybersecurity measures (like encryption of data while in transmission or in storage), ensuring every bit of data is protected from cyber criminals.

3.1.5 Intelligent video command and control centers

Intelligent video command and control center acts as a central facility for managing and monitoring various operational systems within smart cities. These centers integrate multiple data sources to enhance decision-making, improve public safety, and streamline operations across various sectors.

A unified platform present in the command-and-control center oversees city operations, integrating surveillance systems like CCTV with access control and other critical infrastructure. The central platform enables real-time video monitoring and swift incident response, which is fundamental for urban management. The intelligent command and control center aggregates data from multiple sensors and CCTV cameras deployed across the city and processes the data to derive actionable intelligence required for further course of action. The collected data and intelligence support decision making and is often helpful in taking proactive measures. As the number of camera installations increases across the city, the command-and-control center can accommodate the need. The centers can be designed to meet the specific needs of different regions or sectors, allowing for localized monitoring while maintaining overarching control across multiple sites. Some of the applications of intelligent command and control center includes traffic management (managing the flow of traffic to avoid congestion), emergency services coordination (serve as command hubs during an emergency – terror attack, flood, riot, etc.), public transportation oversight (monitor public transport system in real-time to ensure efficiency and safety), and urban infrastructure management (manage utilities and infrastructure by monitoring performance metrics that leads to predictive maintenance).

3.2. Biometric Innovations

Biometric systems are fast replacing traditional security systems – passwords and PINs. Biometric systems come with enhanced and advanced security features, efficiency, and better user experience. It is difficult to replicate since biometric traits like fingerprints, facial features, and iris patterns are unique to every individual making it significantly harder to forge compared to other legacy methods where passwords or PINs could be stolen. Mentioned below are the latest technological trends in biometrics that are shaping the future.

3.2.1 Development of mobile biometrics

Mobile biometrics refers to the use of biometric authentication methods on smart mobile devices like smartphones, tablets and laptops. These biometric techniques are used to verify an individual's identity. It leverages biometric traits – mostly fingerprints, facial features, and voice patters – to offer an alternative to password or pattern-based system security. Today, most smartphones come with advanced sensors (fingerprint scanners, cameras) that facilitate biometric authentication for the user. These systems can be integrated into both native applications and third-party apps using software development kits (SDKs).

The mobile biometrics market is poised for high growth as technology continues to evolve. AI and ML are being integrated into biometric systems that promise improved security and higher accuracy. As the market sees a higher adoption of biometric capabilities, more industry verticals would accept the need for mobile biometric that would drive digital transformation. Mobile biometrics represents a significant advancement in digital security, offering a blend of convenience and robust protection for users in an increasingly digital world.

3.2.2 Multi-modal biometric systems

Unlike a unimodal biometric system which relies on a single biometric input like fingerprint or facial recognition, the multi-modal biometric system utilizes two or more different biometric traits, significantly improving reliability and reducing vulnerability. It has higher levels of security, since two biometric traits are more difficult for hackers to fake than just one trait. Multi-modal biometric systems reduce the likelihood of false acceptance rates (FAR) and false rejection rates (FRR) by combining multiple biometric inputs. It is considered more flexible for users than unimodal biometrics, as it's easier to combat noise in the data. For example, if a person's voice is altered by illness or fingerprint altered by a finger injury, the other biometric trait measured can be used to compensate.

However, multi-modal biometric systems are more expensive than usual unimodal systems. It requires more computing power and storage space for databases to hold biometric data.

3.2.3 AI powered recognition algorithms for enhanced accuracy and security

The integration of AI security has made biometric systems more sophisticated and efficient. AI security algorithms have the potential to process large volumes of data in real-time, allowing for swift and accurate identification. Similarly, ML algorithms enable biometric systems to adapt and improve over time, increasing precision and reliability.

AI-based biometric systems can quickly detect fraudulent attempts with minimum false positives, ensuring higher levels of accuracy and security. For example, AI can differentiate between a real fingerprint and a fake impression, or a genuine face and a photograph, ensuring fool-proof protection against fraudulent activities. Data processing and analyzing biometric data is much faster than traditional methods, enabling quicker and smoother authentication experience. In terms of scalability and adaptability, AI-enabled biometrics can be integrated with other advanced technologies like internet of things (IoT) and cloud computing, thereby widening the range of potential applications. One common example is the use of AI-powered biometric systems to control access to various devices and services in smart homes. Another example is healthcare, where AI-enabled biometrics ensures secure

access to electronic health records and patent data, holistically increasing both aspects of privacy and efficiency.

3.3. IoT and AI Innovation

Both IoT and AI have been two important technology enablers. IoT facilitates the interconnection of devices, enabling data collection, and automating processes. IoT devices are equipped with sensors that continuously gather data from their surroundings. It can allow real-time monitoring of conditions like motion detection, face recognition, energy management, and more. Likewise, AI improves decision-making by analyzing vast datasets quickly and accurately. It can accurately identify patterns and insights that human beings may fail to observe, leading to more informed and efficient choices. Here are some of the latest developments in IoT and AI that make video monitoring, threat detection, and remote surveillance more effective.

3.3.1 IoT enabled monitoring

IoT-based or IoT-enabled video monitoring refers to the use of IoT in video surveillance systems. It allows enhanced monitoring, data analysis, and real-time responsiveness. IoT enabled CCTV cameras can provide real-time video feeds and can be accessed remotely via smartphones or computers. They can automatically trigger alerts based on pre-set criteria. For example, in case of any unauthorized access, alarms can be activated and sent to security personnel.

IoT-enabled CCTV systems generate volumes of data that require to be analyzed for insights into security trends and operational efficiencies. This data helps with planning and decision-making. Another aspect of IoT-enabled video monitoring systems is their scalability. Businesses can add a greater number of cameras or sensors (as per the need) without significant infrastructural changes. This flexibility is helpful for enterprises looking to expand their surveillance capabilities over time.

Smart cities are a great example for the use of IoT-based CCTV cameras. Cameras installed across the cities can monitor traffic patterns, crowd behaviour, and handle emergency situations. The collected data can be further analyzed by city administrators to make informed decisions regarding urban management.

3.3.2 IoT in Smart Cities

Smart cities are a great example of the use of IoT. Urban environments and smart cities are transformed using IoT. Listed below are some of the use-cases of IoT in smart cities.

Exhibit 8: Use of IoT in smart cities

Use-case	Purpose
Smart Traffic Management	With the help of cellular IoT networks like 5G, traffic authorities can collect and analyze real-time traffic data to optimize traffic flow, reduce congestion, and improve travel times
Smart Waste Management	Sensors in waste bins monitor fill levels and optimize pick up and replacement of waste bins by garbage trucks improving waste

	management efficiency
Smart Street Lighting	Sensor-based LED streetlights adjust brightness based on pedestrian presence, saving energy and enhancing public safety
Environmental Monitoring	IoT sensors assess air and water quality providing real-time data on pollution level to city authorities
CCTV Cameras	CCTVs enabled with IoT devices enable emergency response systems improving public safety by providing real-time monitoring and alerts for incidents
Smart Meters	Smart IoT meters can offer water management for administrators and consumers by keeping a tab on the use of water, electricity and gas consumption
Smart Grid Management	IoT devices facilitate the integration of renewable energy sources into the power grid by enabling real-time monitoring of energy supply and demand, optimizing distribution
Urban Planning	IoT sensors that collect data help city planners make informed decisions about infrastructure improvements and resource allocation based on usage patterns
Maintenance and Repair	IoT sensors can identify maintenance and repair issues much earlier and avoid a sudden break-down

Source: Frost & Sullivan

3.3.3 AI based threat detection

Businesses are leveraging AI-based video threat detection to analyze video footage in real-time, identifying potential security threats and unusual behaviour. Based on collected data and analyzing it thereafter, AI algorithms can immediately flag off suspicious activities or objects. ML models can recognize patterns in video data and distinguish between normal and suspicious behaviors. AI tools can be integrated with existing surveillance systems, enhancing their capabilities without requiring extensive hardware overhauls. This allows businesses to use the current infrastructure while upgrading the overall security posture.

4. Market Trends and Use Cases in India

4.1. Video Surveillance

4.1.1 Public places and smart cities

Video surveillance sees high adoption in smart cities. It not only enhances public safety and security but also helps urban management. Surveillance technology has evolved over the years and currently includes advanced technologies like AI and data analytics to improve urban safety and operational efficiency. High-definition cameras are placed at strategic locations in the city that enable 24x7 real-time monitoring of events, allowing law enforcement agencies to act swiftly to any incident. Critical features like facial recognition and license plate recognition help further strengthen the security landscape by aiding suspect identification and vehicle recognition. AI-powered video analytics help detect unusual movements or actions, human behaviour, and intrusion detection. Video surveillance helps monitor traffic patterns, identify congestion hotspots, and streamline traffic movement in the cities. Traffic signals timings are also optimized by tracking video feeds coming from CCTV cameras placed at major road crossings and junctions. The data-driven approach to traffic management helps facilitate smoother traffic flow and reduce delays.

Video surveillance also enables crowd and emergency management. Surveillance cameras equipped with AI continuously monitor crowds, providing local police and traffic control agencies with real-time data on crowd density and movement. It helps security personnel assess situations promptly and respond to potential issues before they escalate. CCTVs can track the movement of crowds and analyze patterns. When the crowd density reaches its critical thresholds, the system automatically alerts the security team. This feature is critical for maintaining safety during large human gatherings such as rallies, sports and entertainment events, festivals, etc. The insights gained after data analysis help authorities to plan future events better with the right resource allocation. Medical emergencies can be addressed properly as video surveillance provides situational awareness for rapid response.

Exhibit 9: Use of video surveillance with video analytics capability in public spaces and smart cities

Use-case	Purpose
Public Safety and Crime Prevention	To identify suspicious activity or to identify criminals using facial recognition
Vehicle Tracking	To automatically identify vehicles that are being searched by law enforcement agencies
Traffic Management	To identify congestion patterns, and manage traffic signals dynamically
Crowd Management	To monitor crowd movement preventing overcrowding
Environmental Monitoring	To monitor environmental conditions like pollution levels or illegal dumping

Smart Infrastructure Management	To monitor the condition of urban infrastructure and detect issues like streetlights not working, potholes, illegal parking, etc.

Source: Frost & Sullivan

4.1.2 Transportation, logistics and warehouse

The transportation and logistics industry is fast adopting video surveillance. It helps transportation and logistics operators enhance safety, efficiency, and operational oversight. Video surveillance is used in public transit systems, freight transport, and logistics operations.

In India, most state governments have started to install video surveillance cameras in buses. Similarly, the Indian Railways have also installed cameras in its coaches to monitor passenger behaviour, safety and security. Real-time footage is being monitored from central command and control centers for authorities to respond quickly to incidents. These cameras are equipped with advanced features like facial recognition and motion detection to enhance security by helping identify potential threats or criminal activity.

The logistics industry has also benefited from video surveillance. Video surveillance coupled with global positioning system (GPS) help logistics companies to keep track of the vehicle location and driver behaviour. This integration helps with managing risks and optimizing routes, overall improving operational efficiency. It also acts as a preventive measure against vandalism since criminals realize that vehicles come fitted with CCTV systems. Video surveillance helps ensure that the logistics business is compliant with industry regulations and adheres to safety norms.

Video footage is considered as court admissible evidence in the event of an accident or dispute. HD cameras or dashcams installed inside the vehicle capture clear images of the incident as it occurred. The video footage helps resolve liability claims and support law enforcement agencies with investigation. Most of these video cameras come with video feed storage capability to archive and retrieve video data that facilitates thorough post-incident analysis.

Exhibit 10: Use of video surveillance with video analytics capability in transportation, logistics and warehouse

Use-case	Purpose
Passenger Safety Enhancement	To improve passenger safety by monitoring behaviors and detecting incidents in real time
Overcrowd Monitoring	To track passenger boarding and deboarding the public transport
Inventory Management	To provide real-time visibility into inventory levels and locations within warehouses
Loaded and Empty Pallet Detection	To identify loaded and empty pallets in warehouses
Box Counting	To count the number of boxes entering or exiting the warehouse

Guard Patrolling Detection	To identify guards present at strategic locations and identify guard action
Package Tracking	To perform package movement and tracking within the warehouse

Source: Frost & Sullivan

4.1.3 Critical infrastructure

The primary use of video surveillance is to provide security. To improve the security posture, enterprises catering to critical infrastructure invest in video surveillance systems. Critical infrastructure includes industries like oil and gas, utilities, defense and military installations, emergency services, chemicals, etc. Companies install video surveillance systems as a part of their security framework.

Video surveillance systems enable 24x7 monitoring of critical infrastructure. It allows immediate detection of security threats, which is otherwise difficult through physical man guarding. It makes security far more reliable and fool-proof. The mere visible presence of video surveillance cameras even reduces the risk of potential intruders or criminals. Knowing that they are being watched often discourages unauthorized access or malicious activity. Criminals realize the event of an incident can be captured and stored through video footage which later can be used for investigative purposes.

Modern video surveillance systems are integrated with other security systems like access control, alarms, and public addressal systems. This integration provides a holistic approach to security that is effective and efficient. AI synced in with video surveillance systems helps analyze data to identify anomalies and patterns. False alarms are reduced, allowing security personnel to focus on genuine threats.

4.1.4 Commercial office

Commercial office buildings have been using video surveillance systems not only for security purposes but also to bring in improved operational efficiency. Video surveillance coupled with video analytics bolsters security measures and safeguard assets. CCTV cameras are being placed at entry points, lobby areas, corridors, elevators, and parking lots serve to deter unauthorized access, monitor visitor traffic, and ensure the safety of employees and visitors. By deploying CCTV systems, office building management can effectively manage security risks, prevent criminal activities, and respond promptly to any security incidents. Listed below are some of the use-cases of video surveillance in commercial offices.

Exhibit 11: Use of video surveillance with video analytics capability in commercial offices

Use-case	Purpose
Identification of suspicious activity	To detect and prevent unauthorized entry and theft
Employee Efficiency	To monitor and evaluate employee productivity
Employee Safety	To provide employees with a sense of safety and security in office

	premises
Visitor Management	To keep track of the outsiders or visitors to the office
Emergency Response	To detect and respond to emergencies quickly
Energy Efficiency	To optimize lighting and energy use
Occupancy	To provide real-time office occupancy status
Evidence Collection	To provide recorded video footage as evidence in legal proceedings

Source: Frost & Sullivan

4.1.5 Retail (including food and beverage)

The retail industry faces several security and operational challenges, including inadequate recognition of customers and staff, monitoring staff behaviour, preventing shoplifting and addressing the increased risk of break-ins after hours. Additionally, optimizing shop floor efficiency, tracking purchase invoices, deploying staff effectively during peak times, managing promotional offers and ensuring cleanliness are critical concerns for retailers.

Video surveillance plays a critical role in improving security and bringing in operational effectiveness. CCTV cameras powered with AI and video analytics help in motion detection, fraud detection, shoplifting prevention, heatmaps (create graphical representations of in-store roaming and identify customer time-spending patterns), face recognition (to understand customer delight, customer behavior, and preferences), monitor customer dwell time, energy management, queue management, employee efficiency, store layout optimization, implementing in-store marketing campaigns, etc. These use-cases are beyond the primary use of video surveillance systems for security monitoring. Today, most organized retail stores in India use CCTV cameras within their infrastructure that get monitored either centrally or from the owner's mobile phone.

Exhibit 12: Use of video surveillance with video analytics capability in retail

Use-case	Purpose
Motion Detection	To detect and prevent unauthorized entry and theft
Fraud Detection	To identify and prevent employee fraud in inventories, orders, or store statistics
Shoplifting Prevention	To monitor and prevent shoplifting by identifying intruders and thieves
Heatmaps	To create graphical representations of in-store roaming and identify customer time-spending patterns
Facial Recognition	To understand customer behavior and preferences related to specific products or services

People Counting	To count the number of prospects who visited the store
Demographic Detection	To conduct demographic analysis on the gender and age of potential customers visiting the retail outlet
Monitoring Customer Dwell Time	To track how long customers spend in specific areas of the store
Queue Management	To manage customer queues and improve checkout efficiency
Inventory Management	To monitor stock levels and track the movement of products
Auditing and Reporting	To audit inventory transfers and sales retrospectively, providing insights into stock management practices – by use of video footage
Training Tool	To use recorded video footage for training purposes, showcasing best practices in customer interaction and operational efficiency
Employee Efficiency	To conduct person detection and monitor/evaluate employee performance
Store Layout Optimization	To optimize store layout based on customer behavior and traffic patterns
Customer Journey Analysis	To understand customer journeys, including inflow, movement, and demographics
Emergency Response	To detect and respond to emergencies quickly
Energy Efficiency	To optimize lighting and energy use
Vehicle Tracking	To automatically track and identify vehicles entering the premise/retail warehouse
Customer Vehicle Parking Management	To streamline and optimize vehicle parking

Source: Frost & Sullivan

4.1.6 Industrial and Manufacturing

Video surveillance synced in with video analytics capability in an industrial and manufacturing setup helps in providing safety, operational efficiency, and security within production facilities. Video analytics can be used to monitor safety protocols, ensuring that workers and employees adhere to operational guidelines by wearing the right protective gear. Hazardous conditions can be detected in real time thereby avoiding an untoward incident. It helps ensure access control and intrusion detection by placing video cameras at strategic locations within the facility. The integration of AI-driven analytics also facilitates the continuous improvement of production processes by providing insights into workflow efficiencies and identifying bottlenecks. Summarily, video surveillance not only safeguards employees

and assets but also contributes to the optimization of manufacturing operations, leading to increased productivity and reduced operational costs.

Exhibit 13: Use of video surveillance with video analytics capability in industrial and manufacturing

Use-case	Purpose
Access Control and Intrusion Detection	To monitor access points and prevent unauthorized entry, thereby reducing the risk of theft or sabotage
Adherence to Safety, Security, Hygiene and Workplace Compliance	To monitor compliance related to standard operating protocols
Fire Detection	To quickly identify an incidence of fire enabling swift response
Crane Hook Lock Detection	To ensure the position of the lock in crane while lifting heavy materials or when not in use
Line Crossing Detection	To identify workers crossing designated safety lines in high-risk environment
Smart Conveying	To automate constant monitoring of conveyor belts to streamline productivity analysis and enhance operational efficiency
Product Defect Detection	To detect defective products by using power video cameras
Loading and Unloading Detection	To identify loading and unloading of goods in a manufacturing facility
Product Count	To automate the process of product counting in manufacturing setup
Automatic Number Plate Recognition	To identify vehicles' number plates automatically to improve security and manage real-time traffic

Source: Frost & Sullivan

4.1.7 Government and PSU

Law enforcement (which includes police and judiciary) is one of the important departments in the government. The installation of video surveillance in police stations aims to enhance monitoring by providing continuous visual surveillance at key locations in the facility. It provides transparency and accountability as actions and movements are diligently recorded and easily accessible. CCTV cameras are placed at all entry and exit points of the police station, in the lock-up areas, corridors, lobbies, and reception spaces to cover every essential aspect of police station operations. The cameras come with night vision ability along with audio recording features. Extended data storage is attached with the CCTV cameras to ensure thorough monitoring and security. Installation of CCTV cameras are made according to the December 2020 directive of the Supreme Court of India to install CCTV cameras in all police

stations and offices of investigative agencies like the Central Bureau of Investigation (CBI), the Directorate of Enforcement (ED), and the National Investigation Agency (NIA). Interrogations are to be made under the monitoring of their activities through visual surveillance and CCTV.

The Supreme Court in another mandate, emphasized the installation of CCTV cameras in courts and tribunal premises. The move is intended solely for security reasons, ensuring safety, and building a disciplined environment within the courtroom. The purpose of these cameras extends to addressing concerns about safety and judicial administration, putting a strong emphasis on trust, accountability, and public interest.

Public sector undertakings (PSUs) often remain a target for criminals. Power plants, waste and water treatment plants, arms and ammunition units, etc. need to be always secured, failing which could be a threat to the public. Video surveillance cameras act as a deterrent against theft, vandalism, and other criminal activities. Continuous monitoring allows security personnel to respond swiftly to incidents, ensuring the safety of employees and assets. Beyond providing security, CCTV cameras ensure that safety protocols and operational procedures are always followed. This is specifically important for regulated industry verticals that have strict regulatory requirements (like power, energy and manufacturing). AI and analytics driven cameras monitor machinery and processes, identifying malfunctions or inefficiencies that could disrupt operations. This proactive approach minimizes downtime and enhances productivity.

4.2. Biometrics

4.2.1 Trends in fingerprint biometrics

Fingerprint technology has seen some remarkable advancements in the recent past. It has become one of the most dependable modes of biometric authentication. From payments to attendance, fingerprint technology has found several use-cases in the modern-day world. Mentioned below are some of the recent advancements in fingerprint biometrics.

Technological advancements

Advanced sensor technologies and concepts

Capacitive and ultrasonic sensors: One of the latest advancements in fingerprint technology is the introduction of capacitive and ultrasonic sensors. Capacitive sensors use an array of tiny capacitors to capture the ridges and valleys in a fingerprint. It is considered more accurate and reliable compared to legacy optical sensors. Ultrasonic fingerprint sensors can record high-resolution images of the fingerprint using high-frequency sound waves, therefore allowing more precise and secure identification.

Live scan fingerprinting: Live scan fingerprinting is a digital fingerprinting process that uses an electronic scanner to capture an individual's fingerprint and personal information. The data can be transferred directly to the relevant authorities (like law enforcement, border control, and background checks) for processing thereby expediting background checks and investigations. This technique is considered beneficial because of its speed and efficiency. Live scan fingerprinting can complete the capturing process in just 5 to 15 mins, much faster than the traditional methods which may take days or weeks to

yield results. The technology has minimum risk of errors associated with ink smudging or improper application, ensuring clearer and more reliable prints.

AI and ML enhancements

Advanced algorithms: Convolutional neural networks (CNNs) which utilize ML algorithms in fingerprint recognition provides much higher accuracy in fingerprint matching and classification tasks. These algorithms outshine in capturing/recording granular fingerprint pattern, thus reducing false acceptance rates (FAR), and false rejection rates (FRR).

Integration with systems

Payment systems: The integration of fingerprint biometrics with payment systems has created an ecosystem of secure and convenient transactions. Fingerprint technology allows users to link their financial accounts to their fingerprints thereby eliminating the need for cash or card-based payments. Using fingerprint biometrics, users can easily authenticate their identity and securely complete the transaction seamlessly.

Mobile device: Fingerprint technology has become ubiquitous in mobile devices, allowing for secure unlocking and authentication across smartphones and tablets. This integration elevates user experience to the next level, creating next-level features for smart phones and tablets.

Market trends

Fingerprint biometrics, with its versatile and secure features, has seamlessly integrated with numerous sectors offering multiple use-cases. From smartphones to healthcare, and healthcare to law enforcement, fingerprint biometrics has seen strong adoption. Mentioned below are some of the use-cases of fingerprint biometrics in industry verticals.

Exhibit 14: Use of fingerprint biometrics across industry verticals and use-cases

Use-case	Purpose
Mobile Device Security	Users conveniently unlock their smartphones and tablets by simply placing their fingerprint on the screen sensor
Access Control Systems	Instead of keycards or PINs, users gain access to buildings or restricted areas by authenticating their fingerprint
Aadhaar	The Indian government use fingerprint recognition to provide residents a digital identity
Financial Transactions	Banks and other financial service providers use fingerprint biometrics to authorize transactions, ensuring a secure and seamless process.
Healthcare	Patient identity, records and medical information verified accurately by securely assessing and managing fingerprint biometrics

Law Enforcement	Law enforcement agencies use fingerprint matching technology to identify criminals and connect them to relevant cases. Live scan fingerprinting technology used by police departments allow real-time capture and submission of fingerprints, facilitating prompt and accurate identification processes.
Border Control and Immigration	Border security and immigration departments use fingerprint biometrics at checkpoints to verify traveler identities
Time and Attendance Tracking	Enterprises use fingerprint recognition technology to record time of entry and attendance of employees in offices
Examinations	Educational institutions use fingerprint technology to stop impersonation in examinations and ensure student identity

Source: Frost & Sullivan

4.2.2 Trends in facial recognition

Facial recognition has rapidly evolved to become one of the significant tools across various industry verticals. It has emerged as a transformational tool that identifies and verifies individuals based on their facial features. Here are some of the technological advancements in facial recognition technology.

Technological advancements

Shift to 3D facial recognition technology: A shift from 2D to 3D facial recognition technology is currently being observed due to superior accuracy and robustness against spoofing attempts. 2D methods rely on flat images while 3D face recognition uses a 3D face model which allows it to take advantage of the human being's 3D geometry. 3D technology offers a potent shield against shortcomings like changing lighting conditions, diverse facial expressions, and varying head angles. Additionally, 3D liveness detection adds an extra layer of facial geometry as it monitors real-time presence, ensuring the face is just not a photograph or video.

Integration of AI and ML: Advanced algorithms in artificial intelligence help analyze data patterns, improve system's adaptability and accuracy in different conditions (facial expressions and poses). AI-based systems instantly match captured facial data against extensive databases, enabling quick identity verification in applications ranging from airport security to mobile payments.

Edge computing in facial recognition: Edge computing enables processing on the device, allowing faster analysis and response. Edge AI helps reduce dependency on cloud servers that causes latency and risk of data breach.

Blockchain integration: Companies like Hyland Credentials and Bext Holdings are pioneering blockchain to transform how facial data is being recorded, stored and used thus fostering trust in the systems that manage and handle personal data (identities). The concept of blockchain is being used for storing encrypted biometric data, creating a sense of security for the individual.

Market trends

Today, facial recognition has become one among the most trusted technology tools on how users interact with systems and services. The technology tool is highly secure, accurately identifying individuals in real-time. It brings in user convenience, allowing for quick and contactless authentication. Moreover, facial recognition technology can be easily integrated with existing security infrastructures and software platforms making it easily adaptable across various industries. Listed below are some of the most common use-cases of facial recognition across industry verticals.

Exhibit 15: Use of facial recognition technology across industry verticals and use-cases

Use-case	Purpose
Security and Law Enforcement	Law enforcement agencies use facial recognition technology to identify suspects and monitor criminals in public places
Mobile Devices	Smart devices enable facial recognition systems to unlock their devices and authorize payments securely
Banking	Banks enable facial recognition technology in their digital banking initiative for secure access management and fraud prevention
Retail	Retailers use facial recognition to identify repeat customers and accordingly tailor their marketing efforts
Healthcare	Hospitals and healthcare clinics leverage facial recognition systems for patent identification, streamlining check-ins, and even diagnosing genetic disorders by analyzing facial features
Social Media	Prominent social media platforms like Facebook use the technology to identify individuals in the photo and tag them accordingly, enhancing user engagement
Attendance Tracking	Educational institutions and commercial establishments use facial recognition technology to monitor attendance and time stamping of students and employees

Source: Frost & Sullivan

4.2.3 Trends in iris scanning

Iris scanning technology is an advanced biometric identification technique that uses unique patterns in the iris of human eyes for authentication purposes. Since its first use, iris scanning has evolved to experience various advancements in technology.

Technological advancements

Integration of deep learning algorithms: Iris scanning technology has started to use deep learning algorithms to enhance the accuracy and efficiency of iris recognition systems. One such example is the implementation of hybrid models that combine convolutional neural networks (CNNs) and recurrent neural networks (RNNs) to improve feature extraction and sequence processing, resulting in better identification rates and reliability.

Use of specialized imaging techniques: The specialized imaging technique captures high-resolution images of the iris, that allows detailed analysis of unique patterns such as furrows and crypts. The images are thereafter converted into encrypted digital templates for secure storage and comparison during the authentication process. Advanced techniques like discrete fast fourier transform (DFFT) and principal component analysis (PCA) are leveraged to enhance the feature extraction process, enabling faster and more accurate identity verification.

Market trends

Some of the applications of iris recognition technology is mentioned below.

Exhibit 16: Use of Iris recognition technology across industry verticals and use-cases

Use-case	Purpose
Aadhaar	One of the biggest use-cases, iris scan is being integrated with Aadhaar, enrolling over 1,300 million citizens. Late last year (2023), the Government of India introduced iris scan for individuals who face challenges with fingerprint recognition such as blurred fingerprints or disabilities.
Security and Access Control	Users get access to buildings and restricted areas through iris scan systems
Healthcare	Healthcare professionals' access electronic health records reducing the chances of errors associated with manual identification methods
Immigration and border control	The immigration and border control office use iris scanning allowing authorized individuals to pass through smoothly
Banks	Banks employ the technology to authenticate customers as well as identify fraudulent activity. Some of the ATM machines come with iris scan systems to verify customers while drawing money.

Source: Frost & Sullivan

4.2.4 Use-case: Aadhaar systems

Aadhaar is the world's largest biometric ID program. It is designed to provide a unique identity to every resident with a 12-digit number linked to their biometric data. Using various modes of biometrics – fingerprint, iris scan, and facial recognition – Aadhaar ensures secure and efficient identity verification. Leveraging the power of biometrics, Aadhaar solves and provides the following applications.

Aadhaar authentication

Aadhaar authentication is the process of enabling verification of an individual's identity through their unique Aadhaar number. In Aadhaar authentication, an individual's identity is compared with the Aadhaar number and associated demographics or biometric information against the records stored with the Central Identities Data Repository (CIDR) which is managed by the Unique Identification Authority of India (UIDAI). Fingerprint or iris scan data is matched with the individual to confirm the identity. As a

part of one-time password (OTP) authentication, an OTP is sent to the registered mobile number linked to the Aadhaar account for the verification. Summarily, a combination of two or more methods (demographic authentication, biometric authentication, OTP authentication) are employed (on a case-by-case basis) to verify the identity of the individual.

Aadhaar Payments Bridge (APB)

Initiated by the National Payments Corporation of India (NPCI), Aadhaar Payments Bridge (APB) is a unique payments method used to facilitate the direct transfer of government subsidies and benefits to beneficiaries through their Aadhaar-linked bank accounts. Under the Direct Benefit Transfer (DBT) scheme, government agencies transfer subsidies enabling electronic retail payment transactions. DBT was introduced to increase transparency in subsidy transactions, which otherwise would go through a third-party agency leading to the pilferage of government-sponsored funds. The entire process is paperless and eliminates delays. Even if the beneficiary changes its bank account, they do not need to inform the government if the new bank account is linked to Aadhaar of the beneficiary.

Unified Payments Interface (UPI) Integration

UPI stands for Unified Payments Interface. It is an instant payment system developed in 2016 by the National Payments Corporation of India (NPCI) to facilitate real-time inter-bank transactions through mobile devices (mostly smartphones), allowing users to send and receive money, pay bills, make recharges, and execute purchase transactions seamlessly. UPI functions in a secure framework, utilizing a virtual payment address (VPA) for transactions that eliminates the need for sharing sensitive bank details. The system is highly user friendly, convenient, interoperable (works with different banks and payment service providers), and secure.

One of the critical aspects that make UPI transactions secure is the integration with Aadhaar. Aadhaar simplifies UPI payments as it links bank accounts to the individual's Aadhaar number, making financial transactions more accessible. The unique 12-digit number (Aadhaar) provides a reliable method for verifying user identities during a UPI transaction. To streamline UPI payments even further, last year Google Pay enabled Aadhaar-based identification for UPI activation. Users can register for UPI using Aadhaar through NPCI and set their UPI PIN without using a debit card.

The exhibit below depicts the growth of UPI transactions since FY 2020.

Exhibit 17: UPI transactions – in volume (in Mn.), India, FY 2020 to FY 2025[15]

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025
UPI Transactions in Volume (Mn.)	12,518.62	22,330.65	45,967.53	83,751.14	1,31,129.83	1,85,866.02

*excludes the transactions having debit/credit to the same account
Source: National Payments Corporation of India

Aadhaar Enabled Services

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[15] UPI Product Statistics, NPCI, accessed on 7th July 2025, https://www.npci.org.in/what-we-do/upi/product-statistics

Aadhaar Enabled Service, of which Aadhaar Enabled Payment System (AePS) is a specific example, is a set of financial services that use Aadhaar biometric identification system to facilitate secure banking transactions. Much like UPI, it was also introduced by NPCI with an aim to promote financial inclusion in the country (India). AePS allow individuals with an Aadhaar number to access their bank accounts and perform various banking activities like biometric authentication (fingerprint or iris scan). It is critically effective specifically in rural India where there are limited facilities in traditional banking.

With AePS, users authenticate biometric authentication using their biometric data. Users visit a Micro ATM or an authorized banking correspondent, provide their Aadhaar number and select the transaction type, following which they authenticate their identity using biometric verification. Users can either withdraw cash, deposit cash, request for balance enquiry, ask for mini statement, or transfer funds. Based on NPCI data, AEPS (inter-bank) transactions over Micro ATM (eg. cash withdrawal, cash deposit) was estimated to be INR. 798.49 Mn. in volume in from April 2024 to November 2024[16].

Aadhaar for governance and administration

Beyond DBT and digital payment services, Aadhaar is also used for governance and administrative purposes. It is often used for identity verification and service delivery as it links biometric data to individuals. It eliminates the need for multiple identity documents and simplifies documentation processes in bank account opening and obtaining social welfare benefits. Aadhaar helps the government to improve governance through digital transformation. During the COVID-19 pandemic, it was used to deliver medical aid and vaccinations through platforms like CoWIN. In the educational sector, Aadhaar is used for accessing scholarships and other benefits thereby streamlining the identity verification process.

4.2.5 Use-case: AI-based video analytics with biometrics

AI-driven video analytics is fast transforming biometric identification especially in the field of facial recognition technology. AI algorithms help detect the face of a person and keep tracking the face until the system rejects or recognizes the face. Artificial intelligence makes the identification process quick and can be performed even at a distance. It can even recognize faces while in sideways or tilt position. The technology maps the facial features of the detected person by measuring the distance between the eyes, the width of the nose, and shape of the jawline. These physical traits are unique for an individual and a facial signature is created thereafter. The facial signature is then compared against a database of known faces using advanced algorithms. AI-based video analytics enable real-time processing of video data allowing for immediate identification and response to security threats or attendance tracking needs.

4.2.6 Use-case: Biometrics for attendance management, employee productivity, and reporting

Enterprises and businesses are fast adopting biometrics technology for attendance management. Biometric systems use fingerprint, facial recognition, or iris scan to accurately record employee attendance, eliminating the need for traditional methods like access cards and manual logs. Biometric systems are real-time allowing administrators to monitor who is present or absent at any given time.
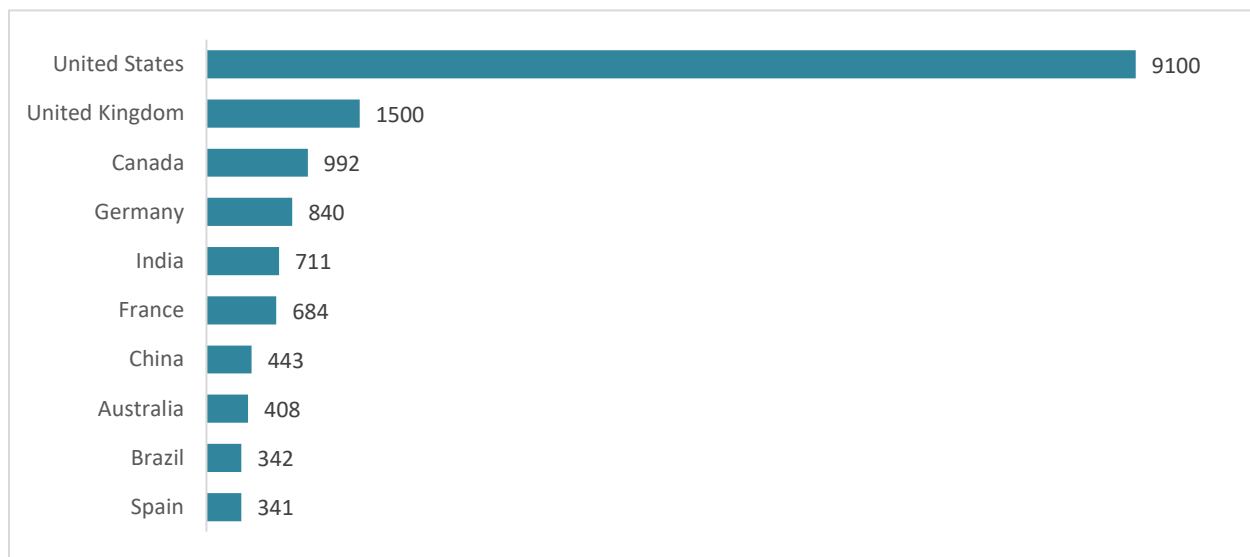
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[16] Retail Payments Statistics on NPCI Platform, NPCI, accessed on 7th July 2025, https://www.npci.org.in/PDF/npci/statics/Retail-Payments-Statistics-Nov24.pdf

Reporting becomes easier since it can be integrated with payroll software to automate the calculation of hours worked, including overtime. With customers looking for pay-per-use models, cloud-based biometric systems allow users to access attendance sheets from anywhere-anytime. Cloud biometric systems are cost effective that do not require high upfront expenditure, rather remain high on operational expense (OPEX).

4.3. Software as a Service (SaaS) Business Model

The Software as a Service (SaaS) delivery model has revolutionized the use of technology in everyday life – be it the enterprise or the consumer setup. It is a cloud-based business model that delivers applications over the internet, allowing users to access software without installing the software locally. SaaS is a subscription-based model centrally hosted with the service provider which manages all aspects of the software including regular updates, maintenance, security and infrastructure. Highly considered as cost effective, NASSCOM estimated the India SaaS market to be $3.5 Bn. in FY 2020. In another report, Bessemer Venture Partners (BVP), a venture capital firm, estimates the India SaaS market to become $25 Bn. by 2025 and $50 Bn. in 2030.

Exhibit 18: Leading SaaS countries, by number of companies, January 2024

Country	Number of companies
United States	9100
United Kingdom	1500
Canada	992
Germany	840
India	711
France	684
China	443
Australia	408
Brazil	342
Spain	341

Source: Statista, January 2024[17]

Much like most application areas, SaaS has also impacted video surveillance and biometrics space. VSaaS as discussed earlier in the report is a fast-emerging area with strong interest from several video surveillance vendors and service providers. Beyond VSaaS, there is an interest from startups in developing innovative video surveillance software applications that offers advanced video analytics capability, real-time insights, higher data compression capability, and network and reliability health check. In biometrics, solutions are being provided through Biometrics-as-a-Service (BaaS) offerings that provide businesses with access to biometric authentication services without the need for extensive

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[17] Leading software as a service (SaaS) countries worldwide in 2024, by number of companies, Statista, Accessed on 7th July 2025, https://www.statista.com/statistics/1239046/top-saas-countries-list/

infrastructure or in-house expertise. The cloud-based model democratizes biometric technology, enabling organizations to leverage advanced authentication methods like fingerprint, facial or iris recognition, to improve security and user experience across important industry sectors and departments like banking and financial services, healthcare, human resources, etc.

4.4. Digital Public Infrastructure

Digital public infrastructure (DPI) refers to setting up digital systems and services that governments and public sectors establish to enhance the functioning of a digital economy and society. DPI plays a critical role in enabling public service delivery, enhancing economic opportunities and promoting social inclusion. The Government of India has been specifically focusing on DPI to promote financial inclusion, improve access to essential services, and foster social transformation. Broadly speaking, there are three foundational layers that make up DPI: identification systems, payment systems, and data exchange platforms.

Identification systems

Aadhaar is known for being unique in terms of providing digital identity to its citizen. It serves as an identity card for individuals, accessing various public and private services, eliminating the need for cumbersome documentation processes. From opening bank accounts to accessing loans, Aadhaar enables seamless know your customer (KYC) process. It helps the government save money through DBT and ensures that the aid reaches the intended recipients on time. Provided below is the list that exhibits how Aadhaar plays a critical role in DPI.

Exhibit 19: Aadhaar as an important identification system

Use-case	Purpose
Identity Verification	Identity verification and authentication of individuals accessing various government and private schemes
Financial Inclusion	Enables KYC processes
Public Service Delivery	Enables DBT significantly reducing fraud and ensuring that government subsidies reach the beneficiary
Interoperability with other systems	Integrated with UPI and DigiLocker that enhances service delivery in health, education, and governance allowing secure document sharing and payment processing
Seamless and Paperless Check-in Services	Enables DigiYatra for seamless travel experiences through facial recognition
Data Empowerment and Protection Architecture (DEPA)	Acts as user consent for data sharing, allowing individuals to control their personal data while facilitating secure transactions across various platforms

Source: Frost & Sullivan

Payment systems

UPI remains the biggest digital payment instrument. It has helped in financial inclusion, reduced cash dependency, and helped cost savings in the economy. It has also helped boost the fintech industry, encouraged e-commerce growth, and brought in a behavioral change in customers – as in how customers make payments.

UPI operates in a zero-charge framework for users and merchants, making it a cost-effective solution for digital transactions. This low operating cost has encouraged small business owners and the rural population to move the digital way. The unified payments interface allows seamless bank-to-bank transfer across different platforms, enhancing user convenience and fostering trust in digital payments. It has streamlined payment processes and reduced transaction costs. Summarily, digital payments have become a cornerstone of India's DPI, setting a global standard for efficient payment systems.

Data exchange platforms

A data exchange platform is defined as a structured and secure system designed to facilitate the sharing and transfer of data between entities (organizations, systems, or applications). It plays a pivotal role in modern information systems by enabling seamless data integration and collaboration while maintaining data integrity, confidentiality, and availability.

However, unlike an open data portal, data warehouse or data lake, a data exchange platform is designed to share data generated in widely distributed systems with no centralized management, ownership or repository of data. Here, the disparate data providers can control and possess the data yet share it with the authorized third parties it chooses. The data is represented through clearly defined standards while considering data protection and privacy, and enforcing appropriate data sharing policies, procedures, and regulations. Individuals can share their personal data with the government, or let the government share the data between themselves, or allow private sector data to be used by the government and vice versa.

Data exchanges platforms are often vertical specific like urban, agriculture, logistics, etc. This includes data collected from IoT devices and sensors (like weather, air quality, traffic, etc.), video surveillance (like demographic or geographic), tax or property records, legal documents or registrations, and historical (like archival sources). Data exchange platforms enable the creation of data-driven applications that startups and others would like to experiment with and innovate with data-driven services. Two of the most common data exchanges in India include:

- **India Urban Data Exchange (IUDX):** Developed by the Ministry of Housing and Urban Affairs (in collaboration with Indian Institute of Science – IISC) and deployed in 38 cities, IUDX helps sharing of urban data (solid waste management, bus transit, multi-modal transport, flood management, citizen safety, etc.) with local bodies and third-party developers.
- **Agricultural Data Exchange (ADeX):** Also jointly developed by IISC and the Government of Telangana, ADeX aims to connect providers and consumers of data in the agriculture sector in a trusted and efficient manner. Data types include - farmer identities and land holdings, soil health, satellite imagery, agri-market data, crop yields, weather data, etc. with applications developed like smart farmer credit, sharing of farm machinery, farmer advisories, and more.

Consent

Amidst the three foundational layers of DPI, consent remains highly critical. Consent refers to the mechanism through which individuals control their personal data and decide how it is shared with third parties. Hence it is important to create a framework that protects an individual's right to privacy.

Released in August 2020, the Data Empowerment and Protection Architecture (DEPA) aims to re-architect data flows from the current organization-centric model to an individual-centric model. It enables individuals to restore ownership and control over their personal data and gives the choice to decide how and with whom their data is to be shared. The architecture introduces consent managers (external entities that facilitate the sharing of data between the user and service provider) who act as intermediaries and ensure data sharing is being done with explicit user consent. DEPA uses a standardized electronic artifact that provides a programmable digital template to capture user consent.

5. India Market Size and Forecast

5.1. India Video Surveillance and Biometrics Solutions and Services Market

India is among the fastest growing large economies in the world. Investments are being made by the government and the private sector in technology to make the country digitally empowered. The government has implemented various initiatives like the Digital India Programme that aims to enhance digital infrastructure and digital literacy among citizens. Internet penetration has increased and so has the establishment of optical fiber networks across rural areas. Smart phone adoption has also reached greater heights. Concurrently, private investments have surged as well with India ranking fourth globally in tech venture capital (VC) investments recording $24.1 Bn. in 2022.

Video surveillance and biometric technologies play an important role in shaping India's digital economy. There has been higher sophistication in video surveillance systems with the emergence of IP cameras, AI-enabled CCTV systems, video analytics, and facial recognition. Video surveillance is no longer seen as a mere security system but as a tool for intelligence and analytics. Likewise, biometrics exemplified by systems like Aadhaar have enhanced identity verification capabilities across important industry verticals like banking and financial services, healthcare, and law enforcement, creating seamless and secured transactions while improving efficiency. Frost & Sullivan estimates that the total India video surveillance and biometrics solutions and services market is currently sized at INR. 431.09 Bn. in FY 2025. Since the COVID-19 pandemic, growth has been consistent and likely to continue growth at CAGR 16.5% from FY 2025 to FY 2030.

Exhibit 20: Total video surveillance and biometrics solutions and services market size (INR. Bn.), India, FY 2020 – FY 2030

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026*	FY 2027*	FY 2028*	FY 2029*	FY 2030*
Market Size (in INR. Bn.)	310.65	282.34	309.18	341.76	383.52	431.09	503.74	583.44	676.32	790.74	925.27

CAGR (FY 2025-FY 2030)* 16.5%

*Projected
Source: Frost & Sullivan

Market	FY 2025	FY 2030*	CAGR (FY 2025 to FY

			2030)
Indian video surveillance and biometrics solutions and services market	**INR. 431.09 Bn.**	**INR. 925.27 Bn.**	**16.5%**
Indian video surveillance solutions and services market	*INR. 274.96 Bn.*	*INR. 612.42 Bn.*	*17.4%*
Indian biometrics solutions and services market	*INR. 156.13 Bn.*	*INR. 312.85 Bn.*	*14.9%*

*Projected
Source: Frost & Sullivan

Market definitions:

- **Video surveillance solutions and services market** includes video surveillance camera, video surveillance storage, video management software (VMS), video analytics, and video command center. In a typical video surveillance/CCTV installation requirement, some of these products and solutions are integrated along with a value-added service (system integration and annual maintenance charges) and delivered to the customer. Hence, please note the market size is calculated at the end-user level, meaning that the final price the customer pays at the end which includes products and solutions, value-added system integration (SI), and annual maintenance charges (AMC).
  - o **Video surveillance camera market** includes CCTV camera vendors who offer CCTV cameras as their primary line of business along with recorder (NVR, DVR), encoder/decoder, and VMS
  - o **Video surveillance storage market** includes players who offer pure play video storage solutions
  - o **Video management software (VMS) market** includes players who offer pure play video management software
  - o **Video analytics market** includes players who offer pure play video analytics
  - o **Video command center market** include players who offer products and solutions focused on centralizing video surveillance, monitoring, and controlling activities within a single interface
- **Biometrics solutions and services market** include iris scanner, fingerprint scanner, facial recognition, and palm vein scanner. Like the video surveillance solutions and services market, the biometrics market size is also calculated at the end-user level, meaning that the final price the customer pays at the end which includes product and solution, value-added system integration (SI), and annual maintenance charges (AMC).
  - o **Iris scanner market** includes players who offer biometric products and solutions that utilize the unique patterns in the iris of the eyes for identity verification
  - o **Fingerprint scanner market** includes players who offer biometric products and solutions that capture and analyze the unique patterns of ridges and valleys on a human being's fingertips for identification and authentication purpose

o **Facial recognition market** includes players who offer biometric products and solutions that identifies an individual by analyzing their facial features

o **Palm vein scanner market** includes players who offer biometric products and solutions that identifies individuals by analyzing the unique patterns of veins in their palms.

5.2. India Video Surveillance Solutions and Services Market

5.2.1 Market Size and Forecast

Video surveillance is a fast-growing market in India. Its growth is driven by increasing security concerns, government initiatives, and advancements in technology. Growth drivers include rising incidents of crime and terrorism in India, urban safety initiatives like Smart Cities Mission, industry regulation and mandates across industry verticals, and infrastructural developments. Today, video surveillance is not only restricted to enterprises or the government but also seen in retail and residential use-cases. The transition from analog to IP-based technologies has reshaped the video surveillance landscape with other advanced technologies like video analytics, cloud-based video surveillance, and AI enabled features enabling the wider acceptance of the technology. Frost & Sullivan estimates, the India video surveillance solutions and services market to be sized at INR. 274.96 Bn. in FY 2025 and expected to grow at CAGR 17.4% to reach INR. 612.42 Bn. by the end of FY 2030. Video surveillance growth would continue as CCTV becomes a fundamental security measure for businesses and the government.

Exhibit 21: Total video surveillance solutions and services market size (INR. Bn.), India, FY 2020 – FY 2030

CAGR (FY 2025-FY 2030)*
17.4%

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026*	FY 2027*	FY 2028*	FY 2029*	FY 2030*
Market Size (in INR. Bn.)	196.71	174.47	193.01	215.51	244.00	274.96	326.75	381.76	444.69	520.94	612.42

*Projected
Source: Frost & Sullivan

The video surveillance solutions and services market include video surveillance cameras, video surveillance storage, video management software, video analytics, and video command center. Some of these products are bundled with a solution and installed through system integration to cater to the customer requirements. AMCs are also signed with customers for maintenance and repair. Video surveillance/CCTV cameras currently (FY 2024) contribute to 57.9% of the total market construction,

followed by video storage at 15.2%, and VMS at 13.5%. However, from a trending perspective, VMS and video analytics are expected to be the fastest growing segments within the market till FY 2030.

Exhibit 22: Total video surveillance solutions and services market construct (%), India, FY 2020 – FY 2030

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026*	FY 2027*	FY 2028*	FY 2029*	FY 2030*
Video Command Center	3.9%	4.4%	4.2%	4.2%	4.2%	4.4%	4.2%	4.2%	4.1%	4.2%	4.2%
Video Analytics	8.5%	8.4%	8.5%	8.5%	8.7%	9.0%	9.0%	9.2%	9.6%	10.1%	10.7%
Video Management Software	12.2%	11.9%	12.0%	12.3%	12.8%	13.5%	13.6%	13.9%	14.3%	14.9%	15.7%
Video Surveillance Storage	13.8%	14.9%	15.1%	15.2%	15.1%	15.2%	14.4%	14.0%	13.7%	13.4%	13.0%
Video Surveillance Camera	61.6%	60.4%	60.1%	59.8%	59.2%	57.9%	58.8%	58.7%	58.2%	57.4%	56.4%
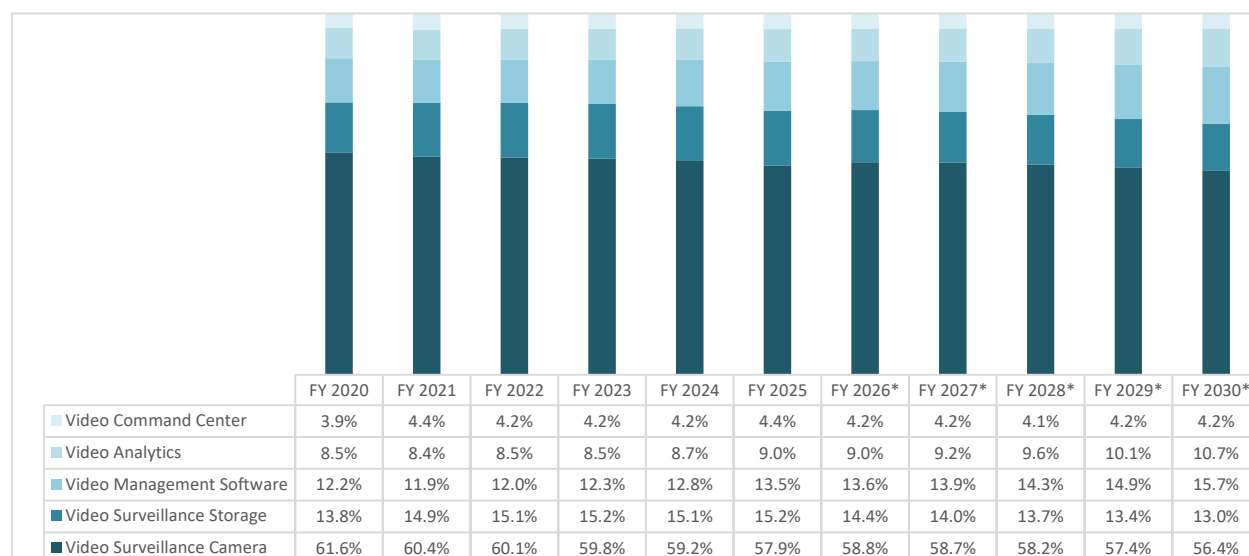
*Projected
Source: Frost & Sullivan

The India video surveillance camera market was sized at INR. 121.10 Bn. in FY 2020. Following the COVID-19 pandemic, the market declined by -13.0% in FY 2021 due to nationwide lockdown during several months of the year and limited business operations. Nevertheless, market demand spiked back in FY 2021 and growth was back on track despite the second wave of the pandemic. This boosted the demand for other adjacent video surveillance solutions (like video surveillance storage, VMS and analytics) and hence the total video surveillance market grew summarily. From INR. 159.28 Bn. in FY 2025, the video surveillance camera market is expected to reach INR. 345.70 Bn. in FY 2030. Likewise, the video surveillance storage market is likely to be sized at INR. 79.77 Bn. by the end of the forecast period.

Exhibit 23: Total video surveillance solutions and services market by product segments (INR. Bn.), India, FY 2020 – FY 2030
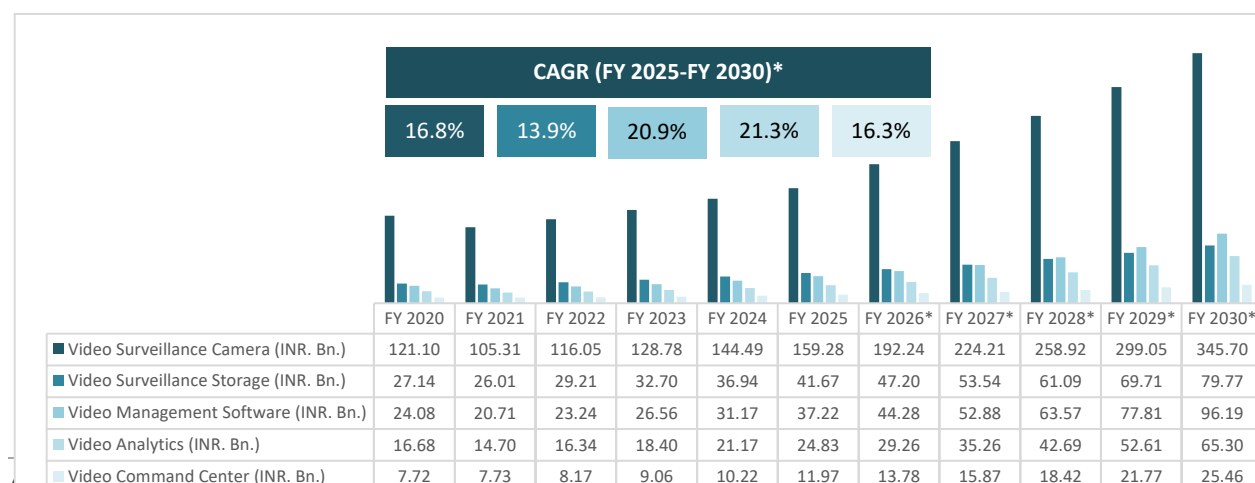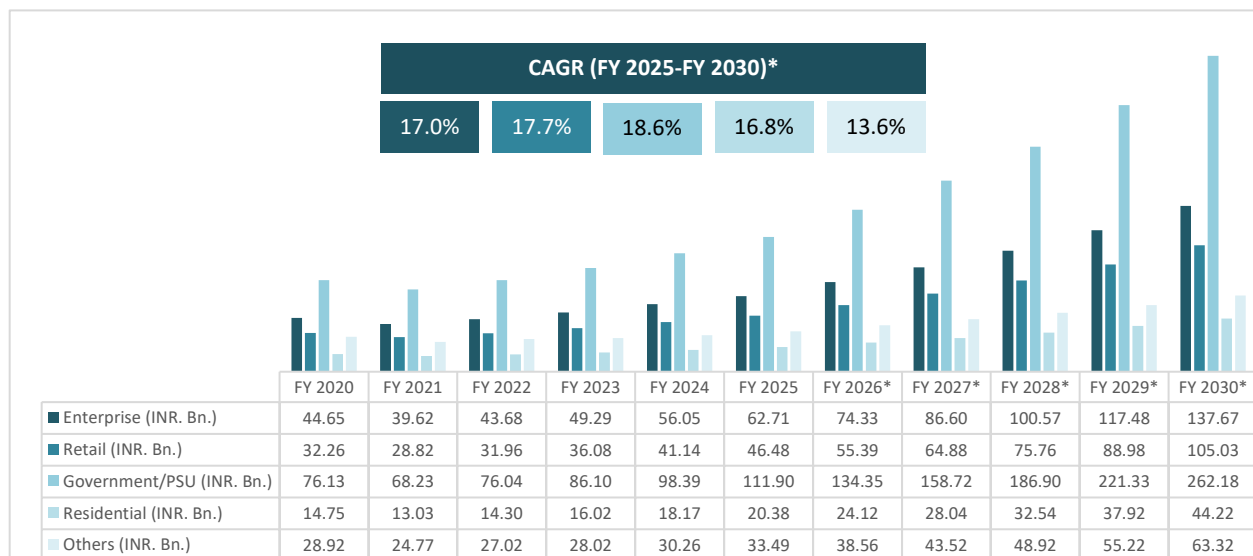

CAGR (FY 2025-FY 2030)*											
16.8%	13.9%	20.9%	21.3%	16.3%							
	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026*	FY 2027*	FY 2028*	FY 2029*	FY 2030*
Video Surveillance Camera (INR. Bn.)	121.10	105.31	116.05	128.78	144.49	159.28	192.24	224.21	258.92	299.05	345.70
Video Surveillance Storage (INR. Bn.)	27.14	26.01	29.21	32.70	36.94	41.67	47.20	53.54	61.09	69.71	79.77
Video Management Software (INR. Bn.)	24.08	20.71	23.24	26.56	31.17	37.22	44.28	52.88	63.57	77.81	96.19
Video Analytics (INR. Bn.)	16.68	14.70	16.34	18.40	21.17	24.83	29.26	35.26	42.69	52.61	65.30
Video Command Center (INR. Bn.)	7.72	7.73	8.17	9.06	10.22	11.97	13.78	15.87	18.42	21.77	25.46

5.2.2 Market Size and Forecast by Industry Verticals

Government/PSU is the largest user of video surveillance systems and solutions in India. It currently contributes to 40.7% of the total market and would continue to grow even further to likely reach 42.8% of the market construct. Government/PSU includes government and public sector undertakings in banks, financial services, power plants, telecom, post office, smart cities, traffic systems, public transport, education, industrial, law enforcement, etc. The government has been setting up video command centers across urban centers to better manage and monitor security. Video feeds received by these centers are also useful in bringing in operational efficiency and enabling proactive management capabilities.

The enterprise segment is the next biggest user of video surveillance followed by retail. Enterprise refers to commercial establishments (only private sector) including offices, hospitality, and healthcare. Some of the use-cases of video surveillance in the enterprise segment include identification of suspicious activity, employee safety, employee efficiency, visitor management, energy efficiency, etc. Likewise, using the power of AI and video analytics, the retail industry has been using video analytics to improve security, monitor customer behaviour, and store management. It is estimated that by the end of FY 2030, the retail segment would contribute to around 17.2% of the market in India.

Exhibit 24: Total video surveillance solutions and services market by industry verticals (INR. Bn.), India, FY 2020 – FY 2030

CAGR (FY 2025-FY 2030)*				
17.0%	17.7%	18.6%	16.8%	13.6%

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026*	FY 2027*	FY 2028*	FY 2029*	FY 2030*
Enterprise (INR. Bn.)	44.65	39.62	43.68	49.29	56.05	62.71	74.33	86.60	100.57	117.48	137.67
Retail (INR. Bn.)	32.26	28.82	31.96	36.08	41.14	46.48	55.39	64.88	75.76	88.98	105.03
Government/PSU (INR. Bn.)	76.13	68.23	76.04	86.10	98.39	111.90	134.35	158.72	186.90	221.33	262.18
Residential (INR. Bn.)	14.75	13.03	14.30	16.02	18.17	20.38	24.12	28.04	32.54	37.92	44.22
Others (INR. Bn.)	28.92	24.77	27.02	28.02	30.26	33.49	38.56	43.52	48.92	55.22	63.32

*Projected
Enterprise: includes only private enterprises and commercial offices including healthcare and hospitality
Retail: includes all retail stores and outlets
Government/PSU: includes government and public sector undertakings in banks, financial services, power plants, telecom, post office, smart cities, traffic systems, public transport, education, industrial, law enforcement, etc.
Residential: includes standalone and gated residential complexes
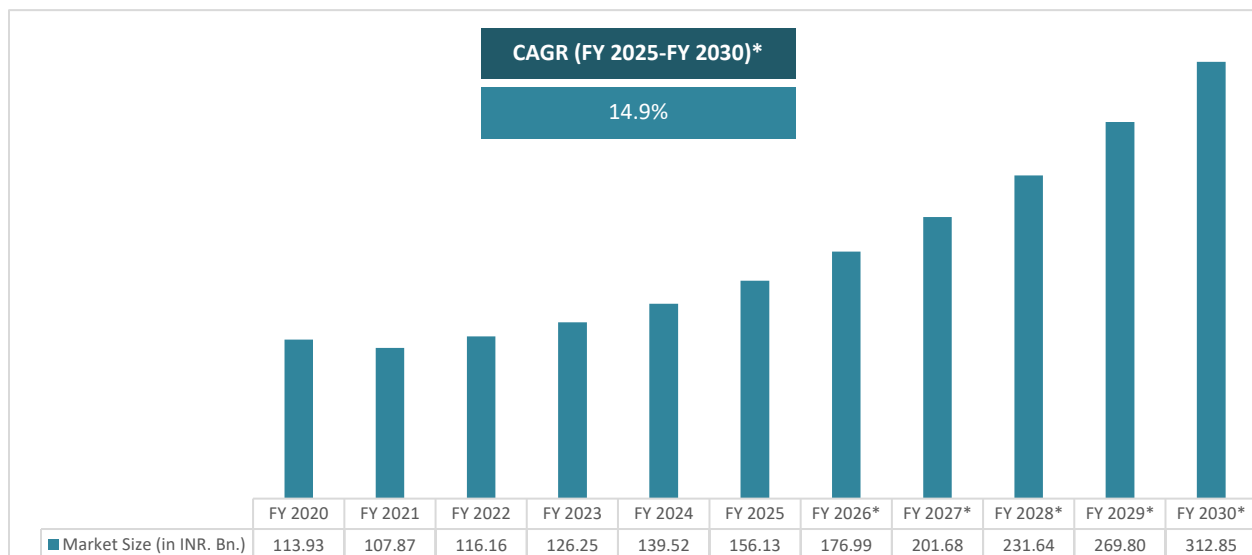Others: include private sector industrial and educational institutions
Source: Frost & Sullivan

5.3. India Biometrics Solutions and Services Market

5.3.1 Market Size and Forecast

India remains as one of the important biometrics markets in the world. Biometrics finds use-cases in Aadhaar and e-passport programs that use fingerprints, iris recognition, and facial patterns. The growth is primarily driven by the government's aim to develop a digital economy without compromising on security. Enhanced security measures in banking, healthcare, and consumer electronics further propel market growth. In addition, biometrics have helped improve accessibility, user convenience, and made systems friendly – especially for mobile devices. As enterprises in India strive to improve operational efficiency and reduce frauds, the biometrics market is set to play a critical role in enabling secure identification practices in the country. Frost & Sullivan estimates the India biometrics solutions and services market to be INR. 156.13 Bn. in FY 2025 and likely to become INR. 312.85 Bn. in FY 2030.

Exhibit 25: Total biometrics solutions and services market size (INR. Bn.), India, FY 2020 – FY 2030

CAGR (FY 2025-FY 2030)*

14.9%

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026*	FY 2027*	FY 2028*	FY 2029*	FY 2030*
Market Size (in INR. Bn.)	113.93	107.87	116.16	126.25	139.52	156.13	176.99	201.68	231.64	269.80	312.85

*Projected
Source: Frost & Sullivan

The biometrics solutions and services market include iris scanner, fingerprint scanner, facial recognition, and palm vein scanner. The fingerprint scanner market remains the biggest among the four aforementioned biometric technologies. It is followed by facial recognition, and iris scanner market. The palm vein scanner market is the smallest among all and still emerging.

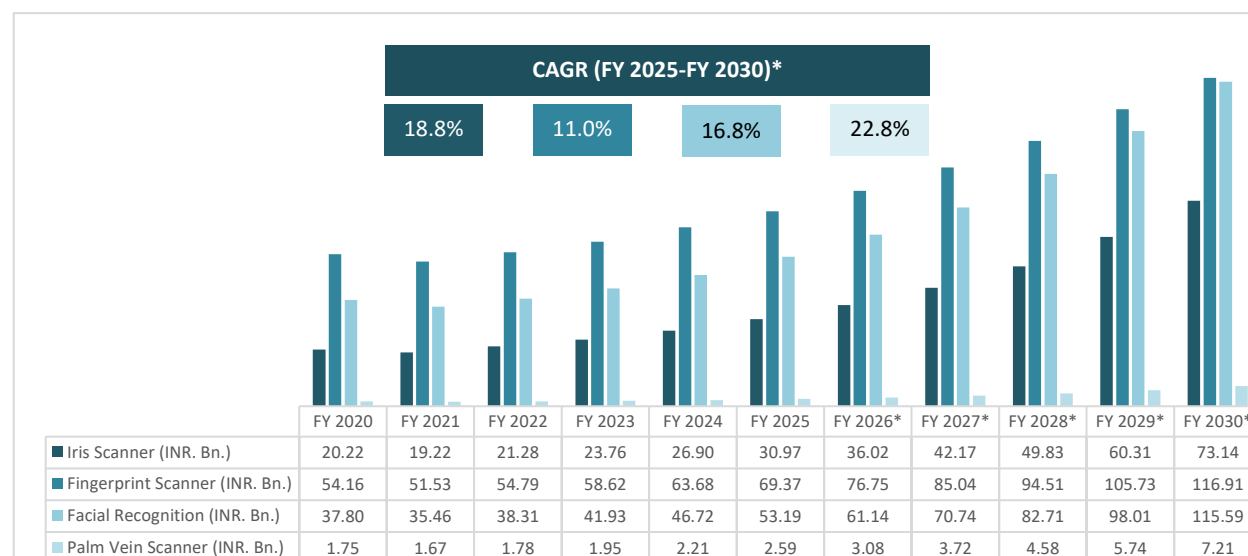**Exhibit 26: Total biometrics solutions and services market construct (%), India, FY 2020 – FY 2030**

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026*	FY 2027*	FY 2028*	FY 2029*	FY 2030*
Palm Vein Scanner	1.5%	1.5%	1.5%	1.5%	1.6%	1.7%	1.7%	1.8%	2.0%	2.1%	2.3%
Facial Recognition	33.2%	32.9%	33.0%	33.2%	33.5%	34.1%	34.5%	35.1%	35.7%	36.3%	36.9%
Fingerprint Scanner	47.5%	47.8%	47.2%	46.4%	45.6%	44.4%	43.4%	42.2%	40.8%	39.2%	37.4%
Iris Scanner	17.7%	17.8%	18.3%	18.8%	19.3%	19.8%	20.4%	20.9%	21.5%	22.4%	23.4%
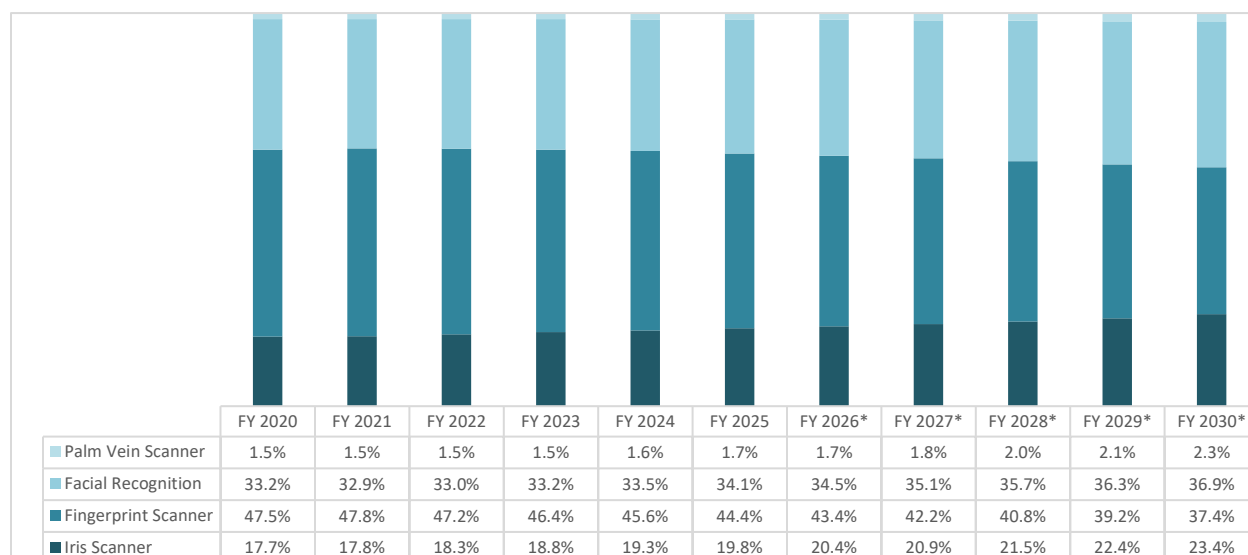
*Projected
Source: Frost & Sullivan

The fingerprint scanner market is currently (FY 2025) sized at INR. 69.37 Bn. representing 44.4% of the total market. It is expected to grow at CAGR 11.0% in the next five years (till FY 2030) and likely to reach INR. 116.91 Bn. Concurrently, the facial recognition market is the next big biometric technology in India with a current market revenue of INR. 53.19 Bn. The iris scanner market is likely to gain market share within the total biometrics market and contribute to 23.4% of the pie by end of the forecast period.

Exhibit 27: Total biometrics solutions and services market by product segments (INR. Bn.), India, FY 2020 – FY 2029

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026*	FY 2027*	FY 2028*	FY 2029*	FY 2030*
Iris Scanner (INR. Bn.)	20.22	19.22	21.28	23.76	26.90	30.97	36.02	42.17	49.83	60.31	73.14
Fingerprint Scanner (INR. Bn.)	54.16	51.53	54.79	58.62	63.68	69.37	76.75	85.04	94.51	105.73	116.91
Facial Recognition (INR. Bn.)	37.80	35.46	38.31	41.93	46.72	53.19	61.14	70.74	82.71	98.01	115.59
Palm Vein Scanner (INR. Bn.)	1.75	1.67	1.78	1.95	2.21	2.59	3.08	3.72	4.58	5.74	7.21

CAGR (FY 2025-FY 2030)*: 18.8% 11.0% 16.8% 22.8%

*Projected
Source: Frost & Sullivan

5.3.2 Market Size and Forecast by Industry Verticals

Biometrics find the biggest use-case in the government and PSU industry vertical. As per Frost & Sullivan estimates, 75.5% of the total biometrics market revenue currently comes from this vertical which is likely to decrease (marginally) during the forecast period (by FY 2030). As discussed earlier in the report, Biometrics forms the foundational element in Aadhaar. The digital identity is used in numerous government schemes ensuring subsidies, public distribution systems, banking and financial services, passport applications, mobile phone connections, Ayushman Bharat Heath Account, digital life certificates for pensioners, scholarships, and more.

Exhibit 28: Total biometrics solutions and services market by industry verticals (INR. Bn.), India, FY 2020 – FY 2030

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026*	FY 2027*	FY 2028*	FY 2029*	FY 2030*
CAGR (FY 2025-FY 2030)*											
16.3%							14.5%				
■ Enterprise (INR. Bn.)	26.77	25.57	27.76	30.43	33.90	38.25	43.72	50.42	58.60	69.07	81.34
■ Govt./PSU (INR. Bn.)	87.16	82.31	88.40	95.83	105.61	117.88	133.27	151.26	173.03	200.73	231.51

*Projected

Enterprise: includes only private enterprises, commercial offices, private healthcare, private hospitality, private education, etc.

Government/PSU: includes government/ministries, government schemes, and public sector undertakings

Source: Frost & Sullivan

In the enterprise segment, biometrics is used for access control, time and attendance tracking, secure transactions, user experience improvement, etc.

6. Government Contract Award Mechanism

6.1. Tendering Process

The government and PSUs take the route of the tendering process while awarding a contract to a vendor. Tendering process is a structured method opted by organizations, particularly in the public sector, to procure goods and services. The tendering process ensures that there is transparency and fairness in the selection of suppliers or contractors. The process starts with an announcement to invite vendors and suppliers to bid for the requirement. A tender document is being floated that outlines the project requirements, specifications, timeline for the project, terms and conditions, and evaluation criteria. At times a pre-bid meeting is held to clarify questions or concerns from potential bidders. Interested bidders prepare and submit their bids by the deadline along with all necessary documentation. The buyer then assesses all the submitted bids based on the pre-set criteria like technical expertise, delivery timelines, and pricing. Thereafter, the most suitable bidder is selected. Finally, the chosen vendor/supplier is notified and the contract formalized with agreed terms and conditions.

In the contract award mechanism, there are two main types of tenders: open tender and closed tender. Open tender is a process where any vendor or supplier who wishes to offer service participates in the tendering process. On the contrary, closed tendering is a mechanism where the buyer decides as to which all vendors can participate in the process. Open tenders can be further classified as quality & cost-based selection (QCBS) and least cost-based selection (LCBS). In QCBS, bidders are evaluated on two parameters: quality, and cost. A formula is used to calculate the composite bid score of a bidder and the vendor/bidder with the highest composite bid score wins the contract. For LCBS and closed tenders, the bidder with the lowest cost is preferred after it meets the technical and financial criteria.

Exhibit 29: Contract Awarding Process in Government and PSU Requirements
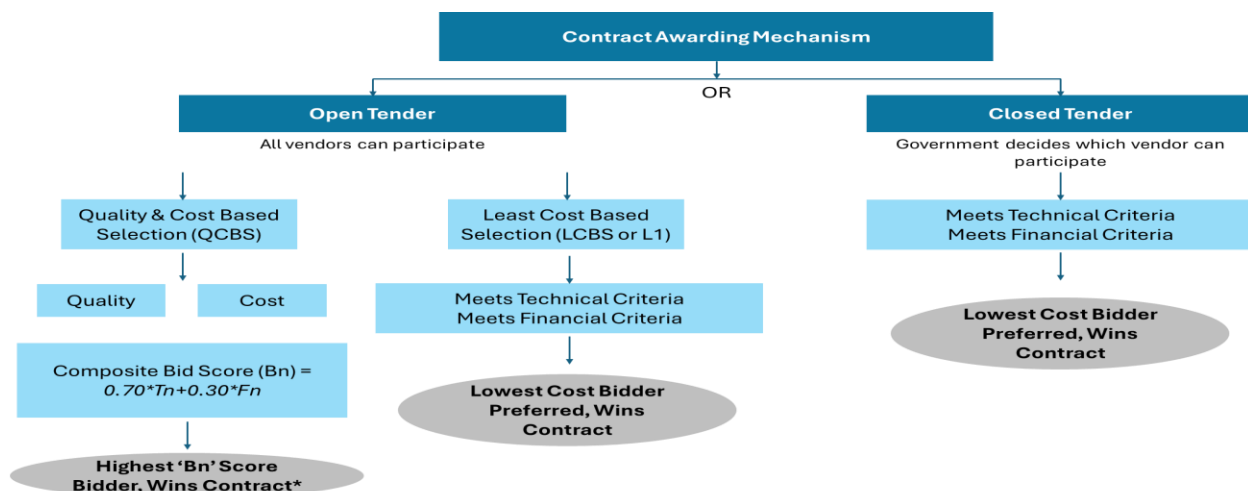
Please note, 0.70 (or 70%) and 0.30 (or 30%) used in the formula of Bn is used as an example and can be changed by the tendering authority

Bn: Composite Bid Score
Tn: Technical Score of the Bidder (out of maximum of 100 marks)
Fn: Normalized Financial Score of the Bidder (out of maximum of 100 marks)

*In the event of a "tied Composite Bid Score", the bidder securing the highest technical score is adjudicated as the Best Value Bidder for award of the Project

Source: Frost & Sullivan

6.2. Government Tender Examples

Tender Example 1

Buyer: Centre for Railway Information Systems (CRIS), Ministry of Railways

Scope of work: Supply, installation & commissioning of IP based CCTV system in EMU and MEMU coaches as per RDSO specification, and crew voice & Video Recording System (CVVRS) integrated with/without Railway Driver Assistance System (RDAS) in Driver Cabs of Driving Motor Coaches with 03 years Warranty followed by 05 years Comprehensive Annual Maintenance Contract (CAMC)

Qualification criteria of bidders (non-exhaustive):

- Bidders to be a private/public company
- Average Annual Turnover of bidder during the last three Financial Years (i.e., 2020-21, 2021-22 & 2022-23) to be minimum INR. 50 Crore.
- Annual Turnover of OEM of Camera during any of the last three Financial Years (i.e., 2020-21, 2021-22 & 2022-23) to be minimum INR. 100 Crore.
- The bidder to have successfully completed/executed the work of "Supply, Installation & Commissioning of minimum 5000 Nos. CCTV Cameras as part of one or more CCTV Surveillance Systems in Central/State Govt. Department/Organization/Autonomous body/PSU/Semi-Govt. Organization/Local Body/Authority or a Public Listed Company in India (having average annual Turnover of Rs.500 Crore & above)" during last five (05) financial years & current financial year ending last day of month previous to the one in which the tender is invited.
- The bidder shall be an original equipment manufacturer (OEM) or an authorized representative of the respective OEMs.
- Security auditing & testing of the offered CCTV System (Camera, VRU/ M-NVR/NVR (including associated sub- units, if any) & System Software of Camera and VRU/MNVR/NVR) including Source Code of Camera & Software to be carried out by STQC as per RDSO specification No. RDSO/SPN/TC/106/2022, Ver.2.1 with amendment No. 1 or latest

Technical suitability criteria (non-exhaustive):

- The Bidder must have a valid ISO 9001:2015 or latest Quality Management Certification at the date of closing of the tender.
- In case the bidder is using any licensed software/tool for the said activity the bidder shall submit the undertaking they have valid licenses for all such software/tool.
- The bidder must furnish the complete Bill of Material (BoM)/Bill of Quantity (BoQ) of offered products
- Bidder to provide undertaking to integrate with the agent software provided by centralized Video Management System (CVMS) including Enterprise Management System (EMS)

Financial evaluation:

- The Financial bid of the bidders who are declared technically suitable shall be opened at this stage and shall be taken up for financial evaluation.

Tender Example 2

Buyer: Information Kerala Mission (IKM), Government of Kerala

Scope of work: Supply, installation, testing, and commissioning of IP based Video Surveillance System (CCTV) at its office at Swaraj Bhavan, Nathancode, Thiruvanananthapuram

Qualification criteria of bidders (non-exhaustive):

- The bidder to be an OEM or Authorized Dealer/Distributor/System Integrator/Company/Firm of the OEM of the offered product.
- Bidder to have experience of successfully completing similar projects during the last 3 years.
- Any Government / Government agency / Banks / Financial Institutions in India to not have blacklisted the Bidder during the last 5 years. Self-declaration to that effect to be submitted along with the technical bid.
- The firm must possess a valid GST/Sales Tax Registration Certificate. (attested copies of all the above certificates should be submitted along with the proposal).
- Bidder to provide necessary supporting documents as proof in respect of the eligibility criteria mentioned above.

Technical suitability criteria (non-exhaustive):

- Bidders to share all the relevant firmware/OS/Patches etc. as and when they are released by OEM during the entire warranty period at no cost to IKM.
- The vendor to liaison on behalf of IKM, with other different OEMs for repairing or replacing of equipment(s) and all other accessories during warranty period.
- Annual Maintenance of the entire system after the warranty to be undertaken as per the terms and conditions mentioned in the tender and any other condition agreed upon as per the terms and conditions of IKM.

Tender Example 3

Buyer: NTPC Limited, a Government of India Enterprise

Scope of work: "CCTV based Surveillance System for NTPC Vindhyachal Township Area

Qualification criteria of bidders (non-exhaustive):

- The Average Annual Turnover of the Bidder to be not less than 53 lacs (Rupees Fifty-Three Lacs Only) during the preceding three (3) completed financial years as on the date of Techno-Commercial bid opening.
- Any Certificate(s) / Financial Statement(s) / Audited Balance Sheet and P&L Account (wherever applicable) undertaken/ signed by a Member of Institute of Chartered Accountant of India (ICAI), which Bidders submit in support of compliance to Qualifying Requirements (QR), to carry Unique Document Identification Number (UDIN) generated in line with the Gazette Notification of Council of Institute of Chartered Accountant of India (ICAI).
- 'Class-I local suppliers'/ 'Class-I local suppliers and Class-II local suppliers'' only are eligible to participate in this tender, as defined in the bidding documents/ Public Procurement (Preference to Make in India), Order 2017 and its subsequent amendments/ revisions issued by DPIIT. The bidders may apprise themselves of the relevant provisions of bidding documents in this regard before submission of their bids."

Technical suitability criteria (non-exhaustive):

- The bidder should have supplied, erected / supervised erection and commissioned/supervised commissioning of the combination of offered make of IP based camera and offered make of video management software for CCTV system having installation of minimum TEN (10) nos. CCTV cameras in a single contract which should have been in successful operation for at least one year prior to the date of Techno-commercial bid opening
- The Bidder to have executed similar works of order values as mentioned here under during the preceding seven (7) years as on the date of Techno-commercial bid opening as per the following:
    - Executed value of not less than 42 lacs in a Single Contract
    - Executed value of not less than 27 lacs each in Two Contracts
    - Executed value of not less than 21 lacs each in three Contracts

7. System Integration Market

System integration (SI) is defined as the process of connecting multiple subsystems and components to enable cohesive functioning. It is the process where different systems (hardware, software, and networking components) with disparate technologies are connected to communicate and share data seamlessly, improving efficiency and productivity within an organization. System integration eliminates data silos enabling systems to talk to each other and bring in streamlined workflows, automated processes, and improved data accuracy. As enterprises adapt to complex IT infrastructure, it is imperative that system integration becomes essential for operational success. Existing legacy systems need to be tied up with advanced and emerging technologies without causing any disruption to overall operations. This adaptability is critical in the fast-evolving technology landscape as enterprises and the government aim to reap the benefit from the latest technology developments.

7.1. Importance of System Integration in Digital Transformation

Mentioned below are some of the important aspects of SI in digital transformation.

- **Facilitates innovation and agility: System** integration has been key to connecting disparate systems, applications, and data sources into a unified framework. It allows enterprises to respond quickly to market changes by introducing advanced technology, products and services into the IT infrastructure. By creating a seamless flow of information across various platforms, enterprises leverage their data to drive innovation and respond to changing customer demands more effectively.
- **Enables real-time data access and analytics:** SI helps enterprises create a mechanism for gaining access to real-time data across all integrated systems. It enhances decision-making processes, as enterprises can analyze data and derive actionable insights without delays caused by manual data entry or outdated tools.
- **Boosts omni-channel customer engagement:** SI helps create a comprehensive view of the customer interaction across different channels. It assists businesses in ensuring consistent experiences across all platforms, critical in today's multi-channel strategy.
- **Improves scalability:** Scalability is a fundamental aspect for any IT infrastructure. As organizations grow, it is critical that the IT infrastructure expands as well. System integration helps provide the scalability required to expand operations without completely changing the existing infrastructure. Cloud technologies help businesses with flexible resource management, helping organizations to scale up or down based on the business decision.

7.2. The Need for Value-added System Integration

The fundamental difference between a legacy system integration and value-added system integration lies in the scope and depth of services being provided to the customer. While a system integrator's primary goal is to achieve interoperability among different systems, enabling streamlined operations, the value-added system integrator goes beyond basic connectivity and enhances the integrated solution with additional features, services, or functionalities that improves the overall operational efficiency and performance of the organization. The value-added system integrator offers tailored and customized

solutions to the customer along with comprehensive support services that increase the functionality and usability of the integrated systems. Often, the value-added system integrator provides consulting (technical advisory), training, and maintenance services to the client. They are also capable of designing and building innovative solutions (in-house) to address and cater to complex IT needs. Summarily, value-added system integration is about providing a more comprehensive approach to digital transformation that elevates overall user experience and business outcomes through new cutting-edge technology solutions, advanced services, and customization. Please note, based on their capability, a value-added system integrator can also be termed as a technology services and consulting company.

7.3. Role of Value-added System Integration in Video Surveillance

Value-added system integration in video surveillance refers to improving the operational efficiency of traditional video surveillance systems through integration of additional features, services, and technologies. It goes much beyond just connecting the video surveillance systems/CCTV cameras, thus providing better value addition to the organization. Mentioned below are the key aspects and benefits that value-added SI offers in video surveillance.

Exhibit 30: Key aspects and benefits of value-added SI in video surveillance

Aspect	Benefit
Integration with other security systems like access control, perimeter security, intrusion detection, and security alarm	Integration of video surveillance with security systems help create a comprehensive security framework that enhances monitoring, response capabilities, and overall safety
Establishing Central Command Center	SI helps create a central command center which is a unified and central interface for managing multiple security systems that simplify operations, allowing security personnel to monitor and control video surveillance and access control from a single platform
Automation of Security Processes	Integrated systems automate a range of security tasks such as alert triggering or displaying relevant camera feeds when specific access points are used, hence relieving security personnel from some of their workload
Intelligent Reporting	Integration helps security teams to create real-time intelligent reports based on data and video feeds received from different security systems
Enables Video Analytics	Value-added system integrators at-times play the role of innovative solution providers who develop in-house solutions like video analytics with use-cases like object identification and tracking, facial recognition, retail analytics, occupancy management, and more
Video Compression Solutions	Leveraging software development capability, value-added SIs can

	also compress video using advanced compression techniques, optimizing storage
Surveillance Health Monitoring Solutions	Service providers can develop system health monitoring tools that can identify any fault in the surveillance system

Source: Frost & Sullivan

7.4. Criticality of Value-added System Integration in Biometrics

With different industry regulations around data privacy and security (like General Data Protection Regulation - GDPR), value-added system integrators help organizations implement biometric solutions that comply with legal requirements. System integration ensures that the data collected, stored and processed is secured and protects user privacy while meeting regulatory requirements. Listed below are some of the aspects and benefits of SI in biometrics.

Exhibit 31: Key aspects and benefits of value-added SI in biometrics

Aspect	Benefit
Smooth Integration with Existing Security Systems	Value-added integrators ensure that biometrics solutions are integrated smoothly with existing security systems like access control, time attendance, and identity management systems
Tailored Solutions	SIs help provide customized solutions for clients that address the specific needs of an organization (like employee access control, customer identification, or secure transactions)
Security Enhancement	Integrators help enterprises sync up biometrics with other security systems to create multi-factor authentication (MFA) that combines password with biometrics
Regulatory Compliance	System integrators ensure that organizations comply with various legal, and compliance needs while implementing biometric solutions
Intelligent Reporting	System integrators help aggregate biometric data with other operational data, enabling organizations to analyze trends and generate insights

Source: Frost & Sullivan

8. About Transline Technologies

8.1. Company Overview

Founded in 2001 and headquartered in New Delhi, Transline Technologies (also referred to as Transline in this report) is a specialized technology solutions provider with a focus on designing, developing, and deploying integrated security and surveillance systems, biometric authentication platforms, and artificial intelligence-driven software platforms. As industries evolve, the boundaries between physical infrastructure, IT, and operational technologies are blurring, creating a growing demand for integrated solutions that address security, efficiency, and scalability. Transline delivers integrated video surveillance and biometric solutions that enhance organizational security, safety protocols, and attendance management capabilities. The company's in-house team developed proprietary technology solutions like StorePulse (an artificial intelligence-powered video analytics tool), CamStore (a real-time video compression tool for CCTV remote storage that reduces bandwidth consumption by up to 90%), and CheckCam (a CCTV network health monitoring system) that are integrated into Transline's comprehensive portfolio of solutions and delivered to customers through the Software-as-a-Service (SaaS) cloud delivery model. By leveraging its experience in security surveillance, biometrics, and IoT solutions, Transline aims to address government priorities such as public safety, smart city infrastructure, efficient resource management, and national development in addition to deploying CCTV cameras, panic buttons, and global positioning systems (GPS) in Delhi Transport Corporation (DTC) buses. A high revenue growth especially in the last three years (FY 2023 to FY 2025) for Transline Technologies is a testament to the trust placed by its customers in the company's solutions and services offering. Operating through regional offices in Navi Mumbai and Hyderabad, Transline ensures a pan-India presence that enables the company to deliver scalable and localized integration services. Each project that Transline undertakes is designed to meet client-specific requirements, blending the best in technology, hardware, and support with its expert team.

As a comprehensive technology company, Transline Technologies provides end-to-end solutions spanning across a wide range of digital and physical security needs. The company's offerings are thoughtfully and strategically designed/developed to position Transline an expert cross key industry verticals including government/public sector undertakings ("PSUs"), information communications technology ("ICT"), railway, telecommunications, manufacturing, retail and education, and food and beverage, where Transline leverages its deep understanding of sector-specific requirements to provide customized technology solutions. Transline is positioned to become the one-stop solution provider of choice for surveillance and security, offering a combination of software, hardware, and advanced analytics. The company is one of the prominent players in India's video surveillance and biometrics sector, with a strong track record in deploying advanced technologies and customized integrated solutions.

8.2. Portfolio of Offerings

Being a technology services and consulting company, Transline Technologies has a wide portfolio of offerings. Mentioned below is the list of portfolio offerings from Transline Technologies.

Industry Solutions

- **Video Surveillance Solutions**

  The video surveillance market in India continues to grow steadily, supported by increasing security needs, government initiatives such as the Smart Cities Mission, regulatory requirements across sectors, and wider adoption in residential and retail settings. Transline provides end-to-end surveillance infrastructure, including high-resolution IP cameras, advanced video analytics, and access control systems, all managed through centralized command and control rooms.

  - **Artificial Intelligence (AI) enabled Video Surveillance:** Transline provides video surveillance solutions that are meant to enhance security, operational efficiency, and data insights. The company offers IP cameras, CCTV systems, access control systems and video analytics software which are empowered with advanced video surveillance technology like AI-based analytics, facial recognition, and cloud-based platforms.

  - **AI and Storage Solutions:** Through Transline's AI driven solutions, the company offers tools for real-time surveillance and operational optimization. It also has advanced solutions for storage. The solutions are customized to meet customer needs and feature some of its own softwares, "StorePulse", "CheckCam", and "CamStore". The in-house developed proprietary software, StorePulse, provides insights by tracking footfall, monitoring customer behavior, and optimizing workflows across different sectors. CheckCam enhances CCTV network reliability with real-time alerts and automated issue resolution, and CamStore addresses storage challenges by compressing CCTV footage, reducing bandwidth usage by up to 90%. All these solutions are meant to elevate security, streamline operations, and improve the operational efficiency of its customers.

  - **Internet of Things (IoT) for Smart Cities:** Transline's IoT enabled smart city focus includes monitoring and people counting. These solutions are developed to help municipalities and urban developers with real-time data and analytics for effective resource management, traffic optimization, and public safety enhancement.

  - **E-Surveillance Solutions:** Transline offers e-surveillance solutions that are designed to enhance security and safety across diverse environments through comprehensive, real-time monitoring. The company provides complete surveillance infrastructure including video cameras, video analytics software, and access control systems, that are managed through central control and command centers. With AI-based analytics and real-time remote monitoring capabilities, Transline helps customers to detect potential threats easily and coordinate swift responses while maintaining secure, compliant, and controlled environments.

- **Biometric Solutions:** Leveraging the power of advanced biometric technologies, Transline offer a range of solutions that include biometric authentication (iris scanner, fingerprint scanner, palm vein scanner), facial recognition software Aadhaar tablet, Aadhaar payment enrolment, centralized attendance, E-KYC (automated identity verification), multimodal biometrics, 2-factor authentication, biometric data and integration of biometrics with other systems. These next-generation authentication solutions are widely used across critical industry verticals like banking and financial services, healthcare, and government ensuring compliance and operational efficiency.

- **IT Infrastructure, and Hardware and Software Solutions:** Over the period of time working with different customer sets and addressing business challenges Transline has developed expertise in designing, deploying, and managing communication infrastructure and enterprise networks, including data center development, network management, and end-client security services. These solutions enable organizations to build robust digital environments without compromising on security.

- **Services:** Transline offer customers IT services which includes technical manpower and annual maintenance services. IT services include support (onsite and offsite) and maintenance of enterprise IT infrastructure. In addition, the proprietary software solutions developed by Transline are also offered to customers as software-as-a-service (SaaS) on a subscription basis thus making the income stream for the company steady and predictable.

Proprietary Innovations

Transline has been an innovation driven organization. With strong support from original equipment manufacturers (OEMs) and technology vendors, the in-house team at Transline is equipped and capable of developing state-of-the-art products tailored to evolving market demands. The company's proprietary software, StorePulse offers e-surveillance insights, tracking footfall and optimizing workflows across different sectors, while CheckCam ensures CCTV network health with real-time alerts and automated issue resolution, geolocation tracking and automated incident management, minimizing downtime and enhancing security. CamStore reduces bandwidth consumption by up to 90% while preserving footage integrity with negligible quality loss providing storage for longer period of time and thus keeping crucial details intact for complete clarity and providing faster processing for seamless real-time monitoring.

Listed below is an overview of the proprietary products and solutions developed by Transline Technologies:

- **StorePulse:** Transline StorePulse software is an AI-powered video analytics tool that integrates with CCTV systems to cater to the unique operational needs of industries like retail, manufacturing and other high footfall industries. StorePulse allow users to monitor employee productivity, workflow efficiency, and compliance, ensuring smooth operations and reduced downtime including insights into customer behavior and customer demographics (including age/sex distribution). StorePulse also enables businesses to identify patterns, analyze trends, and implement data-driven decisions across multiple locations. These features in turn help improve sales and offer target marketing opportunities.

- **CheckCam:** Meant to ensure the health and reliability of CCTV networks, CheckCam provides real-time alerts, and GPS-tracking to safeguard the surveillance infrastructure. The solution comes with features like live status dashboards, automated ticketing, and incident location mapping that enable organizations to proactively manage CCTV networks, minimize downtime, and maintain continuous surveillance. CheckCam helps address common CCTV network challenges like identifying failed cameras, camera disconnections, network down status, unexpected system malfunctions, and delayed responses to security threats.
  With features like realtime alerts, administrators can get notified of system failures, camera drops or unusual activity. It helps prioritize notifications that are most critical. It assists in

responding instantly to potential threats and customizing alerts that are most important. API integration enables data sync-up across platforms for real-time accuracy and helps keep all systems updated automatically. It boosts capabilities like advanced analytics and reporting thereby streamlining operations with user management tools. Camera locations can be identified easily on an interactive map through the GPS-tracking feature, simplifying resource management and deployment, and enabling faster incident response. CheckCam comes with a comprehensive management console that automates ticket creation after a fault has been identified and thereafter assigns task instantly to the right team.

- **CamStore:** A data compression solution for CCTV systems, CamStore reduces storage consumption by up to 90%, thereby delivering significant savings while maintaining footage integrity. The software tool is specifically designed to help customers (like corporate offices, public spaces, retail stores, manufacturing facilities, and educational institutions) with extensive storage needs across multiple locations or for long-term surveillance, addressing bandwidth and storage constraints effectively.

  CamStore provides smart compression, seamless integration, high quality footage, easy access & retrieval, and scalable storage plans. It supports a wide range of video formats and IP CCTV systems. It uses advanced algorithms to reduce bandwidth consumption by up to 90% while preserving footage integrity with negligible quality loss providing storage for longer period of time and thus keeping crucial details intact for complete clarity and providing faster processing for seamless real-time monitoring.

- **Palm Scanner-Based Attendance Machine:** The biometric attendance system allows secure and contactless tracking of employee attendance. This system uses palm vein recognition technology and is equipped with an Android interface that integrates seamlessly with HR management systems for real-time data synchronization. The system enhances accuracy, accountability, and streamlined reporting, making it ideal for large enterprises with diverse workforce requirements.

- **ID1 Software:** Transline ID1 software provides a secure and contactless centralized attendance solution for its customers. The software integrates easily with CCTV based attendance systems as well as biometrics (facial, palm, fingerprint Aadhaar) and GPRS based attendance systems. The software is meant to be implemented in large-scale organizations with a large employee base. In addition, Transline has also developed a complementary palm and finger-based attendance machine. Equipped with an intuitive Android interface, the Transline palm and finger scanner ensures accurate employee identification and integrates seamlessly with HR management systems for real-time data synchronization. Enterprises using the Transline software and scanners benefit from enhanced accuracy in attendance tracking, streamlined reporting, and improved accountability, thus making the system suited for large enterprises with diverse workforce requirements.

Value-added IT System Integration and Managed Services

Through Transline's integration solutions, the company delivers tailored projects that seamlessly combine hardware, software, and services to meet the unique requirements of each customer. Most of

these projects involve product installation, system integration, and maintenance and support of sophisticated security and IT systems, along with sourcing of equipment and components from Transline's preferred vendors. Not just implementation, Transline also provides functional training for installed solutions, to ensure that clients maximize the utility of their systems.

In addition, Transline also extends its service offerings to IT managed services. It provides customers with access to technical manpower, skill development training, and comprehensive annual maintenance services. Signed through service-level agreements (SLAs), these services are structured for flexibility, with payments aligned to pre-defined intervals or contractual terms, ensuring reliable support.

8.3. Enabling Technology Transformation with SaaS

Transline has been meeting customer requirements by integrating the proprietary Transline solutions into IT environments and offering these solutions as Software as a Service (SaaS). This enables customers with flexible and scalable tools that grow their business. From optimizing retail operations and ensuring reliable surveillance to safeguarding sensitive data, Transline products enhance client outcomes and thereafter position Transline Technologies as a prominent player in India for technological advancements. The combination of customized integrated solutions, managed services, and proprietary technologies ensures that customers receive end-to-end support, enabling them to focus on their goals while Transline manages their security, IT, and operational needs.

8.4. Leveraging Next-generation Technologies

Transline has been leveraging cutting-edge information and communication technologies (ICT) to create smarter solutions meant for a diverse range of industry verticals. In Transline's smart city solutions portfolio, the company integrates new-age technologies like cloud computing, IoT, and AI to deliver comprehensive solutions for implementing command control and communication centers. This enables Transline to build smart datacenter and data wall solutions. Similarly, in its custom software development services, the technology provider has been using analytics, security, and cloud to develop innovative solutions that are cost-effective and agile, enabling customers with the right competitive edge.

8.5. Supply Chain and Vendor Network

Transline's projects and engagements involve a mix of software, hardware, and IT infrastructure that include cameras, equipment, cabling, wiring, switches, and consumables. These products and solutions are sourced from Transline's reliable supply chain network that is built on long-term relationships with industry's leading vendors. The partnerships with global technology vendors ensure access to high-quality components and equipments necessary for project success. This enables Transline to deliver seamless and customized solutions that meet the required standards of its clients. Some of the well-known vendor partners include Lenovo, Dell, Microsoft, Sparsh, CP+, Dahua, Willstrong, Irish, Savex, Ingram, Redington, Rashi Peripheral, KSPN, Savitri Telecoms, and more.

8.6. Team

Transline solutions and services are powered by a highly skilled team of certified technicians, engineers, and solution architects. As of 31st March 2025, Transline had a total of 461 employees which included consulting, design, deployment, and management staff. With this team, Transline offers project management, operational support, and managed services that remain critical for clients who need dependable and high-quality services.

8.7. Revenue Analysis

Riding on increased customer confidence and strong market demand, Transline Technologies has seen exceptional growth in the last three years. The company reported total income of INR. 3.72 Bn. in FY 2025 with an unprecedented operations revenue growth of CAGR 80.44% recorded since FY 2023. From consulting and design to engineering and emerging technologies, Transline has been able to deliver to customer expectations through tailored solutions that help customers not only address existing challenges but rather be ready for future endeavors. By the end of FY 2025, the solutions business contributes to 80.36% of the total revenue, nevertheless the services arm also grew significantly in the last three years.

Transline has expertise in important industry verticals like government/public sector undertakings ("PSUs"), information communications technology ("ICT"), education, banking, financial service, retail, food and beverage, and understands the unique customer requirements of each industry vertical and provide tailored solutions to address their specific technology needs.

Exhibit 32: Transline Technologies, Total Income, FY 2023 to FY 2025

INR. 1.15 Bn.   INR. 2.26 Bn.   INR. 3.72 Bn.

FY 2023   FY 2024   FY 2025
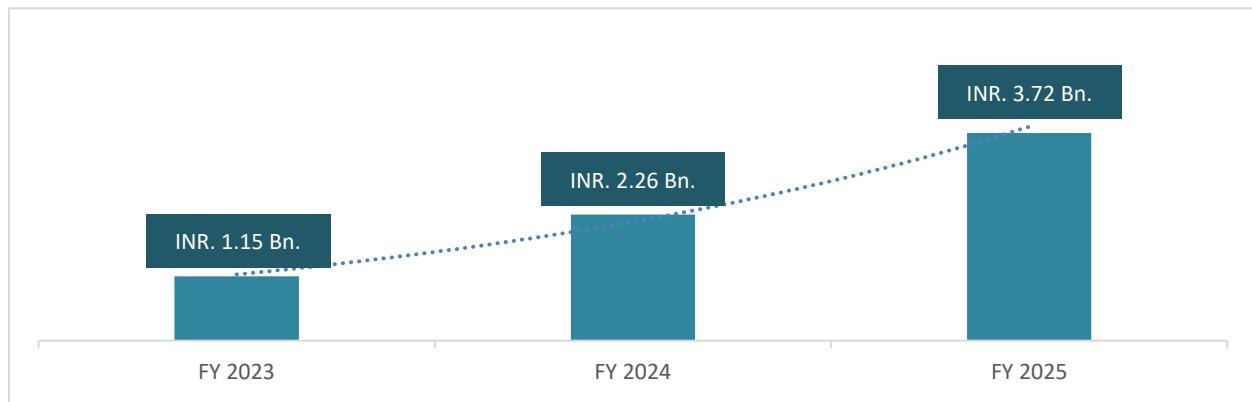
Source: Transline Technologies

The government/PSU segment remains the largest user of Transline solutions and services, contributing 66.03% of the total revenue from operations. While bidding for government and PSU requirements, Transline has been smart enough to maintain quality and control project costs, hence helping them to win contracts. Some of the clients for the company include leading names in banking and financial services, telecom, oil and gas, UIDAI, etc.

8.8. Competitive Advantages

- Over two decades of experience
- Pan India reach, 11+ billing locations

- Innovation driven, one of the prominent players in India for technological advancements in video surveillance and biometrics
- Leverages next generation technologies like AI
- Deep knowledge, understanding, and expertise in video surveillance and biometrics
- StorePulse, CheckCam and CamStore solutions delivered as SaaS ensures a steady and predictable income stream, enhances financial stability, recurring revenue, reduced customer churn and opportunities to cross-sell and up-sell complementary services
- Over 500 clients served
- Exceptional revenue growth noticed in the last three years (FY 2023 to FY 2025) at CAGR of 80.44%
- Strong government/PSU customer base with 66.03% of the revenue coming from the segment
- One of the UIDAI enrolment agencies
- CMMI Maturity Level 5 company
- Recognized as "Great Place to Work" in mid-size organizations by Great Place to Work, India
- Attained several important ISO certifications:
    - ISO 9001:2015 (Quality Management)
    - ISO 14001:2015 (Environmental Management)
    - ISO 27001:2013 (Information Security)
    - ISO/IEC 20000-1:2018 (IT Service Management)

9. Peer Group Comparison with Transline Technologies

The video surveillance and biometric solutions and services market in India is highly fragmented with the presence of different type of providers – system integrators, large IT service providers, managed service providers, facility management companies, and more. While some of these players come with a focus on video surveillance and biometrics – both, others come with either of the two business lines. AI, video analytics, digital enablement and Smart Cities are some of the emerging focus areas for companies in this space. For this industry report, the following companies have been shortlisted as peer-group to Transline Technologies.

9.1. Peer Group Profiling

9.1.1 Nelco Limited

- **About:** Part of the Tata group, Nelco is a solutions provider in the areas of VSAT connectivity, Satcom Projects, and Integrated Security and Surveillance Solutions helping both enterprise and government customers. The company holds a VSAT license, Internet Service Provider (ISP) license as well as the Inflight & Maritime Communication (IFMC) license issued by Department of Telecommunication, Government of India (DOT). Nelco is one of the prominent VSAT providers in India that connects businesses in remote locations through reliable, flexible, swift, and cost-effective satellite communication services. In addition, the company also provides end-to-end networking solutions (Satcom Projects) and maintenance of private hubs and hybrid networks for its customers, from government to corporates.
- **Founded:** 1940
- **Headquartered:** Navi Mumbai (India)
- **Comparable Solutions and Services:**
    - Integrated Security & Surveillance Solutions
        - Consultation on security and surveillance
        - System Engineering, Integration and Technology absorption
        - Project management including installation and commissioning
        - Networking, Customization of interfaces and signal Processing
        - Integration & Testing
        - Pan India Product Lifecycle support
        - Training and documentation

9.1.2 NEC Corporation India

- **About:** NEC Corporation India is a prominent integrator of IT and network technologies that brings expertise in technological innovation to provide solutions to enterprises and the government. The company expanded its business from telecommunications to public safety, logistics, transportation, retail, finance, unified communications and IT platforms. NEC Corporation India also has a sub-unit called as NEC Laboratories India (NLI) which was established in 2018 with an aim to launch new business utilizing local know-how and big data. NLI engages in the creation of new solutions in the fields of public transportation and logistics, public safety, digital government and cashless payment.

- **Founded:** 1950s
- **Headquartered:** New Delhi (India)
- **Comparable Solutions and Services:**
  - Video Surveillance
    - Security consulting
    - CCTV system integration
    - Project management including installation and commissioning
    - Networking and customized solutions
    - Video analytics
    - AI-enabled video surveillance for facial recognition, automatic number plate recognition, red light violation, etc.
  - Biometrics
    - Face recognition
    - Iris recognition
    - Fingerprint and palm recognition
    - Finger vein recognition
    - Voice recognition
    - Ear acoustic authentication

9.1.3 SNR eDatas

- **About:** SNR eDatas is one of the service providers offering services in video surveillance. The company has implemented video surveillance solutions for elections, examinations, and law enforcement agencies in India. It has executed system integration projects for the government and the public sector undertakings. SNR eDatas has successfully deployed command and control centers with other components in Smart City Mission projects. Beyond video surveillance, the company also offers Aadhaar enrolment services with various registrars, banks, and government departments. SNR eDatas has been accredited with Quality Management Systems Standard Certification (ISO 9001:2015), Information Security Management Systems Certification (ISO 27001:2013), IT Service Management Systems Certification (ISO 20000-1:2018) and Environmental Management Systems Certification (ISO 14001:2015).
- **Founded:** 2012
- **Headquartered:** Hyderabad (India)
- **Comparable Solutions and Services:**
  - Surveillance
    - Surveillance systems
    - Webcasting (elections and examinations)
    - Smart Cities/Safe Cities
  - System Integration
    - Command and Control Centers
    - Supply and maintenance of smart devices

- Others (BharatNet, networking and Wi-Fi Services, data centers, smart classrooms, etc.)
  - o Smart Cities
    - Smart surveillance
    - Command and Control Centers
    - Vehicle tracking systems
  - o Digital Enablement
    - Digitization and scanning of records
    - Citizen service centres
  - o Aadhaar Services
    - Aadhaar enrolment and updation services
    - Aadhaar Permanent Enrolment Centres
    - Aadhaar Seva Kendras at Banks and Govt. Offices

9.1.4 Orient Technologies

- **About:** Orient Technologies is a India headquartered IT solutions provider with offerings primarily around cloud & devops, digital transformation, infrastructure managed services (IMS), cybersecurity, data center solutions, and end-user computing. Since its beginning in 1997, the company has evolved strongly, transforming from a local IT infrastructure vendor to a full-scale technology powerhouse. Today, the company has partnerships with leading technology vendors and OEMs like HP Enterprise, Dell, Fortinet, AWS, Microsoft, Nutanix, Apple, Kaspersky, and more. Orient offers solutions tailored to a variety of sectors, including government, BFSI, manufacturing, healthcare, and ITeS. While the company has predominantly offering around IT infrastructure and application services, it also has solutions for video walls and controller implementation. Through its video wall solution, Orient Technologies help organizations with real-time oversight of security systems, analytics, and operations through an integrated monitoring platform.
- **Founded:** 1997
- **Headquartered:** Mumbai (India)
- **Comparable Solutions and Services:**
  - o Surveillance
    - Video wall and controller implementation
    - Security monitoring
    - Video analytics

9.1.5 Allied Digital Services

- **About:** Allied Digital is a global IT services company with clients spread across 70+ countries and offering catering to a diverse range of customers (government, healthcare, retail, BFSI, and automotive). The company's offerings include cloud & infrastructure services, cybersecurity & networking, digital engineering services, workplace services, and software services. The company is listed in the India stock exchange (BSE and NSE), employing over 3000 professionals. Allied Digital's rich history features significant milestones including India's first major Smart City project (Pune City Surveillance, 2015). Today, the company has presence across multiple countries beyond India

including USA, UK, Singapore, Australia, Ireland, Brazil, Japan, China, etc. Some of the leading technology partners include Cisco, Microsoft, Oracle, AWS, IBM and Dell.

- **Founded:** 1984
- **Headquartered:** Mumbai (India)
- **Comparable Solutions and Services:**
  - Surveillance
    - IoT and AI-powered video analytics
    - Camera sensor-based surveillance
  - Smart Cities
    - Video surveillance

9.2. Peer Group Comparison with Nelco Limited, Orient Technologies, and Allied Digital Services

Exhibit 33: Peer group profiling of Transline Technologies with Nelco Limited, Orient Technologies, and Allied Digital Services

A: Overview and Financial KPIs

	Transline Technologies*	Nelco Limited**	Orient Technologies***	Allied Digital Services****
Overview				
Founded	2001	1940	1997	1984
HQ	New Delhi	Navi Mumbai	Mumbai	Mumbai
Solution and Service Offerings	✓	✓	✓	✓
Video Surveillance	✓	✓	✓	✓
Bio-metrics	✓	✗	✗	✗

Financial KPIs												
	Fiscal 2025	Fiscal 2024	Fiscal 2023	Fiscal 2025	Fiscal 2024	Fiscal 2023	Fiscal 2025	Fiscal 2024	Fiscal 2023	Fiscal 2025	Fiscal 2024	Fiscal 2023
Total Income[1] (INR. Mn.)	3,719.07	2,263.38	1,154.89	3,100.50	3,226.60	3,159.00	8,462.86	6,068.64	5,420.09	8,516.70	6,882.20	6,657.30

Revenue from Operations (2) (INR. Mn.)	3,710.78	2,258.93	1,139.68	3,048.70	3,203.00	3,133.30	8,395.30	6,028.93	5,351.02	8,070.70	6,870.60	6,600.70
Revenue CAGR Fiscal 2023 to Fiscal 2025(3) (%)		80.44%			-1.36%			25.26%			10.58%	
EBITDA(4) (INR. Mn.)	793.68	522.68	157.26	471.50	617.50	633.30	743.50	605.89	555.51	986.90	845.30	877.89
EBITDA Margin(5) (%)	21.39%	23.14%	13.80%	15.47%	19.28%	20.21%	8.86%	10.05%	10.38%	12.23%	12.30%	13.30%
PAT(6) (INR. Mn.)	483.33	354.67	98.75	95.30	236.70	198.50	504.37	414.48	382.98	322.50	458.50	537.60
PAT Margin(7) (%)	13.00%	15.67%	8.55%	3.07%	7.34%	6.28%	5.96%	6.83%	7.07%	3.79%	6.66%	8.08%
PAT CAGR Fiscal 2023 to Fiscal 2025(8) (%)		121.24%			-30.71%			14.76%			-22.55%	
Revenue from Government & PSU(9) (Value) (INR. Mn.)	2,450.14	1,452.82	902.91	NA	NA	NA	941.11	821.62	886.83	2,420.00	1,230.00	660.07
Revenue from Government & PSU(10) (%)	66.03%	64.31%	79.22%	NA	NA	NA	11.21%	13.63%	16.57%	29.99%	17.90%	10.00%
Revenue from Top 10 Customers (Value)(11) (INR. Mn.)	3,004.47	1,975.52	1,054.57	NA	NA	NA	NA	2,298.53	1,730.67	NA	3,504.01	3,168.34
Revenue from Top 10 Customers(12) (%)	80.97%	87.45%	92.53%	NA	NA	NA	NA	38.11%	32.34%	NA	51.00%	48.00%

Revenue Split by Product Type / Service Line - Solution (Value)[13] (INR. Mn.)	2,981.92	1,755.44	960.22	359.50	449.70	633.70	5,040.00	3,146.47	3,493.39	1,890.00	1,198.70	622.40
Revenue Split by Product Type / Service Line – Solution[14] (%)	80.36%	77.71%	84.25%	11.79%	14.04%	20.22%	60.03%	52.19%	65.28%	23.42%	17.45%	9.43%
Revenue Split by Product Type / Service Line - Services (Value)[15] (INR. Mn.)	728.86	503.49	179.46	2,688.50	2,752.40	2,495.30	3,350.00	2,882.46	1,857.63	6,180.00	5,671.90	5,978.30
Revenue Split by Product Type / Service Line – Services[16] (%)	19.64%	22.29%	15.75%	88.19%	85.93%	79.64%	39.90%	47.81%	34.72%	76.57%	82.55%	90.57%
ROE[17] (%)	36.86%	62.36%	39.35%	7.58%	20.75%	20.51%	19.98%	27.26%	34.36%	5.10%	7.70%	9.53%
ROCE[18] (%)	53.37%	76.62%	49.94%	18.14%	28.05%	26.02%	26.35%	34.65%	44.27%	10.09%	10.86%	12.94%
Debt to Equity Ratio[19]	0.48	0.49	0.23	0.30	0.27	0.36	0.00	0.03	0.10	0.11	0.10	0.09
Net Debt / EBITDA[20]	1.08	0.75	0.43	0.50	0.18	0.34	-1.54	-0.26	-0.13	-1.18	-0.93	-0.37
Net Working Capital Cycle[21] (days)	165	117	74	-	-12	9	71	81	67	107	99	115
Order Book[22] (INR. Mn.)	1,986.86	2,553.08	623.11	NA	NA	NA	NA	NA	NA	NA	NA	NA

All financial information relating to Transline Technologies Limited and Nelco Limited is presented on a consolidated basis, as sourced from their respective annual reports and financial disclosures.

Source:

*: Financials shared by Transline Technologies

**: Financials for Nelco Limited sourced from the following links:

FY 2025: https://www.nelco.in/pdf/Annual-Reports/NELCO-Limited/82-annual-report-2024-25.pdf

FY 2024: https://www.nelco.in/pdf/Annual-Reports/NELCO-Limited/81-annual-report-2023-24.pdf

FY 2023: https://www.nelco.in/pdf/Annual-Reports/NELCO-Limited/80-annual-report-2022-23.pdf

***: Financials for Orient Technologies

DRHP: https://www.sebi.gov.in/filings/public-issues/sep-2024/orient-technologies-limited-prospectus_86573.html

Q4 FY 2025: https://www.bseindia.com/xml-data/corpfiling/AttachHis/33ee8404-ca2e-4712-94f0-c5eb7a3a357a.pdf

Q4 FY 2025: https://www.bseindia.com/xml-data/corpfiling/AttachHis/33ee8404-ca2e-4712-94f0-c5eb7a3a357a.pdf

****: Financial for Allied Digital Services

FY 2024: https://www.bseindia.com/stockinfo/AnnPdfOpen.aspx?Pname=f924f593-c7ce-4bf9-8c21-0739c2dadf68.pdf

FY 2023: https://www.bseindia.com/stockinfo/AnnPdfOpen.aspx?Pname=\d963ba63-01ba-4a22-bc6c-542ffce8605f.pdf

Q4 FY 2025: https://www.bseindia.com/xml-data/corpfiling/AttachHis/7f0b3bd6-d0d7-4fb2-a04c-673bfdef0d2f.pdf

Q4 FY 2025: https://www.bseindia.com/stockinfo/AnnPdfOpen.aspx?Pname=7892c835-d274-42f9-8a83-25f193515dbe.pdf

Notes:

1) Total Income is as reported in the Restated Financial Information.
2) Revenue from Operations is as reported in the Restated Financial Information.
3) Revenue CAGR (Compound Annual Growth Rate) from Fiscal 2023 to Fiscal 2025 is calculated using the formula: CAGR = (Revenue in Fiscal 2025/ Fiscal 2023)^(1/2) – 1
4) EBITDA is calculated as Profit Before Tax (PBT) plus Depreciation and Amortization Expense, plus Finance Cost, less Other Income.
5) EBITDA Margin is calculated as EBITDA divided by Revenue from Operations, multiplied by 100.
6) PAT (Profit After Tax) is the profit after tax as reported in the Restated Financial Information.
7) PAT Margin is calculated as Profit After Tax (PAT) divided by Total Income, multiplied by 100.
8) PAT CAGR from Fiscal 2023 to Fiscal 2025 is calculated using the formula: (PAT in Fiscal 2025/ PAT in Fiscal 2023)^(1/2) – 1
9) Revenue from Government & PSU is as reported in the financial statements, reflecting the value of revenue generated from government and public sector undertakings.
10) Revenue from Government & PSU (%) is calculated as Revenue from Government & PSU divided by Revenue from Operations, multiplied by 100.
11) Revenue from Top 10 Customers is as reported in the financial statements, reflecting the value of revenue generated from the top 10 customers.
12) Revenue from Top 10 Customers (%) is calculated as Revenue from Top 10 Customers divided by Revenue from Operations, multiplied by 100.
13) Revenue Split by Product Type / Service Line - Solution is as reported, reflecting the value of revenue generated from solutions.
14) Revenue Split by Product Type / Service Line - Solution (%) is calculated as Revenue from Solution divided by Revenue from Operations, multiplied by 100.
15) Revenue Split by Product Type / Service Line - Services is as reported, reflecting the value of revenue generated from services.
16) Revenue Split by Product Type / Service Line - Services (%) is calculated as Revenue from Services divided by Revenue from Operations, multiplied by 100
17) Return on Equity (RoE) is calculated as Profit After Tax (PAT) for the period divided by the average net worth as on the last date of the reporting period, multiplied by 100. Net Worth means the aggregate value of the paid-up share capital and all reserves created out of the profits and securities premium account and debit or credit balance of profit and loss account, after deducting the aggregate value of the accumulated losses, deferred expenditure and miscellaneous expenditure not written off, as per the Restated Financial Statements but does not include reserves created out of revaluation of assets, write-back of depreciation and amalgamation as at the end of year in accordance with Regulation 2(1)(hh) of the Securities and Exchange Board of India (Issue of Capital and Disclosure Requirements) Regulations, 2018
18) Return on Capital Employed (RoCE) is calculated as EBIT (Earnings Before Interest and Tax) divided by average Capital Employed, where Capital Employed is defined as Total Assets minus Current Liabilities, multiplied by 100.Debt to Equity Ratio is calculated as Total Debt divided by Total Equity as on the last date of the reporting period.
19) Debt to Equity Ratio is calculated as Total Debt divided by Total Equity as on the last date of the reporting period.
20) Net Debt to EBITDA is calculated by dividing Net Debt by EBITDA.
21) Net Working Capital Cycle (days) is calculated as the net working capital divided by revenue from operation and multiplied by number of days..
22) Order Book is as reported in the financial statements, reflecting the value of unfulfilled customer orders.

Note: Allied Digital PAT are from continuing operations

B. Operational KPIs

	Transline Technologies*			Nelco Limited**			Orient Technologies			Allied Digital Services		
	Fiscal 2025	Fiscal 2024	Fiscal 2023	Fiscal 2025	Fiscal 2024	Fiscal 2023	Fiscal 2025	Fiscal 2024	Fiscal 2023	Fiscal 2025	Fiscal 2024	Fiscal 2023
Operational KPIs												

Number of Employees [1]	461.00	263.00	111.00	104.00	94.00	93.00	NA	NA	NA	NA	NA	NA
Revenue Per Employee [2] **(INR. Mn.)**	8.05	8.59	10.27	29.31	34.07	33.69	NA	NA	NA	NA	NA	NA
Average Attrition of Employees [3]	11.94%	12.30%	12.68%	12.33%	12.80%	10.80%	NA	21.84%	31.01%	NA	NA	NA
AMC for Video Surveillance (No of Camera 's) [4]	20,000.00	20,000.00	18,718.00	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source:

*: As shared by Transline Technologies

**: Nelco Limited data sourced from the following links:

FY 2025: https://www.nelco.in/pdf/Annual-Reports/NELCO-Limited/82-annual-report-2024-25.pdf

FY 2024: https://www.nelco.in/pdf/Annual-Reports/NELCO-Limited/81-annual-report-2023-24.pdf

FY 2023: https://www.nelco.in/pdf/Annual-Reports/NELCO-Limited/80-annual-report-2022-23.pdf

Notes:

1) Number of Employees is as reported in the financial statements or as of the last date of the reporting period.
2) Revenue per Employee is calculated as Revenue from Operations divided by the Number of Employees.
3) Average Attrition is calculated by dividing the total number of employees who left the company during the period by the average number of employees during the period, then multiplying the result by 100.
4) AMC for Video Surveillance is calculated based on the number of cameras under Annual Maintenance Contract (AMC) provided during the reporting period.

9.3. Peer Group Comparison with Other Providers

Exhibit 34: Peer group profiling of Transline Technologies with NEC Corporation India and SNR eDatas

A: Overview and Financial KPIs

	Transline Technologies*	NEC Corporation India**	SNR eDatas***
Overview			
Founded	2001	1950s	2012
HQ	New Delhi	New Delhi	Hyderabad
Solution and Service Offerings	✓	✓	✓

Video Surveillance	✓	✓	✓
Biometrics	✓	✓	✗

Financial KPIs

Total Income[1] (INR. Mn.)	3,719.07 (FY 2025)	16,298.40 (FY 2024)	1,033.56 (FY 2024)
Revenue from Operations [2] (INR. Mn.)	3,710.78 (FY 2025)	15,886.70 (FY 2024)	1,029.64 (FY 2024)
Revenue CAGR [3] (%)	80.44% (FY 2023 to FY 2025)	9.19% (FY 2022 to FY 2024)	1.37% (FY 2022 to FY 2024)
EBITDA[4] (INR. Mn.)	793.68 (FY 2025)	1,232.40 (FY 2024)	131.13 (FY 2024)
EBITDA Margin[5] (%)	21.39% (FY 2025)	7.76% (FY 2024)	12.74% (FY 2024)
PAT[6] (INR. Mn.)	483.33 (FY 2025)	785.00 (FY 2024)	90.10 (FY 2024)
PAT Margin[7] (%)	13.00% (FY 2025)	4.82% (FY 2024)	8.72% (FY 2024)
PAT CAGR[8] (%)	121.24% (FY 2023 to FY 2025)	(24.30%) (FY 2022 to FY 2024)	19.10% (FY 2022 to FY 2024)
Revenue from Government & PSU[9] (Value) (INR. Mn.)	2,450.14 (FY 2025)	NA	NA
Revenue from Government & PSU[10] (%)	66.03% (FY 2025)	NA	NA
Revenue from Top 10 Customers (Value)[11] (INR. Mn.)	3,004.47 (FY 2025)	NA	NA
Revenue from Top 10 Customers[12] (%)	80.97% (FY 2025)	NA	NA

Revenue Split by Product Type / Service Line - Solution (Value)[13] (INR. Mn.)	2,981.92 (FY 2025)	NA	NA
Revenue Split by Product Type / Service Line – Solution[14] (%)	80.36% (FY 2025)	NA	NA
Revenue Split by Product Type / Service Line - Services (Value)[15] (INR. Mn.)	728.86 (FY 2025)	NA	NA
Revenue Split by Product Type / Service Line – Services[16] (%)	19.64% (FY 2025)	NA	NA
ROE[17] (%)	36.86% (FY 2025)	7.51% (FY 2024)	24.02% (FY 2024)
ROCE[18] (%)	54.22% (FY 2025)	7.37% (FY 2024)	33.06% (FY 2024)
Debt to Equity Ratio[19]	0.48 (FY 2025)	NA	0.01 (FY 2024)
Net Debt / EBITDA[20]	1.08 (FY 2025)	(4.60) (FY 2025)	(9.83) (FY 2024)
Net Working Capital Cycle[21] (days)	165 (FY 2025)	67 (FY 2024)	93.94 (FY 2024)
Order Book[22] (INR. Mn.)	1,986.86 (FY 2025)	NA	NA

All financial information relating to Transline Technologies Limited is presented on a consolidated basis, and financial information relating to NEC Corporation India Pvt. Ltd. and SNR eDatas Pvt. Ltd. are presented on a standalone basis, sourced from their respective annual reports and financial disclosures.

Source:

*: Financials shared by Transline Technologies

**: Financials mentioned for NEC Corporation India is obtained from Private Circle website (https://privatecircle.co/)

***: Financials mentioned for SNR eDatas is obtained from Private Circle Website (https://privatecircle.co/)

Notes:

1) Total income is as reported in the Restated Financial Information.
2) Revenue from Operations is as reported in the Restated Financial Information.
3) Revenue CAGR (Compound Annual Growth Rate) from Fiscal 2023 to Fiscal 2025 is calculated using the formula: CAGR = (Revenue in Fiscal 2025/ Fiscal 2023)^(1/2) – 1
4) EBITDA is calculated as Profit Before Tax (PBT) plus Depreciation and Amortization Expense, plus Finance Cost, less Other Income.
5) EBITDA Margin is calculated as EBITDA divided by Revenue from Operations, multiplied by 100.
6) PAT (Profit After Tax) is the profit after tax as reported in the Restated Financial Information.
7) PAT Margin is calculated as Profit After Tax (PAT) divided by Total Income, multiplied by 100.
8) PAT CAGR from Fiscal 2023 to Fiscal 2025 is calculated using the formula: (PAT in Fiscal 2025/ PAT in Fiscal 2023)^(1/2) – 1
9) Revenue from Government & PSU is as reported in the financial statements, reflecting the value of revenue generated from government and public sector undertakings.
10) Revenue from Government & PSU (%) is calculated as Revenue from Government & PSU divided by Revenue from Operations, multiplied by 100.
11) Revenue from Top 10 Customers is as reported in the financial statements, reflecting the value of revenue generated from the top 10 customers.
12) Revenue from Top 10 Customers (%) is calculated as Revenue from Top 10 Customers divided by Revenue from Operations, multiplied by 100.

13) *Revenue Split by Product Type / Service Line - Solution is as reported, reflecting the value of revenue generated from solutions.*
14) *Revenue Split by Product Type / Service Line - Solution (%) is calculated as Revenue from Solution divided by Revenue from Operations, multiplied by 100.*
15) *Revenue Split by Product Type / Service Line - Services is as reported, reflecting the value of revenue generated from services.*
16) *Revenue Split by Product Type / Service Line - Services (%) is calculated as Revenue from Services divided by Revenue from Operations, multiplied by 100*
17) *Return on Equity (RoE) is calculated as Profit After Tax (PAT) for the period divided by the average net worth as on the last date of the reporting period, multiplied by 100. Net Worth means the aggregate value of the paid-up share capital and all reserves created out of the profits and securities premium account and debit or credit balance of profit and loss account, after deducting the aggregate value of the accumulated losses, deferred expenditure and miscellaneous expenditure not written off, as per the Restated Financial Statements but does not include reserves created out of revaluation of assets, write-back of depreciation and amalgamation as at the end of year in accordance with Regulation 2(1)(hh) of the Securities and Exchange Board of India (Issue of Capital and Disclosure Requirements) Regulations, 2018*
18) *Return on Capital Employed (RoCE) is calculated as EBIT (Earnings Before Interest and Tax) divided by average Capital Employed, where Capital Employed is defined as Total Assets minus Current Liabilities, multiplied by 100.Debt to Equity Ratio is calculated as Total Debt divided by Total Equity as on the last date of the reporting period.*
19) *Debt to Equity Ratio is calculated as Total Debt divided by Total Equity as on the last date of the reporting period.*
20) *Net Debt to EBITDA is calculated by dividing Net Debt by EBITDA.*
21) *Net Working Capital Cycle (days) is calculated as the net working capital divided by revenue from operation and multiplied by number of days..*
22) *Order Book is as reported in the financial statements, reflecting the value of unfulfilled customer orders.*

B. Operational KPIs

	Transline Technologies*	NEC Corporation India	SNR eDatas
Operational KPIs			
Number of Employees(1)	461.00 (FY 2025)	NA	NA
Revenue Per Employee(2) (INR. Mn.)	8.05 (FY 2025)	NA	NA
Average Attrition of Employees(3)	11.94 (FY 2025)	NA	NA
AMC for Video Surveillance (No of Camera's)(4)	20,000 (FY 2025)	NA	NA

Source:

*: As shared by Transline Technologies

Notes:

1) Number of Employees is as reported in the financial statements or as of the last date of the reporting period.
2) Revenue per Employee is calculated as Revenue from Operations divided by the Number of Employees.
3) Average Attrition is calculated by dividing the total number of employees who left the company during the period by the average number of employees during the period, then multiplying the result by 100.
4) AMC for Video Surveillance is calculated based on the number of cameras under Annual Maintenance Contract (AMC) provided during the reporting period.

10. Business Threats and Challenges for Transline Technologies

Transline Technologies is one of the important players in the Indian video surveillance and biometric solutions and services market. While the company has exhibited tremendous revenue growth in the last three years and is likely to continue with a high growth journey in the coming time (keeping in mind Transline's growth strategy and future plans), much like any other business entity, Transline Technologies faces few threats and challenges to growth, few of which are influenced by external and internal factors. Listed below are some of the threats and challenges that the technology service provider faces/likely to face over the period of time.

10.1. Threats for Transline Technologies

In a business scenario, threats are defined as external factors that could potentially harm a business/organization, its operation, and profitability. Business threats are mostly beyond the control of the business, however, the quicker the organization works out a possible solution or alternative, faster it can bounce to growth trajectory.

Here are some of the business threats that Transline Technologies can encounter in the future:

- **Economic uncertainty:** It means uncertainty in business due to the negative impact of unpredictable economic conditions in both global and domestic markets. Economic uncertainty is a result of fluctuating market conditions, political instability, changes in government policies, and inflation. An uncertain economic condition can lead to cautious or reduced spending by both the government and enterprises. There could also be chances of delayed or weaker investments by customers on new projects and expansion plans. Businesses can face operational challenges due to rough market conditions thereby making it difficult for vendors to manage inventory levels and re-construct pricing strategies.

- **Disruptions in supply chain management:** Supply chain disruption is a situation where the normal flow of goods and services is disrupted due to unavoidable circumstances. It is caused due to delays in production, shipping, or distribution of products that can arise due to various internal or external factors. Some of the usual factors include natural disasters, pandemics, geopolitical instability, and logistical challenges. All these factors can lead to product scarcity, increased costs, customer dissatisfaction, and can have an economic impact on the vendor/service provider.

- **Competition:** In any business, competition is considered as one of the biggest threats. Competition impacts businesses by reducing revenue growth and market share. Businesses observe reduced profit margins as customers are compelled to lower prices to attract customers. On the contrary, there remains constant pressure to innovate and to remain a step ahead of its competitors. Additionally, new market entrants can disrupt established markets by introducing innovative products and services at lower prices. It is critical that businesses conduct competitors' strengths, weaknesses, and market strategies to identify potential threats and opportunities. Summarily, the chance of customer loyalty erosion can be noticed since customers would have more options in a competitive market.

- **Lack of regulatory mandates and compliances in video surveillance:** Currently there are few industry verticals that have regulations on the mandatory use of video surveillance and security solutions (like CCTV in examination halls, video surveillance in banks, or in public places in select states). While regulations play a critical role in driving the need for video surveillance and security products, a relaxation in the existing regulatory mandates or lack of regulations in any other industry vertical, can dampen the demand for the solutions.
- **Lack of standardization in the biometrics industry:** The biometrics industry currently does not have comprehensive regulations governing the collection, storage, and use of biometric data. Growing awareness of privacy issues related to biometric data collection can lead to consumer distrust, especially when biometric data is being collected without the individual's consent.

10.2. Challenges for Transline Technologies

Business challenges refer to difficulties that an organization faces to achieve their goals and maintain healthy operations. These challenges are mostly internal to an organization which can be addressed through better strategy formulation and course correction by the business entity.

Mentioned below are some of the business challenges that Transline Technologies can face in the future:

- **Financial management of the company:** Inefficient financial management of an organization can led to several challenges for the company, impacting growth and stability. It is critical to develop accurate and realistic financial plans to achieve steady growth. Many companies struggle to create budgets that's align with their strategic goals. Maintaining healthy cash flow is crucial for running day-to-day business operations. To have a healthy financial position, companies should ensure minimum accounts receivable so that there is no cash shortage. Margins should be always maintained so that profitability is not questioned. Debts should be managed efficiently and there should be controlled borrowing. Audits need to be conducted at regular intervals so that any irregularity can be flagged off immediately. Summarily, by addressing financial challenges effectively, companies can improve their financial health and achieve their strategic goals.
- **Talent acquisition and retention:** To be counted among the leaders in business, it is important to attract, hire, develop, and retain the best talent. By actively looking out for the best talent rather than relying on whatever is available, it would ensure the right person is selected for the job. It is important that new hires are well suited for the company culture and have the required skills, thereby reducing the likelihood of early departures. The best performing employees should be identified and rewarded to keep them motivated. A focus on diversity in hiring can bring in varied perspectives, fostering innovation and creativity. It is imperative that talent acquisition and retention are critical aspects of a successful business strategy. By focusing on attracting, developing, and retaining the best talent, companies can improve their performance, reduce turnover, align with their strategic goals, and maintain a competitive advantage in the marketplace.

11. Future Growth Opportunities to Video Surveillance and Biometrics

11.1. Growing Trends

11.1.1 Video Surveillance

IoT integration with Video Surveillance

The integration of IoT with video surveillance systems is seen as an emerging trend. Convergence enhances traditional surveillance capabilities by making them smarter, more efficient and highly intelligent. IoT enabled surveillance devices make cameras and sensors connect seamlessly within a network, facilitating real-time monitoring and immediate data transmission, enabling security personnel to respond swiftly to incidents. On detection of unusual activity, smart cameras can send alerts directly to security teams making incident response quicker. The huge volume of data generated by IoT enabled video surveillance systems is utilized for identifying patterns and trends that may indicate security threats. Integrating AI with IoT further adds value by leveraging sophisticated functions like facial recognition and anomaly detection, increasing overall surveillance effectiveness by multiple folds.

Another aspect of IoT integration with video surveillance is automation and smart responses. For example, if IoT enabled video surveillance cameras sense no employee in an office floor using motion detection technology, it can automatically switch off the light, fan or air conditioning switches and enable energy management. Such video surveillance applications go beyond providing just security and safety but also help in resource management and operational management.

Edge AI in Video Surveillance

Edge AI is defined as the integration of artificial intelligence capabilities directly into the device placed at the edge, rather than relying on cloud computing. While AI provides object/people detection, facial recognition, automatic number plate recognition, behavioral analysis, traffic monitoring, motion detection, etc., in a usual case the video data is sent to the cloud over the available network. However, edge AI in video surveillance makes the data processing and analysis closer to where it is captured, making it more efficient, faster, and results in better outcomes and improved privacy protection. Edge AI is integrated directly into the cameras or into edge boxes, which include purpose-built VMS or NVRs. In such devices, video streams are taken from cameras and AI algorithms applied for detection, identification, and more. The need to send the video data to the cloud servers for processing is eliminated.

Customizable AI solutions

The use of AI in video surveillance has seen wider adoption in the last few years. AI-enabled cameras can significantly reduce errors by reliably detecting human beings and vehicles. However, with the wider adoption of AI, there would be improvements in accuracy and the need to detect unique items, which usual AI cameras are unable to detect. The next generation of customizable AI solutions would be able to recognize unique objects that are important for a business to track or count. On-site AI training of edge devices would further improve accuracy by identifying logos on vehicles or uniforms, count planes, forklifts, baby strollers, etc.

Ultra-High-Definition video streaming with even lower latency over 5G networks

The acceptance of 5G networks across the country has started to have a transformational impact on the video surveillance industry. 5G allows ultra-high-definition (UHD) video streaming, allowing deployment of up to 8K cameras without the concern around bandwidth constraints that earlier technologies faced. Video quality improves significantly with 5G connectivity ensuring that details are captured more clearly and accurately. Also, with 5G network, there is ultra-low latency which reduces from 50-100 milliseconds in 4G to 1-4 milliseconds in 5G, enabling almost instantaneous video streaming and response time. This capability is considered highly critical, especially for preventing incidents or attending to emergencies.

11.1.2 Biometrics

Blockchain for Biometric Data Security

One of the critical aspects of biometrics is data security. This is especially important when volumes of biometric data are collected and stored. The insecurities of centralized data storage have prompted the exploration of blockchain technology for biometric use. Blockchain's concept of immutable ledger is considered highly dependable for storing encrypted biometric data, enhancing security and giving control back to the individual. Some of the niche and innovative companies in the area have already started to pioneer blockchain solutions that promise to revolutionize how facial data is stored and used, fostering trust in systems that handle personal identities.

Adaptive Biometrics

With age, the biometric features often change. Adaptive biometrics is a technology that learns and adjust to changes in an individual's physical attributes over time (like aging or changes in appearance due to facial hair or tattoos).

Heartbeat Identification

Facial recognition, voice recognition, fingerprint scan, iris scan, and palm vein recognition have been in use for some time now. In addition, there has been a focus on heartbeat recognition. Heartbeat recognition is the latest addition to biometric technologies that identify individuals based on their unique heartbeat patterns. This approach uses sophisticated patterns matching AI to authenticate uses, considered as an additional layer of security to verify users.

11.2. Industry Vertical Focus

Video surveillance and biometrics have immense potential across various industry verticals and use-cases. From smart cities to banking and transportation to industrial complexes, both these technologies have seen strong adoption and acceptance. Mentioned below are some of the growth opportunities in key industry verticals:

Exhibit 35: Growth opportunities (use-cases) in video surveillance and biometrics

Industry Vertical	Video Surveillance	Biometrics
Smart Cities	Real-time monitoring Crowd management Traffic congestion monitoring Accident detection Air quality monitoring Weather monitoring Pedestrian flow analysis Waste management Energy management	Access control to public buildings and restricted areas
Consumer Goods, Retail, and Food and Beverage	Theft deterrence Inventory management Customer behaviour analysis Footfall tracking Real-time AI insights	Payment through fingerprint Time and attendance tracking of store employees Identification of banned individuals
Government and Citizen Services	Public safety and crime prevention Border security	Citizen identity services (Aadhaar) Criminal identification Identity verification for public welfare schemes Election
Transportation and Logistics	Passenger safety and security Incident detection and emergency response Fleet monitoring Blind spot detection Evidence collection	Airport check-in systems (DigiYatra) Fare collection in public transport Driver identification
Commercial Buildings	Crime prevention and deterrence Incident monitoring and response Visitor management	Access control to buildings Employee check-in and visitor management Time and attendance tracking

	Employee safety Automatic number plate recognition Energy management in buildings	
Industrial	Safety monitoring Incident detection and response Inventory management Operational efficiency Evidence collection	Access control to restricted areas Employee identification Time and attendance tracking

Source: Frost & Sullivan

11.3. Global Reach

While India remains as one among the most important video surveillance and biometrics markets, the demand for both the technologies are well established in the global scenario. North America, particularly United States of America, has strong embrace towards video surveillance due to increased security concerns and investments in public safety measures. Europe, especially with countries like the United Kingdom, has long history of surveillance, however there are growing concerns regarding privacy implications, leading to stricter regulations governing the use of surveillance technologies. Asia Pacific (APAC) driven by China is the biggest video surveillance market in the world, emerging countries in ASEAN are fast adopting the technology.

For Biometrics, United States has gained substantial traction driven by use-cases in industry verticals like government, finance, and healthcare. Europe has also seen strong adoption of biometric solutions, especially in border control and national ID programs, however, regulations like GDPR have led to cautious ways to handle personal data. In the APAC region, India has shown the way for right use of biometrics through the well-established Aadhaar program. In the Middle East and Latin America, governments and enterprises have shown significant interest in the acceptance and adoption of the technology.

Summarily, it is important that companies not only explore the domestic market but also look towards advanced and emerging economies. The tier-II cities in India remain as a moderate to high growth potential for companies in video surveillance and biometrics as the metros and tier-I urban pockets get competitive. Exploring global markets is essential as opportunities remain lucrative and the right opportunity utilization would only boost the company's finances.